

A Proposal for an Interdepartmental Program of Graduate Studies in Biophysics for the M.S. and Ph.D. Degrees



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Executive Summary

An interdepartmental graduate program in the field of Biophysics is proposed, justified on the basis of the intrinsic importance of the field in the life sciences and the growing number of faculty at UC Riverside who are presently working in the area as broadly defined. The intent is to provide a means to recruit and train a new cadre of graduate students to UCR that will complement existing graduate programs on campus and provide trainees for the research programs of the participating faculty. Areas of existing expertise on campus include macromolecular structure determination, spectroscopic methods of various sorts, photosynthesis, physiological ecology and ecosystem processes, computational/mathematical modeling of biological systems, biological electron transfer, neurobiophysics and protein engineering. Formal course requirements will consist of a core curriculum and electives that amount to approximately one full academic year of coursework, and will be comprised of existing classes. Training in professional integrity and the responsible conduct of research will be explicit components of the curriculum. Basic requirements for the M.S. Plan II degree will consist of successful completion of the coursework and passing a Comprehensive Examination prepared and graded by the participating faculty. For the Ph.D. degree, in addition to the requirements for the M.S. Plan II degree, students will be expected to complete a Qualifying Examination consisting of the preparation and defense of a research proposal based on their dissertation research and prepared in the format of a regular grant proposal to the National Science Foundation or National Institutes of Health. Upon successfully completing the Qualifying Examination, Ph.D. students will be expected to complete an independent research project under the direction of a three-member dissertation committee chaired by a faculty member in the Program who will serve as the student's dissertation advisor. The dissertation advisor will be responsible for direction of the research, including providing an appropriate environment and other resources required to undertake the research. The Dissertation Committee will provide general guidance in the course of research, and be responsible for administering the final oral defense of the dissertation arising from the research, which will consist of a public presentation of the principal findings of the research followed by a private defense of the dissertation.

The Program will be administered by a Director and a three-member Executive Committee. The members of the Executive Committee will be responsible for graduate admissions, graduate oversight and curriculum, with each chairing a standing committee comprised of two additional participating faculty members from the Program. The Director, in conjunction with an administrator from the CNAS Graduate Student Affairs Center, will be responsible for the day-to-day operation of the program, including admissions, student advising and monitoring students' progress through the Program.

Section 1. Introduction

1.1) Aims and objectives of the program. The objectives of the proposed interdepartmental graduate program are to provide graduate training leading to the M.S. and Ph.D. degrees in Biophysics, and to promote teaching and research in the field of Biophysics by students and faculty at the University of California, Riverside. Biophysics is a major area of study and research in the life sciences, and attracts a considerable number of students. Biophysicists are needed by institutions of higher learning, and by federal, state and private research organizations in order to fulfill their respective missions. UC Riverside has considerable strength in the area of Biophysics, but this strength has a relatively low level of national visibility given the broad dispersal of the faculty working in the area on campus and the absence of a cohesive training environment

1.2) Historical development of the field. Biophysics as an academic discipline arose in the mid-19th Century out of studies by a group of German physicians and physiologists whose work focused on various aspects of electrophysiology and sensory stimulus, which in turn had grown out of the earlier work of Galvani and Volta. By the mid-20th Century, a formal Biophysical Society had been created in the US as an outgrowth of the American Physiological Society, and the Biological Physics Division of the American Physical Society had been established. At this time the discipline had grown to encompass a great many areas of research utilizing a variety of physical methods to study biological phenomena, as well as computational modeling of same. Examples include: structural biology, spectroscopy, electrophysiology, bioenergetics and biomechanics, neural networks, single-molecule dynamics, theoretical biology and a wide range of computational methods. Today the combined membership of the Biophysical Society and the APS Division of Biological Physics includes over 10,000 scientists, a large and thriving intellectual community. Here at UC Riverside, there has been significant investment in faculty hiring in the area of biophysics in several departments, and an undergraduate track in Biophysics already exists as part of the BS major in Physics. A number of graduate and undergraduate courses are in place in the Physics and Astronomy Department, as well as the departments of Biochemistry and Chemistry. Significantly, substantial expertise already exists on campus in areas recognized as lying within Biophysics, including: macromolecular structure determination, spectroscopic methods of various sorts, photosynthesis, physiological ecology and ecosystem processes, biological electron transfer, computational/mathematical modeling of biological systems, neurobiophysics and protein engineering. The departments Biochemistry, Chemistry and Physics and Astronomy have all made multiple hires in the area of biophysics over the past few years, and the rapid growth of the biophysics community has provided the impetus for the creation of a graduate program in Biophysics. The proposed program will be essential to maximize the growth and vigor of the research programs of both existing and future faculty at UC Riverside working in the area.

1.3) Timetable for development of the program. Upon approval of the Program, a Director will be appointed by the Dean of the Graduate Division and the program's standing committees established as described in Section 8 below. A website describing the new program and the research interests of its participating faculty will be created to advertise the program, and graduate admissions will commence, focusing on Ph.D. applicants. We anticipate a graduate admission rate of 5-10 students per year over the first several years of the Program, and 5-15 thereafter. Assuming an average matriculation-to-graduation time of 4.5 to 5 years, the Program will eventually grow to approximately 45 students. Given the significant amount of faculty recruitment in Biophysics that has taken and continues to take place on campus, the number of participating faculty is expected to grow, which may well lead to even more rapid growth of the Program. Table 1 provides a timetable for anticipated Ph.D. enrollment.

Table 1

Year of program	new students min-max	# graduating	cumulative min-max
1	5-10	0	5-10
2	5-10	0	10-20
3	5-10	0	15-30
4	5-15	2-5	15-38
5	5-15	5-10	20-45

1.4) Relation of the proposed program to existing programs and to the Campus Academic Plan.

Biophysics is inherently interdisciplinary, and the proposed program will effectively complement existing graduate programs in the Departments of Biochemistry, Chemistry and Physics and Astronomy. The majority of participating faculty also come from these academic units, and the proposed Program will provide them with a new source of trainees to participate in their individual research programs. The intent is to create a mechanism for the recruitment of a cadre of graduate students interested in studying and training in biophysics that would not otherwise have considered UC Riverside. For this reason, it is to be expected that there will be negligible negative impact on existing programs on campus. The proposed program is also consistent with the growth of the graduate student population at UC Riverside anticipated by the Graduate Division, and former Dean Joe Childers was specifically enthusiastic about the creation of the program. A major focus of the Campus Academic Plan is growth of UC Riverside's research portfolio (particularly the NIH-supported component), and achieving AAU accreditation. Much of the field of biophysics in fact has immediate biomedical relevance, and creation of a Biophysics Program is thus fully aligned with the Campus Academic Plan. Graduate programs are the engine of the research enterprise in the laboratory sciences, and creation of a graduate program in Biophysics can be expected to facilitate the development of new and expanded research programs by the participating faculty. Creation of the program is also justified by the significant level of faculty recruitment in the area at UC Riverside over the past several years in several departments, with a critical mass of faculty now having been achieved. Indeed, a major impetus for the creation of the program was the insufficiently large pool of graduate students available to the participating faculty, particularly junior faculty eager to establish their laboratories. Additional faculty growth in the area of biophysics is a specific component of the strategic plans for (minimally) the departments of Biochemistry, Chemistry and Physics, and the demand for graduate students will only increase in future. As part of this growth, and consistent with UC Riverside's Strategic Plan, the program is committed to diversity, both in the participating faculty as the home departments of the participating faculty recruit and in the demographic make-up of the graduate students accepted into the program. The campus's nationally recognized standing as an institution committed to developing and sustaining a pipeline of underrepresented minorities and women in STEM disciplines will be leveraged to ensure a diverse academic community in biophysics.

1.5) Interrelationship of the program with other UC institutions. Biophysics programs at other UC campuses fall into two principal groups: Berkeley, Davis and San Francisco have interdepartmental graduate programs in Biophysics similar to that being proposed here, while Los Angeles, Santa Barbara, Santa Cruz and San Diego have competing tracks or sections in both their Physics and Chemistry/Biochemistry Departments. Additionally, Irvine has a Department of Physiology and Biophysics in its School of Medicine, and Merced has a Biophysics track in the Ph.D. program of its Department of Physics. Given the distribution of the participating faculty at UC Riverside, the interdepartmental graduate program model seen at Berkeley, Davis and San Francisco is considered the more appropriate for UC Riverside, and the solicited letters from the Directors of the

interdepartmental graduate programs at both Berkeley and Davis are very supportive (see Appendix III); clearly, there is no perceived concern regarding competition between campuses. Indeed, given the important role of Biophysics in the biological sciences, all research universities involved in graduate training in the biological sciences would be well served by providing a degree program in biophysics. UC Riverside is no exception.

1.6) Administration. As described in detail in Section 8 below, the Program will be administered by a Director and a three-member Executive Committee. The members of the Executive Committee will be responsible for Graduate Admissions, Graduate Oversight and Curriculum, with each chairing a standing committee comprised of two additional participating faculty members from the Program. The Director, in conjunction with an administrator from the CNAS Graduate Student Affairs Center, will be responsible for the day-to-day operation of the program, including admissions, student advising and monitoring students' progress through the Program. The Graduate Student Affairs Center presently oversees the administration of 16 graduate programs, and the addition of one more does not significantly increase the workload of its staff. Indeed, a staff member has already been assigned to take responsibility for the proposed program. The Chair of the Graduate Oversight Committee will serve as graduate advisor and will be responsible for administering the Cumulative Examination, which will consist of questions provided by the participating faculty.

1.7) Plan for evaluation of the program. In the first two years, the participating faculty will self-evaluate the graduate program prior to the normal third-year review to be conducted by Graduate Council that is required for all new graduate programs at UC Riverside. Thereafter, the program will be evaluated by an external team of experts every 6-7 years, as is the standard practice the Graduate Division at UC Riverside.

Section 2. Program Description

2.1) Undergraduate preparation for admission. Students admitted to the Biophysics Graduate Program will be expected to have completed a bachelor's degree in Biochemistry, Biology, Chemistry or Physics (or related fields) at an accredited 4-year college or university, and to have attained an undergraduate academic record that meets or exceeds the standards established by the Graduate Division of UC Riverside. Students will have completed coursework in chemistry (minimally, one year each of introductory and organic, including laboratories), physics (minimally, one year introductory, including laboratory), mathematics (minimally, one year calculus, plus one upper division course), biochemistry (minimally, one year introductory, including laboratory) and biology (minimally, one year introductory, including laboratory) in addition to upper-division courses in their major. Students with strong academic records may be admitted with coursework deficiencies, provided these are remediated during the first two years of graduate study. Entry into the program will require adequate performance on the Graduate Record Examination (GRE), as well as the Subject Examination in Physics, Chemistry, Biochemistry or Biology.

2.2) Foreign language competency. None required.

2.3) Program of study.

2.3a) Specific fields of emphasis. The program will offer a Master's (M.S.) Plan II and a doctoral (Ph.D.) degree in Biophysics. Students enrolled in the program are expected to complete core coursework consisting of a one-year (three quarter) series of graduate coursework. Students are also expected to participate in seminars and colloquia, and to become informed about the major technological methods and advances that provide the

essential underpinnings to new discoveries in the field. Upon entry, each student will work with the program's Graduate Oversight Committee to develop an appropriate course of study given the student's interests, including the assignment of laboratory rotations (tentatively BPHY 297) with three different participating faculty as part of the preceptor selection process.

2.3b) Plans. **M.S.** Master's students will complete core coursework in biophysics, and will take at least one graduate seminar course each quarter that they are enrolled. They must take and pass a Comprehensive Examination at the end of their coursework. **Ph.D.** Doctoral students will be expected to fulfill all requirements for the M.S. degree; the expectation for satisfactory performance on the Comprehensive Examination will be higher than for the M.S. degree. Doctoral students must also pass a combined written and oral Qualifying Examination consisting of: (1) the preparation of a research proposal based on the student's dissertation work and taking the form of a grant proposal to NSF or NIH; and (2) defense of same before a faculty committee consisting of a Chair and three additional program faculty, plus one external member to ensure fairness (see Section 2.5 below). The student will also undertake a research project leading to a dissertation, with annual presentations to the dissertation committee to assess progress toward degree. Publications in peer-reviewed journals are also expected. In the course of their studies, Ph.D. students will be expected to complete a minimum of two quarters as teaching assistant to gain experience in instruction.

2.3c) Unit requirements. **M.S.** 36 units of 100 or 200 series courses, of which at least 18 units must be in the graduate 200 series. This coursework will include the program's graduate core curriculum and courses from a list of approved electives (see Section 5). **Ph.D.** 36 units of 100 or 200 series courses, of which at least 24 units must be in the graduate 200 series. This coursework will include the program's graduate core curriculum and courses from a list of approved electives (see Section 5). A minimum of 16 units of coursework other than courses in the 290 series must be completed in fulfillment of the 24-unit program requirement for graduate coursework.

2.3d) Required and recommended courses. All students will be required to take a three-quarter sequence of introductory biophysics (consisting of BCH 184, BIOL 203 and PHYS 246), as well as a series of four five-week research rotations in laboratories of participating faculty under the auspices of BPHY 297, as part of the thesis advisor selection process. Participation in the Biophysics Graduate Seminar (tentatively BPHY 252) is also required each quarter that the student is enrolled, and each student is expected to present a formal research seminar in this course prior to graduation. Students will also be required to complete the Responsible Conduct of Research program provided by the Office of Research Integrity. To complete the 36 unit requirements for degree, students will select courses from a list of approved electives to meet unit requirements (see Section 5).

2.3e) Comprehensive Examination. Both Master's and doctoral students will be required to pass a three-hour Comprehensive Examination consisting of questions provided by the participating faculty, with topics taken from the core curriculum. The Comprehensive Examination will be graded by those submitting questions, and the results presented to the participating faculty for a decision of PhD Pass, MS Pass, or Fail in each student's case. The expectation for satisfactory performance on the Comprehensive Examination will be higher for doctoral students than for Master's students.

2.3f) Licensing/certification requirements. None.

Professional development and training – The program of study described above incorporates a number of aspects that contribute to the professional development and training of the program's graduate students. These include:

- The written component of the General Examination, which is intended to provide experience in the preparation of grant proposals to be submitted to federal granting agencies;
- The oral component of the General Examination, the requirement for an annual research evaluation and requirement to present in BPHY 252, which provide the opportunity to develop presentation skills that will complement those developed in research group meetings and journal clubs that the student may participate in;
- The TA requirement, which includes participation in the Teaching Assistant Development Program administered by the Graduate Division of UC Riverside, which is intended to develop pedagogical skills; and
- Involvement in the Office of Research Integrity's Responsible Conduct of Research program, which is intended to reinforce a strong sense of professional ethics.
- Participation in national and international scientific conferences, providing the opportunity to develop presentation skills and personal networking opportunities.
- Participation in professional development programs run by organizations such as The Department of Education, the National Science Foundation, the National Institutes of Health, the American Association for the Advancement of Science, the Association of Women in Science, the Biophysical Society and the Biological Division of the American Physical Society.

2.4) Field examinations. None.

2.5) Ph.D. Qualifying Examination. Doctoral students must pass a written qualifying examination that, as indicated above, will consist of the preparation of a research proposal based on their dissertation work and taking the form of a grant application to the National Science Foundation or National Institutes of Health. The proposal will be evaluated by an Oral Qualifying Exam committee consisting of a participating faculty member selected by the Director in consultation with the student's dissertation advisor and three additional program faculty selected by the student and his/her preceptor, and approved by the Program Director. All members of the Oral Qualifying Examination Committee must be members of the Academic Senate, and the Committee will include one external examiner whose principal is to ensure the fairness of the examination, for a total of five committee members. The Committee will not include the student's dissertation advisor. Once the written proposal is deemed satisfactory by the Committee, the student must pass an oral examination that will consist of a defense of the written research proposal before the student's Qualifying Examination committee. Upon successful completion of all coursework and passing of the Qualifying Examination, the student will advance to Candidacy.

2.6) Thesis and/or dissertation. Having completed the four required laboratory rotations in BPHY 297 in their first year, students will be expected to have selected a dissertation advisor by the end of their first academic year. The student's dissertation advisor will chair a Ph.D. Dissertation Committee that will consist of a minimum of two additional members of the Academic Senate, who will normally also be participating members of the Biophysics Graduate Program. All committee members should be able to provide guidance and judge the scholarship of the dissertation

research. The student is expected to meet with his/her Dissertation Committee once a year in an Annual Research Evaluation, in which the student formally presents his/her work to date and progress is assessed and input to the research project provided by the committee. During this time, students will be enrolled in sufficient credits of directed research (tentatively BPHY 299) to ensure good standing in the Graduate Division. A written dissertation will be completed by each student in the program.

2.7) Final examination. Doctoral candidates will defend their dissertations in a public, oral presentation at a time announced to members of the University community. The public presentation will be followed by a private defense of the dissertation to the Dissertation Committee, which will make a recommendation to the Graduate Division as to whether the degree of Ph.D. should be conferred.

2.8) Explanation of special requirements. None.

2.9) Relationship of M.S. and Ph.D. programs. Students will normally be admitted to the Ph.D. program. Upon passing the Qualifying Examination and advancement to Candidacy, the student may petition the Graduate Division for conferral of the M.S. degree.

2.10) Special preparation for careers in teaching. Not applicable.

2.11) Sample Ph.D. program. Students enrolled in the proposed program will be expected to complete an individualized curriculum that will include the core coursework described in Section 2.3d above, with additional coursework tailored to the student's research interests and background (including remediation of deficiencies identified upon admission to the program). Table 2 provides a sample program designed to meet the needs of a student wishing to work in the area of structural biology, with an emphasis in protein structure determination as elucidated by NMR.

Table 2

	Fall	Winter	Spring
Year 1	BIOL 203 (Intro) BPHY 252 (Seminar) BPHY 290 (Lab Rotation) Elective	BCH 184 (Intro) BPHY 252 (Seminar) BPHY 290 (Lab Rotation) Elective	PHYS 246 (Intro) BPHY 252 (Seminar) BPHY 290 (Lab Rotation) Elective
Year 2	CHEM 209M (Introduction to NMR) BPHY 252 (Seminar) BPHY 297 (Research)	CHEM 229Q (Advanced NMR) BPHY 252 (Seminar) BPHY 297 (Research)	BCH 210 (Bch Macromol) BPHY 252 (Seminar) BPHY 297 (Research)
Years 3-5	BPHY 252 (Seminar) BPHY 299 (Dissertation Research)	BPHY 252 (Seminar) BPHY 299 (Dissertation Research)	BPHY 252 (Seminar) BPHY 299 (Dissertation Research)

2.12) Normative time from matriculation to degree. A typical doctoral student will be expected to complete all degree requirements in approximately five years.

Section 3. Projected Need

3.1) Student demand for the program. The National Research Council recognizes Biochemistry, Biophysics and Structural Biology as major disciplines in the Life Sciences, and specifically ranks Ph.D. programs in these areas. Biophysics and Computational Biology is also a major section of *Proc. Natl. Acad. Sci. (USA)*, emphasizing its importance as a discipline. Significant breakthroughs over the past decade in protein structure determination and a variety of imaging methodologies, new insights into the dynamic behavior of individual protein molecules and advances in understanding the relationship of structure to function (in systems ranging from nitrogen fixation and photosynthesis to the replisome and signal transduction) have brought great attention to Biophysics. These advances in turn have attracted students eager to participate in such discoveries. At the same time, a wide range of career opportunities await individuals trained in biophysics, including positions in the pharmaceutical and chemical industries, academia and both public and private research institutions. The proposed graduate program will provide a coherent, campus-wide umbrella organization under which faculty efforts and resources can be marshaled, faculty and student interactions and research/grant productivity facilitated, and the overall reputation of the campus in the field enhanced. This will then generate even greater interest among potential students who will be attracted to the program. While students interested in the research programs of the participating faculty are already entering one or another existing departmental graduate program, a formal interdepartmental program will provide prospective students with greater educational and training opportunities and be of greater interest to students specifically seeking a degree in Biophysics. Again, the expectation is that the proposed program will attract a cadre of students who would not otherwise consider coming to UC Riverside and is not expected to have a negative impact on existing graduate programs. It will also address a significant manpower need on the part of the research programs of present and future faculty working in the area. As indicated above, the program is committed to the development of a diverse graduate student population that will contribute to the campus, indeed national, priority of developing an increasingly robust pipeline of under-represented minorities and women in STEM disciplines.

3.2) Opportunities for placement of graduates. There is high demand for biophysicists in a broad range of areas. The development of new drugs in the pharmaceutical industry is increasingly guided by the detailed three-dimensional structures of therapeutic targets (e.g., reverse transcriptases, viral coat protein maturases, membrane channel proteins) and by the modeling of their dynamic behavior and interaction with potential drugs. Similarly, the chemical industry has become increasingly invested in the use of individual enzymes and even entire metabolic pathways in the development of more efficient methods to produce a wide range of commodity and fine chemicals. The US National Laboratories have had a long-standing and strategic interest in the application of sophisticated physical methods to understand biological systems and processes, as have private research institutions such as the Scripps Research Institute and Howard Hughes Medical Institute. Finally, recruitment of biophysicists has become a priority in academia nationwide, and particularly in biomedically relevant areas. This national trend is reflected in recent faculty recruitment at UC Riverside in the Departments of Biochemistry, Bioengineering and Chemistry, and to a lesser extent the Department of Physics. There is every reason to believe that students receiving a Ph.D. in Biophysics from UC Riverside will have excellent job prospects.

3.3) Importance to the discipline. Biophysics is an inherently interdisciplinary enterprise, with strong components drawn from Physics, Biochemistry, Mathematics and Chemistry, as well as other life sciences. Having a Ph.D. program that will provide a coherent training program to students across disciplinary lines will provide students with an exceptionally broad perspective that will make them

extremely well-qualified to contribute at the cutting edge of modern research in the area. The broad disciplinary distribution of participating faculty in the proposed program will greatly contribute to the breadth of training provided at UC Riverside.

3.4) Ways in which the Program will meet societal needs. Over the past 50 years, many of the most important advances in our understanding of the processes of life have been made by biophysicists. Signal contributions include: discovery of the atomic-resolution structure of DNA; elucidation of the genetic code and mechanism of information transfer in biological systems; structure of the ribosome, photosynthetic and nitrogen-fixation systems; behavior of individual molecules of the replisome, topoisomerase, helicase and other complex enzymatic systems working on DNA; the physical basis of transmembrane ion transport, particularly as relates to neuronal function; and visualization/analysis of neural networks. These and other advances have contributed enormously to our understanding of various disease states, including cancer and heart disease, and to the improvement of human health. Students in the proposed Biophysics Program will be able to participate in either basic or applied research in these and other emerging areas and thus contribute to a deeper understanding biological processes and to improved human health. And to reiterate, the program is committed to the development of a diverse graduate student population that will contribute to the national priority of developing an increasingly robust pipeline of under-represented minorities and women in STEM disciplines.

3.5) Relationship of the Program to research interests of the faculty. Many faculty members at UC Riverside are engaged in biophysics-related research, including a significant number of new hires in the Departments of Biochemistry, Chemistry and Physics. The participating faculty are spread across five different departments, and an interdepartmental graduate program such as proposed will provide an effective and much-needed mechanism for facilitating productive interactions among the participating faculty and for generating an enriched training environment for its students.

3.6) Program differentiation. Most UC campuses have graduate programs in biophysics (UC Irvine has a Department of Physiology and Biophysics in it School of Medicine), and a biophysics program on each campus is easily justified in light of the information provided in Sections 3.1 - 3.5 above. The strongly supportive letters from the Directors of the interdepartmental graduate programs in Biophysics at Berkeley and Davis (Appendix III) attest to the lack of perceived competition with existing programs at other UC campuses. The proposed program is distinctive in the range of specific physical methods employed by its participating faculty as well as the breadth of the particular biological systems and processes under investigation, factors which combine to provide a unique training environment. In addition, UC Riverside's nationally recognized leadership in the education of under-represented minorities will provide the proposed program with opportunities to contribute to the STEM pipeline.

Section 4. Faculty

The 27 participating faculty in the proposed Biophysics Graduate Program are self-identified from among five departments in the College of Natural and Agricultural Sciences; of these eight are women and eleven are minority. Each has a significant component of biophysics in his or her research program. Detailed *curricula vitae* are provided in Appendix I, and individual letters of participation in Appendix II. Letters from the Chairs of the Departments of Biochemistry, Biology, Botany and Plant Sciences, Chemistry and Physics and Astronomy are provided in Appendix III, along with letters from the Directors of interdepartmental graduate programs at UC Berkeley, UC Davis and UC San

Francisco. Letters of support from the Dean of CNAS can be found in Appendix IV, and a memorandum from the Executive Committee of CNAS in Appendix V.

Biochemistry

Gregor Blaha (Assistant Professor, Ph.D.)
Richard Debus (Professor, Ph.D.)
Li Fan (Associate Professor, Ph.D.)
Russ Hille (Distinguished Professor, Ph.D.)
Seán O'Leary (Assistant Professor, Ph.D.)
Jeff Perry (Assistant Professor, Ph.D.)
Jikui Song (Assistant Professor, Ph.D.)

Biology

Richard Cardullo (Professor, Ph.D.)
Theodore Garland (Distinguished Professor, Ph.D.)
Nicole Rafferty (Assistant Professor, Ph.D.)

Botany and Plant Sciences

Darrel Jenerette (Associate Professor, Ph.D.)
Dawn Nagel (Assistant Professor, Ph.D.)
Carolyn Rasmussen (Assistant Professor, Ph.D.)
Louis Santiago (Associate Professor, Ph.D.)

Chemistry

Huiwang Ai (Assistant Professor, Ph.D.)
Chia-en Chang (Associate Professor, Ph.D.)
Joseph Genereux (Assistant Professor, Ph.D.)
Richard Hooley (Associate Professor, Ph.D.)
Ryan Julian (Professor, Ph.D.)
Len Mueller (Professor, Ph.D.)
Yinsheng Wang (Professor, Ph.D.)
Min Xue (Assistant Professor, Ph.D.)
Wenwang Zhong (Professor, Ph.D.)

Physics

Mark Alber (Distinguished Professor, Ph.D.)
John Barton (Assistant Professor, Ph.D., arriving 1/1/18)
Umar Mohideen (Professor, Ph.D.)
Roya Zandi (Professor, Ph.D.)

Section 5. Courses

No new didactic courses are required to implement the proposed program, although new Biophysics Seminar (tentatively BPHY 252), Research Rotation (tentatively BPHY 297) and Dissertation Research (tentatively BPHY 299) courses will need to be established. Three existing courses, BCH 184 (Physical Biochemistry, 4 units), BIOL 203 (Cellular Biophysics, 3 units) and PHYS 246 (Biophysics, 4 units each) will constitute the core curriculum for the proposed program. Syllabi for these three courses along with their catalog descriptions are provided in Appendix VI. Additional elective courses appropriate for the program include:

BCH 186 (Topics in Molecular Bioenergetics, 3 units)
BCH 187 (Fundamentals of Enzymology, 3 units)
BCH 210 (Biochemistry of Macromolecules, 4 units)
BCH 230F (Advanced Topics in Biochemistry: Enzymology)
CHEM 201A (Advanced Physical Chemistry: Quantum Mechanics, 3 units)
CHEM 201B (Advanced Physical Chemistry: Quantum Mechanics and Spectroscopy, 3 units)
CHEM 201C (Advanced Physical Chemistry: Elementary Statistical Mechanics, 3 units)

CHEM 201D (Advanced Physical Chemistry: Thermodynamics, 3 units)
CHEM 201E (Advanced Physical Chemistry: Kinetics, 3 units)
CHEM 206A (Introduction to Computational Quantum Chemistry, 3 units)
CHEM 206B (Modeling Chemical and Biochemical Molecules, 3 units)
CHEM 209M (Introduction to NMR, 3 units)
CHEM 211D (Spectrometry in Organic Structure Analysis, 3 units)
CHEM 229Q (Advanced NMR, 3 units)
PHYS 145ABC (Biophysics, 4 units each)
PHYS 212A (Thermodynamics and Statistical Mechanics I, 4 units)
PHYS 212B (Thermodynamics and Statistical Mechanics II, 4 units)

Catalog descriptions of the above courses are provided in Appendix VII. All courses are currently offered, (some in alternate years), and all are currently staffed. New elective courses can be added upon approval as described in Section 8.

Section 6. Resource Requirements

6.1) FTE faculty. No additional faculty positions are sought, although new or replacement positions awarded to departments with participating faculty in the proposed program can reasonably be expected to expand the program over time. The process for admitting new faculty to the program is described in Section 8, in Article II.1 of the by-laws. Administrative support will be provided by the Graduate Student Affairs Center of CNAS, which presently administers 16 graduate programs; as indicated above one staff member has already been identified to work with the proposed program. Support for the Director will be provided by CNAS commensurate with that provided other Directors of interdepartmental graduate programs (e.g., Cell, Molecular and Developmental Biology; Genetics, Genomics and Bioinformatics; Environmental Toxicology), as described in the letters provided by CNAS Dean Uhrich and Divisional Deans Umar Mohideen (Physical Sciences and Mathematics) and Frances Sladek (Life Sciences) (Appendix IV).

6.2) Library acquisition. The UCR library system, in particular the Science Library, currently subscribes to all the major journals relevant to Biophysics, and also purchases the important books, monographs and the like in the field. No increase in demand for new acquisitions is anticipated.

6.3) Computing costs. No increases in computing costs are anticipated beyond those associated with UC Riverside's projected growth in faculty and research portfolio, as laid out in the campus's Strategic Plan. Personal computer facilities are available in the laboratories of all the participating faculty, providing access to the Internet. The computer facilities of the Science Library are also available to student and participating faculty of the program. More advanced computing capabilities are available in the laboratories of several of the participating faculty, who also have access to off-campus supercomputing facilities as needed.

6.4) Equipment. No new equipment is required to implement the proposed program, although one of the expected benefits accruing from its creation is that greater interaction among laboratories will identify common equipment needs for which extramural funds will be sought. While institutional matching funds are typically required of granting agencies in making such awards, these are usually modest relative to the total cost of the instrumentation. As a particular example, plans are being made for the submission of a proposal for a 900 MHz NMR instrument that will be used by several of the participating faculty of the proposed program, to be housed in space already available in the Chemical Sciences Building.

6.5) Space and other capital facilities. None, although again plans are being made for the submission of a proposal for a 900 MHz NMR instrument that will be used by several of the participating faculty of the proposed program, to be housed in specifically designed space already available in the Chemical Sciences Building. Additional space may be made available in the MRB1 building that is presently under construction, scheduled for completion at the end of 2018.

6.6) Other operating costs. As indicated above, support for the Director of the proposed program will be provided by CNAS, consistent with its policies as outlined in the Deans' letters (Appendix IV). Additionally, administrative services will be provided by the CNAS Graduate Student Affairs Center as discussed above. Again, this Center already provides administrative support for 16 graduate programs, and the proposed program does not substantively increase its workload. A staff member of the Center has already been identified to serve the proposed program.

Section 7. Graduate Student Support

Graduate students in the proposed program will be supported by a combination of sources. Support in the first year will be provided by fellowships through the Graduate Division, and creation of the program is consistent with the Graduate Division's projected growth of graduate fellowships as the number of UCR faculty grows. In consultation with the Graduate Division, former Dean Childers was enthusiastic about creation of the program. At the end of the first year students will have selected a dissertation advisor and will typically be supported thereafter as research assistants on grants awarded to their dissertation advisors, individual pre-doctoral fellowships from federal granting agencies and private foundations, and/or teaching assistantships provided either by the home department of the student's dissertation advisor or through the Teaching Assistantship Allocation Committee (TAAC), which makes assignments for all graduate programs in the Life Sciences. The TAAC has a strong track record of providing support for graduate students in 16 different graduate programs, specifically including successful interdepartmental graduate programs such as Cell, Molecular and Developmental Biology and Genetics, Genomics and Genomics. While the Graduate Division has no formal requirement for 301/302-level coursework to provide training in becoming a teaching assistant, biophysics students holding teaching assistantships in departments that require 301/302 coursework will take them. As laid out in the Deans' letters provided in Appendix IV, the CNAS leadership is strongly committed to ensuring continuous funding for all the program's students in good academic standing throughout their time in the proposed program as described in. It is to be emphasized that CNAS has demonstrated an outstanding track record to support for graduate students that is clearly articulated in the Deans' letters in Appendix IV and is far more specific than letters of support for past proposals for the creation on interdepartmental graduate programs (e.g., GGB, CMDDB and Materials Science). Students in the proposed program can thus expect to have the benefit of appropriate support from the college.

Section 8. Governance

The Program will be administered by a Director and a three-member Executive Committee. The Director, in conjunction with an administrator from the CNAS Graduate Affairs Center, will be responsible for the day-to-day operation of the program, including admissions, student advising and monitoring students' progress through the Program. The members of the Executive Committee will chair subcommittees for Graduate Admissions, Graduate Oversight and Curriculum, with each subcommittee comprised of two additional participating faculty members from the Program.

The proposed graduate program will be governed by the following by-laws:

Article I. Objective

The proposed Biophysics Graduate Program is intended to encourage broad-based study of and post-graduate training in biophysics and to foster communication between biophysicists within different departments on the UC Riverside campus. The Program is thus intended to be interdepartmental, and includes some 27 faculty from the departments of Biochemistry, Biology, Botany and Plant Sciences, Chemistry and Physics. The program's primary objective is to train scientists able to teach and conduct research in the area of biophysics. The proposed Biophysics Program will offer both a M.S. and a Ph.D. in Biophysics.

Given the departmental distribution of the biophysics community on campus, graduate students will have the opportunity to incorporate a wide range of disciplines into their training experience. Programs of study will be tailored to the interests and goals of individual students.

Article II. Membership

- 1) Membership Criteria. The participating faculty recognize that involvement in a graduate program can take many forms, although the principal one is obviously training of graduate students in the field as broadly defined. Criteria for membership can include 1) maintenance of an active research program in the area of biophysics as broadly defined; 2) service on graduate student General Examination and Dissertation Committees; 3) continued participation in the Biophysics program by emeritus faculty, and 4) support of research endeavors in the field of biophysics by non-Academic Senate members. Approval of new members to the Biophysics program will be vested in the Executive Committee. Faculty requesting membership in the Biophysics Program should send a *curriculum vitae* to the Graduate Program Director with a cover letter describing how the candidate expects to be involved in the program. The Director will then forward the documents to the Executive Committee for consideration. With a favorable review, an e-mail vote of the participating faculty will be taken; membership will be conferred with a positive vote by a majority of the responding faculty.
- 2) Membership Retention. The membership status of Biophysics faculty will be reviewed every three years by the Executive Committee. Criteria used to evaluate members can include serving as a major professor or as a member of advisory, candidacy exam or supervisory committees for Biophysics graduate students; service on committees of the Biophysics Program; attendance at seminars; participation in recruitment activities and other Biophysics Program functions. Faculty whose membership is to be evaluated will be notified in Fall of the academic year and may be asked to supply a brief summary of their Biophysics-related activities to the Executive Committee by the end of the Fall quarter. The Executive Committee will complete its evaluations by the end of Winter quarter of the same academic year.
- 3) Termination of Membership. A participating faculty member who wishes to leave the program may request termination of their membership at any time by sending a memo to the Program Director. Program members whose participation is deemed below that sufficient for good standing will be reviewed by the Executive Committee to determine the source of any problems and to recommend solutions. Members will be given a year to improve their participation in the Biophysics Program before facing termination.

Article III. Organization and Administration

As indicated above, the administration of the program and its activities will be vested in an Executive Committee consisting of three program members in addition to the Biophysics Program Director, who will serve as chair. Each of these will chair one of the three standing committees of the Program: Recruitment and Admissions, Graduate Oversight and Curriculum, with the responsibilities described below.

- 1) Program Director. The Graduate Program Director will be responsible for the overall direction and organization of the Biophysics Program and will chair the Executive Committee. The appointment of the Program Director will be in keeping with the regulations of Graduate Council. Initially, the Dean of the Graduate Division will solicit nominations from the program faculty and make an appointment. Afterwards, the Executive Committee will solicit confidential nominations from the participating faculty and submit the names of no more than two qualified faculty to the Dean of the Graduate Division, along with a supporting statement for each nominee. The Dean of the Graduate Division will then forward his/her final nominee to the Chancellor, who will make the actual appointment of the new Program Director. The Biophysics Program Director will be the Biophysics representative at CNAS chairs meetings and other meetings on campus requiring representation of the program. The Biophysics Program Director will send nominations of faculty to serve as Graduate Advisor to the Dean of the Graduate Division as well as nominations of faculty to serve as chairs of the program's standing committees. The Biophysics Program Director will appoint additional members to these standing committees (see below).
- 2) Chair, Recruitment and Admissions. The chair of the Recruitment and Admissions committee will be responsible for recruiting students to the Program and assessing the files of applicants to the program. The Recruitment and Admissions Chair will be nominated by the Biophysics Program Director, with final approval given by the Dean of the Graduate Division.
- 3) Chair, Graduate Oversight. The chair of the Graduate Oversight Committee will serve as Graduate Advisor and will be responsible for the overall academic advising of students in the Biophysics Program. S/he will be responsible for revisions of the Graduate Student Handbook and will be responsible for setting up faculty rotation schedules for first-year graduate students. S/he will also be responsible for advising students as to forming their Qualifying Examination and Dissertation Committees, and will have responsibility of the Program's annual Comprehensive Examination. The Dean of the Graduate Division will give final approval of the Qualifying Examination and Dissertation Committees. As Graduate Advisor, the chair of the Graduate Oversight Committee will be nominated by the Biophysics Program Director, with final approval given by the Dean of the Graduate Division.
- 4) Chair, Curriculum. The chair of the Curriculum Committee will oversee the assessment of the Program curriculum and implementation of changes in same, as described further below. With his/her committee, s/he will also have overall responsibility for organizing the Program's seminar series. The Recruitment and Admissions Chair will be nominated by the Biophysics Program Director, with final approval given by the Dean of the Graduate Division.

Article IV. Committees

- 1) Executive. The administration of the program and its activities will be vested in an Executive Committee consisting of four members: Biophysics Program Director who will serve as chair, and the chairs of the program's three standing committees. The Executive Committee will act in an advisory capacity to the Program Director for any issues that arise concerning the Biophysics Program and will be responsible for review and approval of new faculty to the Biophysics program and for final decisions on termination of membership. The Executive Committee will also facilitate the process used to nominate new Program Directors. It will meet at least once per year, more frequently as needed.
- 2) Recruitment and Admissions. The Recruitment and Admissions Committee will be responsible for recruitment activities and review of applications of students who wish to enter the Biophysics Program. This committee will send files of qualified applicants, along with supporting documentation, to the Graduate Division Dean, who will make the final decision regarding admission and Graduate Division fellowship support. The Recruitment and Admissions Committee

will also coordinate the recruitment visits of admitted graduate students to UCR, oversee the maintenance of the program website and prepare advertising/recruitment materials for the program.

The Recruitment and Admissions Committee will consist of the committee Chair from the Executive Committee plus two participating faculty members appointed by the Director, and will meet as necessary to review files and plan recruitment activities. The term of membership on the Admissions Committee will be three years.

- 3) Graduate Oversight. The Graduate Oversight Committee will be responsible for overseeing students' progress through the program, and will assist the Chair of the committee in forming students' Qualifying Examination and Dissertation Committees, and in the preparation of the Program's annual Comprehensive Examination.

The Graduate Oversight Committee will consist of the committee Chair from the Executive Committee plus two participating faculty members appointed by the Director, and will meet as necessary to undertake its responsibilities. The term of membership on the Admissions Committee will be three years.

- 4) Curriculum. The Curriculum Committee will be responsible for assessment of and changes to the curriculum of the Biophysics program, and will make recommendations for such changes to the curriculum as are deemed appropriate, including the addition of new elective courses, to the participating Biophysics faculty during a Biophysics faculty meeting. A subsequent e-mail vote will be held to approve or disapprove the recommended changes. In order to be considered approved, at least 51% of the participating program faculty must vote in favor of the changes to the program curriculum. The Curriculum Committee will also be responsible for administering the Program's seminar series, selecting and hosting speakers and planning program retreats or research symposia. The Curriculum Committee will meet at least once per year.
- The Curriculum Committee will consist of the committee Chair from the Executive Committee plus two participating faculty members appointed by the Director, and will meet as necessary to undertake its responsibilities. The term of membership on the Admissions Committee will be three years.

Article V. Changes to the By-Laws

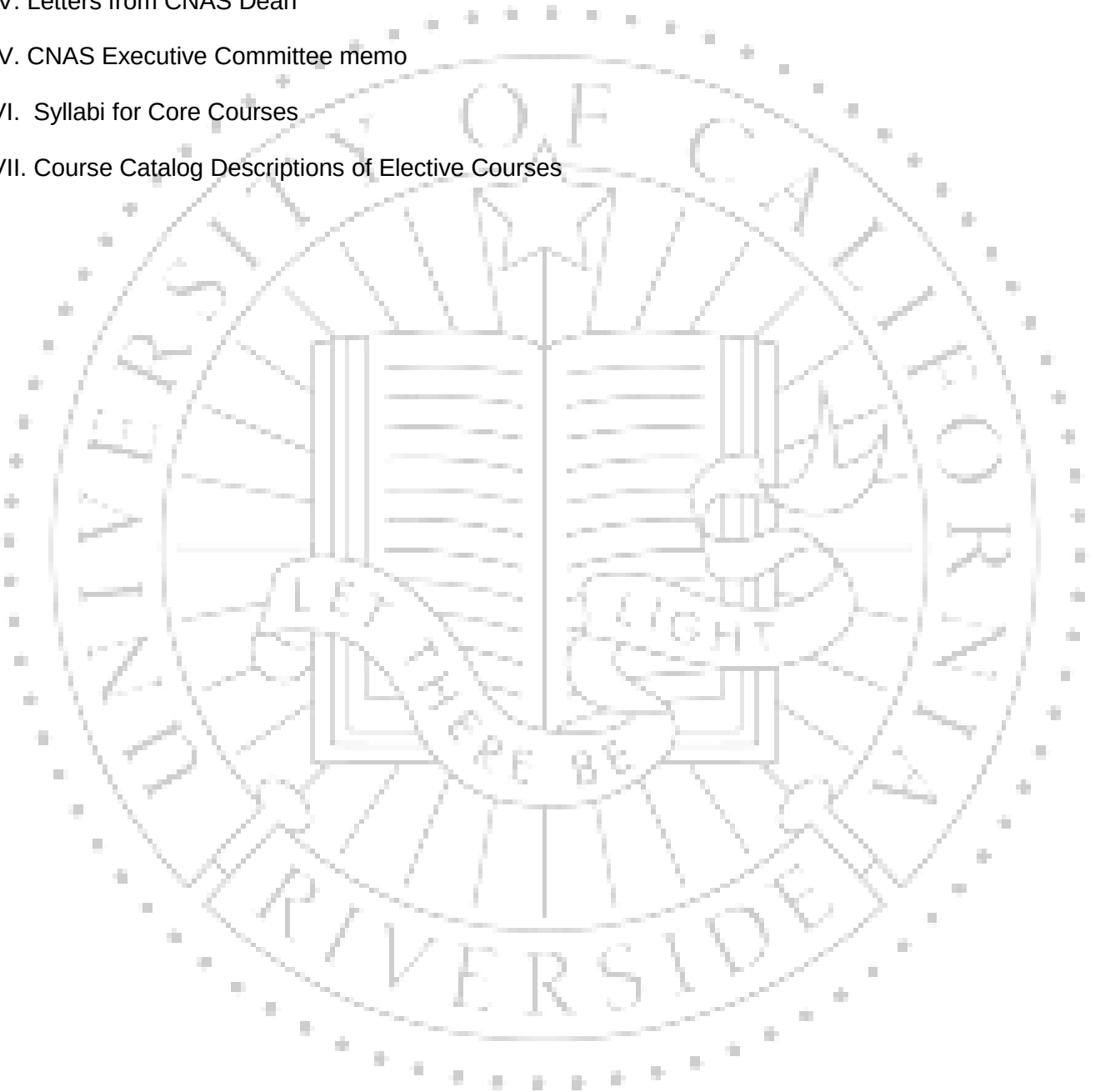
- Changes to the by-laws of the program will be considered at a meeting of the participating faculty, and a subsequent e-mail vote will be held to approve or disapprove the proposed changes. In order to be considered approved, at least 51% of the participating program faculty must vote in favor of the changes to the program's by-laws.

Section 9. Changes in Senate Regulations

No changes in Academic Senate Regulations are required.

Appendices

- I. Faculty CV's
- II. Faculty Letters of Participation
- III. Departmental Chair and Program Director Letters
- IV. Letters from CNAS Dean
- V. CNAS Executive Committee memo
- VI. Syllabi for Core Courses
- VII. Course Catalog Descriptions of Elective Courses





Graduate Council

November 21, 2017

To: Dylan Rodriguez, Chair
Riverside Division

From: Christiane Weirauch, Chair
Graduate Council

A handwritten signature in black ink, appearing to read "Christiane Weirauch".

Re: Revised Biophysics Proposal

Graduate Council reviewed the revised Biophysics proposal at their November 16, 2017 meeting. The Council is very supportive of this new program but would like clarification on the following items:

- TAsHips – explicitly listing TAAC as a mechanism to secure TAsHips for students in this interdepartmental program is a strength, but it would be good to explore potential buy-in from departments and to mention this in the proposal.
- Please specify the number of required lab rotations in the proposal. This information is useful for students and prevents confusion.
- Section 2.3d: “Students will also be required to complete the Responsible Conduct of Research program provided by the Graduate Division”: it is unclear what this “program” entails, given there is no detail on the corresponding webpage. Please be more specific.
- Professional Development (PD): clarify the last bullet point (“Responsible Conduct of Research program”). As per current catalog copy PD training is explained as “Training typically includes elements of research and professional ethics, grant and professional writing, strategies for success in graduate school and the profession, pedagogy, public speaking, career and job market guidance, and other relevant topics to help students become successful professionals.” The currently listed requirements are integral parts of a graduate program, but PD requirements would ideally address additional training aspects and be more rigorous.



October 20, 2017

To: Dylan Rodriguez, Chair
Riverside Division

From: Jiayu Liao 
Committee on Library and Information Technology

Re: [Campus Review] New Graduate Program Proposal: Revised Biophysics
Interdepartmental Graduate Program

The Committee on Library and Information Technology reviewed the [Campus Review] New Graduate Program Proposal: Biophysics Interdepartmental Graduate Program at their October 19, 2017 meeting and voted to support the program. Although it was noted in the proposal that there will be no increase in demand for new library acquisitions and no increases in computing costs, the committee believes that if this new program brings new faculty and students to campus, this will need to be re-evaluated as more computer support and dedicated lab space will be needed.



PLANNING & BUDGET

December 21, 2017

To: Dylan Rodriguez, Chair
Riverside Division

From: Christian Shelton, Chair 
Committee on Planning and Budget

RE: Revised Biophysics Proposal

P&B discussed the revised proposal for a graduate program in Biophysics and feels that the issues the committee raised last year have been addressed and resolved. The revised proposal makes it clear how this program fits into UCR's plans to increase the size of graduate programs.

Separately, P&B noted that the current difficulties of budgetary support for interdisciplinary programs remain. This is not unique to this proposal and does not stand in the way of P&B's support of the Biophysics proposal.

Yet, some of the issues raised in the last round of review were mitigated in the current proposal by the reduction of the proposal to a single college.

For the first cycle of review by Graduate Council, P&B suggests that potential problems with interdisciplinary funding be paid special attention to.



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DISTINGUISHED PROFESSOR
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July 22, 2017

To the University Senate:

Please find attached a revised proposal to create an interdepartmental graduate program in Biophysics at UCR, the original version having been submitted December 21, 2016. In their reviews of the original proposal, both Graduate Council and the Senate Committee on Budget and Planning expressed support for the proposed graduate program, but each had concerns that warranted the present revision. These concerns, and the responses to them, are summarized below.

Graduate Council expressed concern regarding funding of the program, and asked for additional information regarding compensation for the program Director and overall support for the program. There was also a general statement made regarding faculty diversity. Regarding diversity, a second round of solicitations to participate has been circulated, and of the 27 faculty now participating in the revised proposal, seven are women and eleven are minority, a significant improvement.

Regarding support for the program, new wording in Sections 1.6, 6.1, 6.6 and the Introduction to Section 8 emphasizes that the proposed program will be administered by the CNAS Graduate Affairs Center, which presently provides administrative services for 16 departmental and interdepartmental graduate programs. The proposed program represents only a modest increase in the Center's workload, and a member of the Center's staff has already volunteered to serve the proposed program.

By far the most substantive change to the proposal has been the removal of ten faculty in BCOE, with all remaining 27 participants being in CNAS. This was necessitated in response to concerns expressed by Graduate Council, which specifically stated:

"Given the campus-wide nature of the program, the Council feels that funding should be defined and commitments outlined at inception. This could involve discussion and commitment among the deans of the various colleges (who have all indicated support of the proposal), or perhaps funding of these programs could be best managed at the provost level. Either way, budget support should be determined in detail, including provisions for future expansions, before the program begins."

In attempting to address this concern, Deans Kathryn Uhrich of CNAS and Sharon Walker of BCOE met in early July to discuss a joint response. At the end of the day, Dean Walker made clear that while she fully supported the creation of the proposed program she was not prepared to make any specific financial commitment to it. Given the express concerns of Graduate Council, this decision has necessitated dropping BCOE participants so that all participating faculty are now from CNAS. I personally find this unfortunate, but Graduate Council has clearly articulated its concerns and there is simply no other way forward. I observe that with 27 participants, the revised proposal remains well above critical mass and retains broad programmatic depth.

To address the concerns expressed by Graduate Council, a second letter from the CNAS Dean and Divisional Deans of the Life Sciences and Physical Sciences and Mathematics has been provided in Appendix IV, and as indicated there and in modified wording to Sections 6.1 and 6.6, compensation for the Program Director will be provided by the CNAS Dean's office in a manner consistent with college policy, as described in the letter. This letter also clearly articulates the Deans' commitment to provide a level of support appropriate to ensure the success of the proposed program, including the allocation of teaching assistantships for program students through the TA Allocation Committee

responsible for assigning TAs for all the Life Science graduate programs. This commitment represents a level of support comparable to that enjoyed by other interdepartmental graduate programs in the Life Sciences, including Cellular, Molecular and Developmental Biology, and Genetics, Genomics and Bioinformatics, which by any measure must be considered very successful. I trust this second letter of support from CNAS satisfactorily addresses the concerns raised by Graduate Council.

The Committee on Budget and Planning voted unanimously in support of the program, but commented on the need for the proposed curriculum to comply with Graduate Division requirements regarding 301/302-level coursework and requested additional information concerning the relationship of the proposed graduate program to existing ones and how teaching assistantships would be allocated for program students. Regarding the 301/302-level coursework, it is to be noted that Graduate Division has no formal requirements for these courses, which provide department-specific training for prospective teaching assistants. Section 7 has been expanded, however, to include a statement that program students seeking teaching assistantships should comply with departmental requirements for such coursework in order to be eligible.

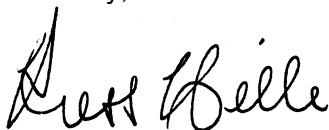
Regarding the relationship of the proposed program to existing ones, Section 1.4 has been substantially expanded to emphasize the point made in the original proposal that the intent is to complement rather than duplicate or compete with existing graduate programs, and specifically to recruit a cadre of students seeking study and training in biophysics who would not have otherwise considered UC Riverside. The Committee specifically asked the question "how will faculty in biophysics be able to increase their total number of mentored graduate students without additional faculty lines?", which seems to suggest that the program can only grow at the expense of others, and that the number of participating faculty and the size of their research programs is static. Suffice it to say that the research programs of the participating faculty are substantially under-staffed at present, a situation that has been a major impetus for proposing the new graduate program in the first place. It is further to be emphasized that the number of faculty working in the area of biophysics has been rapidly expanding, with 12 of the participating faculty hired in the last two years. Three additional hires have been approved in the coming year in Biochemistry, Chemistry and Physics and there is every reason to believe this expansion will continue for the foreseeable future. While these hires are not required for the success of the proposed program, they do underscore how timely the present proposal is. The demand for graduate students working in the area is only expected to increase and there is every reason to believe that the participating faculty will be able to accommodate the anticipated increase in graduate students accruing from the program's growth, as projected in Section 1.3. Creation of the proposed graduate program is also fully consistent with the projected growth of the Graduate Division as the size of the faculty expands.

Finally, the Committee requested additional information regarding the allocation and administration of teaching assistantships for the program's students. In response, Section 7 has been expanded considerably to address this and, as referred to above, a new letter from the CNAS Dean has been provided in Appendix IV that clearly articulates their commitment to providing teaching assistantships and other resources sufficient to ensure the success of the proposed program.

In addition to these specific responses to points raised by Graduate Council and the Committee on Budget and Planning, a number of stylistic changes have been made throughout the proposal and two egregious grammatical mistakes have been corrected. These are not enumerated.

In conclusion, I would like to thank both Graduate Council and the Committee on Budget and Planning for their thoughtful critiques of the original proposal. I look forward to learning of final disposition of the revised proposal.

Sincerely,

A handwritten signature in black ink, appearing to read "Russ Hille", with a stylized, cursive script.

Russ Hille
Distinguished Professor of Biochemistry



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RIVERSIDE, CALIFORNIA 92521-0122

December 21, 2016

University Senate
University of California, Riverside

Dear Colleagues:

I attach for your consideration a proposal to create an interdepartmental graduate program in Biophysics at UC Riverside. The 31 participating faculty represent seven departments in two colleges, and collectively reflect the full breadth of biophysics as presently practiced internationally.

In addition to the body of the proposal, including an executive summary, seven appendices are included containing the following:

- CV's of participating faculty
- letters of participation from the participating faculty
- letters from the seven departmental chairs at UCR as well as letters from the directors of two existing interdepartmental graduate programs at UC Berkeley and UC Davis
- letters of support from the Deans of CNAS and BCOE
- memoranda of approval from the Executive Committees of CNAS and BCOE
- syllabi for the proposed core curriculum
- catalog descriptions of the proposed elective courses

I submit the following names as suggested internal and external examiners:

Wendy Salzman, Department of Biology, UCR michele.salzman@ucr.edu
Mary Droser, Department of Earth Sciences, UCR mary.droser@ucr.edu
Jay Gan, Department of Environmental Sciences, UCR j.gan@ucr.edu
Howard Judelson, Department of Plant Pathology & Microbiology, UCR howard.judelson@ucr.edu
Jory Yarmoff, Department of Physics, UCR jory.yarmoff@ucr.edu
David Britt, Department of Chemistry, UC Davis rdbritt@ucdavis.edu
Carlos Bustamante, Department of Physics, UC Berkeley carlos@alice.berkeley.edu
Alison Butler, Department of Chemistry, UC Santa Barbara butler@chem.ucsb.edu
Susan Miller, Department of Pharmaceutical Chemistry, UC San Francisco Susan.MillerPhd@ucsf.edu
Tom Poulos, Department of Biochemistry, UC Irvine poulos@uci.edu

Thank you for your consideration, and I look forward to hearing back from you in due course.

With best regards,

Russ Hille, Ph.D.
Distinguished Professor of Biochemistry

A Proposal for an Interdepartmental Program of Graduate Studies in Biophysics for the M.S. and Ph.D. Degrees



Prepared September 14, 2016; revised August 22, 2017

Contact Information

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Executive Summary

An interdepartmental graduate program in the field of Biophysics is proposed, justified on the basis of the intrinsic importance of the field in the life sciences and the growing number of faculty at UC Riverside who are presently working in the area as broadly defined. The intent is to provide a means to recruit and train a new cadre of graduate students to UCR that will complement existing graduate programs on campus and provide trainees for the research programs of the participating faculty. Areas of existing expertise on campus include macromolecular structure determination, spectroscopic methods of various sorts, photosynthesis, physiological ecology and ecosystem processes, computational/mathematical modeling of biological systems, biological electron transfer, neurobiophysics and protein engineering. Formal course requirements will consist of a core curriculum and electives that amount to approximately one full academic year of coursework, and will be comprised of existing classes. Training in professional integrity and the responsible conduct of research will be explicit components of the curriculum. Basic requirements for the M.S. Plan II degree will consist of successful completion of the coursework and passing a Comprehensive Examination prepared and graded by the participating faculty. For the Ph.D. degree, in addition to the requirements for the M.S. Plan II degree, students will be expected to complete a Qualifying Examination consisting of the preparation and defense of a research proposal based on their dissertation research and prepared in the format of a regular grant proposal to the National Science Foundation or National Institutes of Health. Upon successfully completing the Qualifying Examination, Ph.D. students will be expected to complete an independent research project under the direction of a three-member dissertation committee chaired by a faculty member in the Program who will serve as the student's dissertation advisor. The dissertation advisor will be responsible for direction of the research, including providing an appropriate environment and other resources required to undertake the research. The Dissertation Committee will provide general guidance in the course of research, and be responsible for administering the final oral defense of the dissertation arising from the research, which will consist of a public presentation of the principal findings of the research followed by a private defense of the dissertation.

The Program will be administered by a Director and a three-member Executive Committee. The members of the Executive Committee will be responsible for graduate admissions, graduate oversight and curriculum, with each chairing a standing committee comprised of two additional participating faculty members from the Program. The Director, in conjunction with an administrator from the CNAS Graduate Student Affairs Center, will be responsible for the day-to-day operation of the program, including admissions, student advising and monitoring students' progress through the Program.

Section 1. Introduction

1.1) Aims and objectives of the program. The objectives of the proposed interdepartmental graduate program are to provide graduate training leading to the M.S. and Ph.D. degrees in Biophysics, and to promote teaching and research in the field of Biophysics by students and faculty at the University of California, Riverside. Biophysics is a major area of study and research in the life sciences, and attracts a considerable number of students. Biophysicists are needed by institutions of higher learning, and by federal, state and private research organizations in order to fulfill their respective missions. UC Riverside has considerable strength in the area of Biophysics, but this strength has a relatively low level of national visibility given the broad dispersal of the faculty working in the area on campus and the absence of a cohesive training environment

1.2) Historical development of the field. Biophysics as an academic discipline arose in the mid-19th Century out of studies by a group of German physicians and physiologists whose work focused on various aspects of electrophysiology and sensory stimulus, which in turn had grown out of the earlier work of Galvani and Volta. By the mid-20th Century, a formal Biophysical Society had been created in the US as an outgrowth of the American Physiological Society, and the Biological Physics Division of the American Physical Society had been established. At this time the discipline had grown to encompass a great many areas of research utilizing a variety of physical methods to study biological phenomena, as well as computational modeling of same. Examples include: structural biology, spectroscopy, electrophysiology, bioenergetics and biomechanics, neural networks, single-molecule dynamics, theoretical biology and a wide range of computational methods. Today the combined membership of the Biophysical Society and the APS Division of Biological Physics includes over 10,000 scientists, a large and thriving intellectual community. Here at UC Riverside, there has been significant investment in faculty hiring in the area of biophysics in several departments, and an undergraduate track in Biophysics already exists as part of the BS major in Physics. A number graduate and undergraduate courses are in place in the Physics and Astronomy Department, as well as the departments of Biochemistry and Chemistry. Significantly, substantial expertise already exists on campus in areas recognized as lying within Biophysics, including: macromolecular structure determination, spectroscopic methods of various sorts, photosynthesis, physiological ecology and ecosystem processes, biological electron transfer, computational/mathematical modeling of biological systems, neurobiophysics and protein engineering. The departments Biochemistry, Chemistry and Physics and Astronomy have all made multiple hires in the area of biophysics over the past few years, and the rapid growth of this community has provided the impetus for the creation of a graduate program in Biophysics. The proposed program will be essential to maximize the growth and vigor of the research programs of both existing and future faculty at UC Riverside working in the area.

1.3) Timetable for development of the program. Upon approval of the Program, a Director will be appointed by the Dean of the Graduate Division and the program's standing committees established as described in Section 8 below. A website describing the new program and the research interests of its participating faculty will be created to advertise the program, and graduate admissions will commence, focusing on Ph.D. applicants. We anticipate a graduate admission rate of 5-10 students per year over the first several years of the Program, and 5-15 thereafter. Assuming an average matriculation-to-graduation time of 4.5 to 5 years, the Program will eventually grow to approximately 45 students. Given the significant amount of faculty recruitment in Biophysics that has taken and continues to take place on campus, the number of participating faculty is expected to grow, which may well lead to even more rapid growth of the Program. Table 1 provides a timetable for anticipated Ph.D. enrollment.

Table 1

Year of program	new students min-max	# graduating	cumulative min-max
1	5-10	0	5-10
2	5-10	0	10-20
3	5-10	0	15-30
4	5-15	2-5	15-38
5	5-15	5-10	20-45

1.4) Relation of the proposed program to existing programs and to the Campus Academic Plan.

Biophysics is inherently interdisciplinary, and the proposed program will effectively complement existing graduate programs in the Departments of Biochemistry, Chemistry and Physics and Astronomy. The majority of participating faculty also come from these academic units, and the proposed Program will provide them with a new source of trainees to participate in their individual research programs. The intent is to create a mechanism for the recruitment of a cadre of graduate students interested in studying and training in biophysics that would not otherwise have considered UC Riverside. For this reason, it is to be expected that any negative impact on existing programs will be negligible. The proposed program is also consistent with the growth of the graduate student population at UC Riverside anticipated by the Graduate Division, and former Dean Joe Childers was specifically enthusiastic about the creation of the program. A major focus of the Campus Academic Plan is growth of UC Riverside's research portfolio (particularly the NIH-supported component), and achieving AAU accreditation. Much of the field of biophysics in fact has immediate biomedical relevance, and creation of a Biophysics Program is thus fully aligned with the Campus Academic Plan. Graduate programs are the engine of the research enterprise in the laboratory sciences, and creation of a graduate program in Biophysics can be expected to facilitate the development of new and expanded research programs by the participating faculty. Creation of the program is also justified by the significant level of faculty recruitment in the area at UC Riverside over the past several years in several departments, with a critical mass of faculty now having been achieved. Indeed, a major impetus for the creation of the program was the insufficiently large pool of graduate students available to the participating faculty, particularly junior faculty eager to establish their laboratories. Additional faculty growth in the area of biophysics is a specific component of the strategic plans for (minimally) the departments of Biochemistry, Chemistry and Physics, and the demand for graduate students will only increase in future.

1.5) Interrelationship of the program with other UC institutions. The majority of Biophysics programs at other UC campuses fall into two groups: Berkeley, Davis and San Francisco have interdepartmental graduate programs in Biophysics similar to that being proposed here, while Los Angeles, Santa Barbara, Santa Cruz and San Diego have competing tracks or sections in both their Physics and Chemistry/Biochemistry Departments. Additionally, Irvine has a Department of Physiology and Biophysics in its School of Medicine, and Merced has a Biophysics track in the Ph.D. program of its Department of Physics. Given the distribution of the participating faculty at UC Riverside, the interdepartmental graduate program model seen at Berkeley, Davis and San Francisco is considered the more appropriate for UC Riverside, and the solicited letters from the Directors of the interdepartmental graduate programs at both Berkeley and Davis are very supportive (see Appendix III); clearly, there is no perceived concern regarding competition between campuses. Indeed, given the important role of Biophysics in the biological sciences, all research universities involved in graduate training in the biological sciences would be well served by providing a degree program in biophysics. UC Riverside is no exception.

1.6) Administration. As described in detail in Section 8 below, the Program will be administered by a Director and a three-member Executive Committee. The members of the Executive Committee will be responsible for Graduate Admissions, Graduate Oversight and Curriculum, with each chairing a standing committee comprised of two additional participating faculty members from the Program. The Director, in conjunction with an administrator from the CNAS Graduate Student Affairs Center, will be responsible for the day-to-day operation of the program, including admissions, student advising and monitoring students' progress through the Program. The Graduate Student Affairs Center presently oversees the administration of 16 graduate programs, and the addition of one more does not significantly increase the workload of its staff. Indeed, a staff member has already volunteered to take responsibility for the proposed program. The Chair of the Graduate Oversight Committee will serve as graduate advisor and will be responsible for administering the Cumulative Examination, which will consist of questions provided by the participating faculty.

1.7) Plan for evaluation of the program. In the first two years, the participating faculty will self-evaluate the graduate program prior to the normal third-year review to be conducted by Graduate Council that is required for all new graduate programs at UC Riverside. Thereafter, the program will be evaluated by an external team of experts every 6-7 years, as is the standard practice the Graduate Division at UC Riverside.

Section 2. Program Description

2.1) Undergraduate preparation for admission. Students admitted to the Biophysics Graduate Program will be expected to have completed a bachelor's degree in Biochemistry, Biology, Chemistry or Physics (or related fields) at an accredited 4-year college or university, and to have attained an undergraduate academic record that meets or exceeds the standards established by the Graduate Division of UC Riverside. Students will have completed coursework in chemistry (minimally, one year each of introductory and organic, including laboratories), physics (minimally, one year introductory, including laboratory), mathematics (minimally, one year calculus, plus one upper division course), biochemistry (minimally, one year introductory, including laboratory) and biology (minimally, one year introductory, including laboratory) in addition to upper-division courses in their major. Students with strong academic records may be admitted with coursework deficiencies, provided these are remediated during the first two years of graduate study. Entry into the program will require adequate performance on the Graduate Record Examination (GRE), as well as the Subject Examination in Physics, Chemistry, Biochemistry or Biology.

2.2) Foreign language competency. None required.

2.3) Program of study.

2.3a) Specific fields of emphasis. The program will offer a Master's (M.S.) Plan II and a doctoral (Ph.D.) degree in Biophysics. Students enrolled in the program are expected to complete core coursework consisting of a one-year (three quarter) series of graduate coursework. Students are also expected to participate in seminars and colloquia, and to become informed about the major technological methods and advances that provide the essential underpinnings to new discoveries in the field. Upon entry, each student will work with the program's Graduate Oversight Committee to develop an appropriate course of study given the student's interests, including the assignment of laboratory rotations (tentatively BPHY 297) with three different participating faculty as part of the preceptor selection process.

- 2.3b) Plans. **M.S.** Master's students will complete core coursework in biophysics, and will take at least one graduate seminar course each quarter that they are enrolled. They must take and pass a Comprehensive Examination at the end of their coursework. **Ph.D.** Doctoral students will be expected to fulfill all requirements for the M.S. degree; the expectation for satisfactory performance on the Comprehensive Examination will be higher than for the M.S. degree. Doctoral students must also pass a combined written and oral Qualifying Examination consisting of: (1) the preparation of a research proposal based on the student's dissertation work and taking the form of a grant proposal to NSF or NIH; and (2) defense of same before a faculty committee consisting of a Chair and three additional program faculty, plus one external member to ensure fairness (see Section 2.5 below). The student will also undertake a research project leading to a dissertation, with annual presentations to the dissertation committee to assess progress toward degree. Publications in peer-reviewed journals are also expected. In the course of their studies, Ph.D. students will be expected to complete a minimum of two quarters as teaching assistant to gain experience in instruction.
- 2.3c) Unit requirements. **M.S.** 36 units of 100 or 200 series courses, of which at least 18 units must be in the graduate 200 series. This coursework will include the program's graduate core curriculum and courses from a list of approved electives (see Section 5). **Ph.D.** 36 units of 100 or 200 series courses, of which at least 24 units must be in the graduate 200 series. This coursework will include the program's graduate core curriculum and courses from a list of approved electives (see Section 5). A minimum of 16 units of coursework other than courses in the 290 series must be completed in fulfillment of the 24-unit program requirement for graduate coursework.
- 2.3d) Required and recommended courses. All students will be required to take a three-quarter sequence of introductory biophysics (consisting of BCH 184, BIOL 203 and PHYS 246), as well as a series of research rotations in laboratories of participating faculty under the auspices of BPHY 297, as part of the thesis advisor selection process. Participation in the Biophysics Graduate Seminar (tentatively BPHY 252) is also required each quarter that the student is enrolled, and each student is expected to present a formal research seminar in this course prior to graduation. Students will also be required to complete the Responsible Conduct of Research program provided by the Graduate Division. To complete the 36 unit requirements for degree, students will select sufficient courses from a list of approved electives to meet unit requirements (see Section 5).
- 2.3e) Comprehensive Examination. Both Master's and doctoral students will be required to pass a three-hour Comprehensive Examination consisting of questions provided by the participating faculty, with topics taken from the core curriculum. The Comprehensive Examination will be graded by those submitting questions, and the results presented to the participating faculty for a decision of PhD Pass, MS Pass, or Fail in each student's case. The expectation for satisfactory performance on the Comprehensive Examination will be higher for doctoral students than for Master's students.
- 2.3f) Licensing/certification requirements. None.

Professional development – The program of study described above incorporates a number of aspects that contribute to the professional development of the program's graduate students. These include:

- The written component of the General Examination, which is intended to provide experience in the preparation of grant proposals to be submitted to federal granting agencies;
- The oral component of the General Examination, the requirement for an annual research evaluation and requirement to present in BPHY 252, which provide the opportunity to develop presentation skills that will complement those developed in research group meetings and journal clubs that the student may participate in;
- The TA requirement, which includes participation in the Teaching Assistant Development Program administered by the Graduate Division of UC Riverside, which is intended to develop pedagogical skills; and
- Involvement in the Graduate Division's Responsible Conduct of Research program, which is intended to reinforce a strong sense of professional ethics.

2.4) Field examinations. None.

2.5) Ph.D. Qualifying Examination. Doctoral students must pass a written qualifying examination that, as indicated above, will consist of the preparation of a research proposal based on their dissertation work and taking the form of a grant application to the National Science Foundation or National Institutes of Health. The proposal will be evaluated by an Oral Qualifying Exam committee consisting of a participating faculty member selected by the Director in consultation with the student's dissertation advisor and three additional program faculty selected by the student and his/her preceptor, and approved by the Program Director. All members of the Oral Qualifying Examination Committee must be members of the Academic Senate, and the Committee will include one external examiner whose principal is to ensure the fairness of the examination, for a total of five committee members. The Committee will not include the student's dissertation advisor. Once the written proposal is deemed satisfactory by the Committee, the student must pass an oral examination that will consist of a defense of the written research proposal before the student's Qualifying Examination committee. Upon successful completion of all coursework and passing of the Qualifying Examination, the student will advance to Candidacy.

2.6) Thesis and/or dissertation. Having completed laboratory rotations in BPHY 297 in their first year, students will be expected to have selected a dissertation advisor by the end of their first academic year. The student's dissertation advisor will chair a Ph.D. Dissertation Committee that will consist of a minimum of two additional members of the Academic Senate, who will normally also be participating members of the Biophysics Graduate Program. All committee members should be able to provide guidance and judge the scholarship of the dissertation research. The student is expected to meet with his/her Dissertation Committee once a year in an Annual Research Evaluation, in which the student formally presents his/her work to date and progress is assessed and input to the research project provided by the committee. During this time, students will be enrolled in sufficient credits of directed research (tentatively BPHY 299) to ensure good standing in the Graduate Division. A written dissertation will be completed by each student in the program.

2.7) Final examination. Doctoral candidates will defend their dissertations in a public, oral presentation at a time announced to members of the University community. The public presentation will be followed by a private defense of the dissertation to the Dissertation Committee, which will make a recommendation to the Graduate Division as to whether the degree of Ph.D. should be conferred.

2.8) Explanation of special requirements. None.

2.9) Relationship of M.S. and Ph.D. programs. Students will normally be admitted to the Ph.D. program. Upon passing the Qualifying Examination and advancement to Candidacy, the student may petition the Graduate Division for conferral of the M.S. degree.

2.10) Special preparation for careers in teaching. Not applicable.

2.11) Sample Ph.D. program. Students enrolled in the proposed program will be expected to complete an individualized curriculum that will include the core coursework described in Section 2.3d above, with additional coursework tailored to the student's research interests and background (including remediation of deficiencies identified upon admission to the program). Table 2 provides a sample program designed to meet the needs of a student wishing to work in the area of structural biology, with an emphasis in protein structure determination as elucidated by NMR.

Table 2

	Fall	Winter	Spring
Year 1	BIOL 203 (Intro) BPHY 252 (Seminar) BPHY 290 (Lab Rotation) Elective	BCH 184 (Intro) BPHY 252 (Seminar) BPHY 290 (Lab Rotation) Elective	PHYS 246 (Intro) BPHY 252 (Seminar) BPHY 290 (Lab Rotation) Elective
Year 2	CHEM 209M (Introduction to NMR) BPHY 252 (Seminar) BPHY 297 (Research)	CHEM 229Q (Advanced NMR) BPHY 252 (Seminar) BPHY 297 (Research)	BCH 210 (Bch Macromol) BPHY 252 (Seminar) BPHY 297 (Research)
Years 3-5	BPHY 252 (Seminar) BPHY 299 (Dissertation Research)	BPHY 252 (Seminar) BPHY 299 (Dissertation Research)	BPHY 252 (Seminar) BPHY 299 (Dissertation Research)

2.12) Normative time from matriculation to degree. A typical doctoral student will be expected to complete all degree requirements in approximately five years.

Section 3. Projected Need

3.1) Student demand for the program. The National Research Council recognizes Biochemistry, Biophysics and Structural Biology as major disciplines in the Life Sciences, and specifically ranks Ph.D. programs in these areas. Biophysics and Computational Biology is also a major section of *Proc. Natl. Acad. Sci. (USA)*, emphasizing its importance as a discipline. Significant breakthroughs over the past decade in protein structure determination and a variety of imaging methodologies, new insights into the dynamic behavior of individual protein molecules and advances in understanding the relationship of structure to function (in systems ranging from nitrogen fixation and photosynthesis to the replisome and signal transduction) have brought great attention to Biophysics. These advances in turn have attracted students eager to participate in such discoveries. At the same time, a wide range of career opportunities await individuals trained in biophysics, including positions in the pharmaceutical and chemical industries, academia and both public and private research institutions. The proposed graduate program will provide a coherent, campus-wide umbrella organization under which faculty efforts and resources can be marshaled, faculty and student interactions and research/grant productivity facilitated, and the overall reputation of the campus in the field enhanced. This will then generate even greater interest among potential students who will be attracted to the program. While

students interested in the research programs of the participating faculty are already entering one or another existing departmental graduate program, a formal interdepartmental program will provide prospective students with greater educational and training opportunities and be of greater interest to students specifically seeking a degree in Biophysics. Again, the expectation is that the proposed program will attract a cadre of students who would not otherwise consider coming to UC Riverside and is not expected to have a negative impact on existing graduate programs. It will also address a significant manpower need on the part of the research programs of present and future faculty working in the area.

3.2) Opportunities for placement of graduates. There is high demand for biophysicists in a broad range of areas. The development of new drugs in the pharmaceutical industry is increasingly guided by the detailed three-dimensional structures of therapeutic targets (e.g., reverse transcriptases, viral coat protein maturases, membrane channel proteins) and by the modeling of their dynamic behavior and interaction with potential drugs. Similarly, the chemical industry has become increasingly invested in the use of individual enzymes and even entire metabolic pathways in the development of more efficient methods to produce a wide range of commodity and fine chemicals. The US National Laboratories have had a long-standing and strategic interest in the application of sophisticated physical methods to understand biological systems and processes, as have private research institutions such as the Scripps Research Institute and Howard Hughes Medical Institute. Finally, recruitment of biophysicists has become a priority in academia nationwide, and particularly in biomedically relevant areas. This national trend is reflected in recent faculty recruitment at UC Riverside in the Departments of Biochemistry, Bioengineering and Chemistry, and to a lesser extent the Department of Physics. There is every reason to believe that students receiving a Ph.D. in Biophysics from UC Riverside will have excellent job prospects.

3.3) Importance to the discipline. Biophysics is an inherently interdisciplinary enterprise, with strong components drawn from Physics, Biochemistry, Mathematics and Chemistry, as well as other life sciences. Having a Ph.D. program that will provide a coherent training program to students across disciplinary lines will provide students with an exceptionally broad perspective that will make them extremely well-qualified to contribute at the cutting edge of modern research in the area. The broad disciplinary distribution of participating faculty in the proposed program will greatly contribute to the breadth of training provided at UC Riverside.

3.4) Ways in which the Program will meet societal needs. Over the past 50 years, many of the most important advances in our understanding of the processes of life have been made by biophysicists. Signal contributions include: discovery of the atomic-resolution structure of DNA; elucidation of the genetic code and mechanism of information transfer in biological systems; structure of the ribosome, photosynthetic and nitrogen-fixation systems; behavior of individual molecules of the replisome, topoisomerase, helicase and other complex enzymatic systems working on DNA; the physical basis of transmembrane ion transport, particularly as relates to neuronal function; and visualization/analysis of neural networks. These and other advances have contributed enormously to our understanding of various disease states, including cancer and heart disease, and to the improvement of human health. Students in the proposed Biophysics Program will be able to participate in either basic or applied research in these and other emerging areas and thus contribute to a deeper understanding biological processes and to improved human health.

3.5) Relationship of the Program to research interests of the faculty. Many faculty members at UC Riverside are engaged in biophysics-related research, including a significant number of new hires

in the Departments of Biochemistry and Chemistry. The participating faculty are spread across five different departments, and an interdepartmental graduate program such as proposed will provide an effective and much-needed mechanism for facilitating productive interactions among the participating faculty and for generating an enriched training environment for its students.

3.6) *Program differentiation.* Most UC campuses have graduate programs in biophysics (UC Irvine has a Department of Physiology and Biophysics in its School of Medicine), and a biophysics program on each campus is easily justified in light of the information provided in Sections 3.1 - 3.5 above. The strongly supportive letters from the Directors of the interdepartmental graduate programs in Biophysics at Berkeley and Davis (Appendix III) attest to the lack of perceived competition with existing programs at other UC campuses. The proposed program is distinctive in the range of specific physical methods employed by its participating faculty as well as the breadth of the particular biological systems and processes under investigation, factors which combine to provide a unique training environment.

Section 4. Faculty

The 27 participating faculty in the proposed Biophysics Graduate Program are self-identified from among five departments in the College of Natural and Agricultural Sciences; of these eight are women and eleven are minority. Each has a significant component of biophysics in his or her research program. Detailed *curricula vitae* are provided in Appendix I, and individual letters of participation in Appendix II. Letters from the Chairs of the Departments of Biochemistry, Biology, Botany and Plant Sciences, Chemistry and Physics and Astronomy are provided in Appendix III, along with letters from the Directors of interdepartmental graduate programs at UC Berkeley, UC Davis and UC San Francisco. Letters of support from the Dean of CNAS can be found in Appendix IV, and a memorandum from the Executive Committee of CNAS in Appendix V.

Biochemistry

Gregor Blaha (Assistant Professor, Ph.D.)
Richard Debus (Professor, Ph.D.)
Li Fan (Associate Professor, Ph.D.)
Russ Hille (Distinguished Professor, Ph.D.)
Seán O'Leary (Assistant Professor, Ph.D.)
Jeff Perry (Assistant Professor, Ph.D.)
Jikui Song (Assistant Professor, Ph.D.)

Biology

Richard Cardullo (Professor, Ph.D.)
Theodore Garland (Distinguished Professor, Ph.D.)
Nicole Rafferty (Assistant Professor, Ph.D.)

Botany and Plant Sciences

Darrel Jenerette (Associate Professor, Ph.D.)
Dawn Nagel (Assistant Professor, Ph.D.)
Carolyn Rasmussen (Assistant Professor, Ph.D.)
Louis Santiago (Associate Professor, Ph.D.)

Chemistry

Huiwang Ai (Assistant Professor, Ph.D.)
Chia-en Chang (Associate Professor, Ph.D.)
Joseph Genereux (Assistant Professor, Ph.D.)
Richard Hooley (Associate Professor, Ph.D.)
Ryan Julian (Professor, Ph.D.)
Len Mueller (Professor, Ph.D.)
Yinsheng Wang (Professor, Ph.D.)

Min Xue (Assistant Professor, Ph.D.)
Wenwang Zhong (Professor, Ph.D.)

Physics

Mark Alber (Distinguished Professor, Ph.D.)
John Barton (Assistant Professor, Ph.D., arriving 1/1/18)
Umar Mohideen (Professor, Ph.D.)
Roya Zandi (Professor, Ph.D.)

Section 5. Courses

No new didactic courses are required to implement the proposed program, although new Biophysics Seminar (tentatively BPHY 252), Research Rotation (tentatively BPHY 297) and Dissertation Research (tentatively BPHY 299) courses will need to be established. Three existing courses, BCH 184 (Physical Biochemistry, 4 units), BIOL 203 (Cellular Biophysics, 3 units) and PHYS 246 (Biophysics, 4 units each) will constitute the core curriculum for the proposed program. Syllabi for these three courses along with their catalog descriptions are provided in Appendix VI. Additional elective courses appropriate for the program include:

BCH 186 (Topics in Molecular Bioenergetics, 3 units)
BCH 187 (Fundamentals of Enzymology, 3 units)
BCH 210 (Biochemistry of Macromolecules, 4 units)
BCH 230F (Advanced Topics in Biochemistry: Enzymology)
CHEM 201A (Advanced Physical Chemistry: Quantum Mechanics, 3 units)
CHEM 201B (Advanced Physical Chemistry: Quantum Mechanics and Spectroscopy, 3 units)
CHEM 201C (Advanced Physical Chemistry: Elementary Statistical Mechanics, 3 units)
CHEM 201D (Advanced Physical Chemistry: Thermodynamics, 3 units)
CHEM 201E (Advanced Physical Chemistry: Kinetics, 3 units)
CHEM 206A (Introduction to Computational Quantum Chemistry, 3 units)
CHEM 206B (Modeling Chemical and Biochemical Molecules, 3 units)
CHEM 209M (Introduction to NMR, 3 units)
CHEM 211D (Spectrometry in Organic Structure Analysis, 3 units)
CHEM 229Q (Advanced NMR, 3 units)
PHYS 145ABC (Biophysics, 4 units each)
PHYS 212A (Thermodynamics and Statistical Mechanics I, 4 units)
PHYS 212B (Thermodynamics and Statistical Mechanics II, 4 units)

Catalog descriptions of the above courses are provided in Appendix VII. All courses are currently offered, (some in alternate years), and all are currently staffed. New elective courses can be added upon approval as described in Section 8.

Section 6. Resource Requirements

6.1) *FTE faculty*. No additional faculty positions are sought, although new or replacement positions awarded to departments with participating faculty in the proposed program can reasonably be expected to expand the program over time. The process for admitting new faculty to the program is described in Section 8, in Article II.1 of the by-laws. Administrative support will be provided by the Graduate Student Affairs Center of CNAS, which presently administers 16 graduate programs; as indicated above one staff member has already volunteered to work with the proposed program. Support for the Director will be provided by CNAS commensurate with that provided other Directors of interdepartmental graduate programs (e.g., Cell, Molecular and Developmental Biology; Genetics, Genomics and Bioinformatics; Environmental Toxicology), as described in the letters provided by

CNAS Dean Uhrich and Divisional Deans Umar Mohideen (Physical Sciences and Mathematics) and Frances Sladek (Life Sciences) (Appendix IV).

6.2) Library acquisition. The UCR library system, in particular the Science Library, currently subscribes to all the major journals relevant to Biophysics, and also purchases the important books, monographs and the like in the field. No increase in demand for new acquisitions is anticipated.

6.3) Computing costs. No increases in computing costs are anticipated. Personal computer facilities are available in the laboratories of all the participating faculty, providing access to the Internet. The computer facilities of the Science Library are also available to student and participating faculty of the program. More advanced computing capabilities are available in the laboratories of several of the participating faculty, who also have access to off-campus supercomputing facilities as needed.

6.4) Equipment. No new equipment is required to implement the proposed program, although one of the expected benefits accruing from its creation is that greater interaction among laboratories will identify common equipment needs for which extramural funds will be sought. While institutional matching funds are typically required of granting agencies in making such awards, these are usually modest relative to the total cost of the instrumentation. As a particular example, plans are being made for the submission of a proposal for a 900 MHz NMR instrument that will be used by several of the participating faculty of the proposed program, to be housed in space already available in the Chemical Sciences Building.

6.5) Space and other capital facilities. None, although again plans are being made for the submission of a proposal for a 900 MHz NMR instrument that will be used by several of the participating faculty of the proposed program, to be housed in specifically designed space already available in the Chemical Sciences Building. Additional space may be made available in the MRB1 building that is presently under construction, scheduled for completion at the end of 2018.

6.6) Other operating costs. As indicated above, support for the Director of the proposed program will be provided by CNAS, consistent with its policies as outlined in the Deans' letters (Appendix IV). Additionally, administrative services will be provided by the CNAS Graduate Student Affairs Center as discussed above. Again, this Center already provides administrative support for 16 graduate programs, and the proposed program does not substantively increase its workload. A staff member of the Center has already volunteered to serve the proposed program.

Section 7. Graduate Student Support

Graduate students in the proposed program will be supported by a combination of sources. Support in the first year will be provided by fellowships through the Graduate Division, and creation of the program is consistent with the Graduate Division's projected growth of graduate fellowships as the number of faculty increases. In consultation with the Graduate Division, former Dean Childers was enthusiastic about creation of the program. At the end of the first year students will have selected a dissertation advisor and will typically be supported thereafter as research assistants on grants awarded to their dissertation advisors, individual pre-doctoral fellowships from federal granting agencies and private foundations, and/or teaching assistantships provided either by the home department of the student's dissertation advisor or through the Teaching Assistantship Allocation Committee (TAAC), which makes assignments for all graduate programs in the Life Sciences. The TAAC has a strong track record of providing support for graduate students in 16 different graduate programs, specifically including successful interdepartmental graduate programs such as Cell, Molecular and Developmental Biology and Genetics, Genomics and Genomics. While the Graduate

Division has no formal requirement for 301/302-level coursework to provide training in becoming a teaching assistant, biophysics students holding teaching assistantships in departments that require 301/302 coursework will take them. The departments with participating faculty in the program will work in partnership with the Graduate Division and CNAS to ensure continuous funding for all the program's students in good academic standing throughout their time in the proposed program as described in Deans' letters provided in Appendix IV. It is to be emphasized that there are a number of very successful interdepartmental graduate programs on campus and that there has never been a case where a graduate student in good academic standing in CNAS ever had to leave a graduate program, departmental or interdepartmental, for lack of funding. CNAS has demonstrated an outstanding track record to support for graduate students that is clearly articulated in the Deans' letters in Appendix IV and is far more specific than letters of support for past proposals for the creation of interdepartmental graduate programs (e.g., GGB, CMDB and Materials Science). Students in the proposed program can thus expect to have the benefit of appropriate support from the college.

Section 8. Governance

The Program will be administered by a Director and a three-member Executive Committee. The Director, in conjunction with an administrator from the CNAS Graduate Affairs Center, will be responsible for the day-to-day operation of the program, including admissions, student advising and monitoring students' progress through the Program. The members of the Executive Committee will chair subcommittees for Graduate Admissions, Graduate Oversight and Curriculum, with each subcommittee comprised of two additional participating faculty members from the Program.

The proposed graduate program will be governed by the following by-laws:

Article I. Objective

The proposed Biophysics Graduate Program is intended to encourage broad-based study of biophysics and to foster communication between biophysicists within different departments on the UC Riverside campus. The Program is thus intended to be interdepartmental, and includes some 39 faculty from the departments of Biochemistry, Bioengineering, Biology, Botany and Plant Sciences, Chemical and Environmental Engineering, Chemistry and Physics. The program's primary objective is to train scientists able to teach and conduct research in the area of biophysics. The proposed Biophysics Program will offer both a M.S. and a Ph.D. in Biophysics.

Given the diversity in the biophysics community on campus, graduate students will have the opportunity to incorporate a wide range of disciplines into their training experience. Programs of study will be tailored to the interests and goals of individual students.

Article II. Membership

1) **Membership Criteria.** The participating faculty recognize that involvement in a graduate program can take many forms, although the principal one is obviously training of graduate students in the field as broadly defined. Criteria for membership can include 1) maintenance of an active research program in the area of biophysics as broadly defined; 2) service on graduate student General Examination and Dissertation Committees; 3) continued participation in the Biophysics program by emeritus faculty, and 4) support of research endeavors in the field of biophysics by non-academic senate members. Approval of new members to the Biophysics program will be vested in the Executive Committee. Faculty requesting membership in the Biophysics Program should send a *curriculum vitae* to the Graduate Program Director along by a letter describing how the candidate expects to be involved in the program. The Director will then forward the documents to the rest of the Executive Committee for consideration.

- 2) Membership Retention. The membership status of Biophysics faculty will be reviewed every three years by the Executive Committee. Criteria used to evaluate members can include serving as a major professor or as a member of advisory, candidacy exam or supervisory committees for Biophysics graduate students; service on committees of the Biophysics Program; attendance at seminars; participation in recruitment activities and other Biophysics Program functions. Faculty whose membership is to be evaluated will be notified in Fall of the academic year and may be asked to supply a brief summary of their Biophysics-related activities to the Executive Committee by the end of the Fall quarter. The Executive Committee will complete its evaluations by the end of Winter quarter of the same academic year.
- 3) Termination of Membership. A participating faculty member who wishes to leave the program may request termination of their membership at any time by sending a memo to the Program Director. Program members whose participation is deemed below that sufficient for good standing will be reviewed by the Executive Committee to determine the source of any problems and to recommend solutions. Members will be given a year to improve their participation in the Biophysics Program before facing termination.

Article III. Organization and Administration

The administration of the program and its activities will be vested in an Executive Committee consisting of three program members in addition to the Biophysics Program Director, who will serve as chair. Each of these will chair one of the three standing committees of the Program: Recruitment and Admissions, Graduate Oversight and Curriculum.

- 1) Program Director. The Graduate Program Director will be responsible for the overall direction and organization of the Biophysics Program and will chair the Executive Committee. The appointment of the Program Director will be in keeping with the regulations of Graduate Council. Initially, the Dean of the Graduate Division will solicit nominations from the program faculty and make an appointment. Afterwards, the Executive Committee will solicit confidential nominations from the participating faculty and submit the names of no more than two qualified faculty to the Dean of the Graduate Division, along with a supporting statement for each nominee. The Dean of the Graduate Division will then forward his/her final nominee to the Chancellor, who will make the actual appointment of the new Program Director. The Biophysics Program Director will be the Biophysics representative at CNAS chairs meetings and other meetings on campus requiring representation of the program. The Biophysics Program Director will send nominations of faculty to serve as Graduate Advisor to the Dean of the Graduate Division as well as nominations of faculty to serve as chairs of the program's standing committees. The Biophysics Program Director will appoint additional members to these standing committees (see below).
- 2) Chair, Recruitment and Admissions. The chair of the Recruitment and Admissions committee will be responsible for recruiting students to the Program and assessing the files of applicants to the program. The Recruitment and Admissions Chair will be nominated by the Biophysics Program Director, with final approval given by the Dean of the Graduate Division.
- 3) Chair, Graduate Oversight. The chair of the Graduate Oversight Committee will serve as Graduate Advisor and will be responsible for the overall academic advising of students in the Biophysics Program. S/he will be responsible for revisions of the Graduate Student Handbook and will be responsible for setting up faculty rotation schedules for first-year graduate students. S/he will also be responsible for advising students as to forming their Qualifying Examination and Dissertation Committees, and will have responsibility of the Program's annual Comprehensive Examination. The Dean of the Graduate Division will give final approval of the Qualifying Examination and Dissertation Committees. As Graduate Advisor, the chair of the Graduate Oversight Committee

will be nominated by the Biophysics Program Director, with final approval given by the Dean of the Graduate Division.

- 4) Chair, Curriculum. The chair of the Curriculum Committee will oversee the assessment of the Program curriculum and implementation of changes in same, as described further below. With his/her committee, s/he will also have overall responsibility for organizing the Program's seminar series. The Recruitment and Admissions Chair will be nominated by the Biophysics Program Director, with final approval given by the Dean of the Graduate Division.

Article IV. Committees

- 1) Executive. The administration of the program and its activities will be vested in an Executive Committee consisting of four members: Biophysics Program Director who will serve as chair, and the chairs of the program's three standing committees. The Executive Committee will act in an advisory capacity to the Program Director for any issues that arise concerning the Biophysics Program and will be responsible for review and approval of new faculty to the Biophysics program and for final decisions on termination of membership. The Executive Committee will also facilitate the process used to nominate new Program Directors. It will meet at least once per year, more frequently as needed.
- 2) Recruitment and Admissions. The Recruitment and Admissions Committee will be responsible for recruitment activities and review of applications of students who wish to enter the Biophysics Program. This committee will send files of qualified applicants, along with supporting documentation, to the Graduate Division Dean, who will make the final decision regarding admission and Graduate Division fellowship support. The Recruitment and Admissions Committee will also coordinate the recruitment visits of admitted graduate students to UCR, oversee the maintenance of the program website and prepare advertising/recruitment materials for the program.

The Recruitment and Admissions Committee will consist of the committee Chair from the Executive Committee plus two participating faculty members appointed by the Director, and will meet as necessary to review files and plan recruitment activities. The term of membership on the Admissions Committee will be three years.
- 3) Graduate Oversight. The Graduate Oversight Committee will be responsible for overseeing students' progress through the program, and will assist the Chair of the committee in forming students' Qualifying Examination and Dissertation Committees, and in the preparation of the Program's annual Comprehensive Examination.

The Graduate Oversight Committee will consist of the committee Chair from the Executive Committee plus two participating faculty members appointed by the Director, and will meet as necessary to undertake its responsibilities. The term of membership on the Admissions Committee will be three years.
- 4) Curriculum. The Curriculum Committee will be responsible for assessment of and changes to the curriculum of the Biophysics program, and will make recommendations for such changes to the curriculum as are deemed appropriate, including the addition of new elective courses, to the participating Biophysics faculty during a Biophysics faculty meeting. A subsequent e-mail vote will be held to approve or disapprove the recommended changes. In order to be considered approved, at least 51% of the participating program faculty must vote in favor of the changes to the program curriculum. The Curriculum Committee will also be responsible for administering the Program's seminar series, selecting and hosting speakers and planning program retreats or research symposia. The Curriculum Committee will meet at least once per year.

The Curriculum Committee will consist of the committee Chair from the Executive Committee plus two participating faculty members appointed by the Director, and will meet as necessary to undertake its responsibilities. The term of membership on the Admissions Committee will be three years.

Article V. Changes to the By-Laws

Changes to the by-laws of the program will be considered at a meeting of the participating faculty, and a subsequent e-mail vote will be held to approve or disapprove the proposed changes. In order to be considered approved, at least 51% of the participating program faculty must vote in favor of the changes to the program's by-laws.

Section 9. Changes in Senate Regulations

No changes in Academic Senate Regulations are required.

Appendices

- I. Faculty CV's
- II. Faculty Letters of Participation
- III. Departmental Chair and Program Director Letters
- IV. Letters from CNAS Dean
- V. CNAS Executive Committee memo
- VI. Syllabi for Core Courses
- VII. Course Catalog Descriptions of Elective Courses

Appendix I. CV's of participating faculty

Huiwang Ai (Assistant Professor, Chemistry, Ph.D.)
Mark Alber (Distinguished Professor, Physics, Ph.D.)
John Barton (Assistant Professor, Ph.D., Physics, arriving 1/1/18)
Gregor Blaha (Assistant Professor, Biochemistry, Ph.D.)
Chia-en Chang (Associate Professor, Chemistry, Ph.D.)
Richard Cardullo (Professor, Biology, Ph.D.)
Richard Debus (Professor, Biochemistry, Ph.D.)
Li Fan (Associate Professor, Ph.D.)
Theodore Garland (Distinguished Professor, Biology, Ph.D.)
Joseph Genereux (Assistant Professor, Chemistry, Ph.D.)
Russ Hille (Distinguished Professor, Biochemistry, Ph.D.)
Richard Hooley (Associate Professor, Chemistry, Ph.D.)
Darrel Jenerette (Associate Professor, Botany and Plant Sciences, Ph.D.)
Ryan Julian (Professor, Chemistry, Ph.D.)
Umar Mohideen (Professor, Physics, Ph.D.)
Len Mueller (Professor, Chemistry, Ph.D.)
Dawn Nagel (Assistant Professor, Botany and Plant Sciences, Ph.D.)
Seán O'Leary (Assistant Professor, Biochemistry, Ph.D.)
Jeff Perry (Assistant Professor, Biochemistry, Ph.D.)
Nicole Rafferty (assistant Professor, Biology, Ph.D.)
Carolyn Rasmussen (Assistant Professor, Botany and Plant Sciences, Ph.D.)
Louis Santiago (Associate Professor, Botany and Plant Sciences, Ph.D.)
Jikui Song (Assistant Professor, Biochemistry, Ph.D.)
Yinsheng Wang (Professor, Chemistry, Ph.D.)
Min Xue (Assistant Professor, Chemistry, Ph.D.)
Wenwang Zhong (Professor, Chemistry, Ph.D.)
Roya Zandi (Professor, Physics, Ph.D.)

DR. HUIWANG AI

CURRICULUM VITAE

Assistant Professor of Chemistry (07/2011-present)
Cooperating faculty member of Biochemistry, Environmental Toxicology (ETOX), and Cell,
Molecular & Developmental Biology (CMDDB) graduate programs
University of California, Riverside
501 Big Springs Road, Riverside, CA 92521, USA
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Web Page: <http://ailab.ucr.edu>

Research statement

Biological signaling occurs at different levels, but basic processes are largely chemically based. Our research program in the fields of Bioanalytical Chemistry and Chemical Biology has a focus on the engineering of novel molecular probes to peer into cells and brains to understand their communications. We use a collection of innovative techniques, such as protein engineering and fluorescence and bioluminescence imaging, to dissect signaling pathways involving redox-active molecules, neurotransmitters, and protein post-translational modifications (PTMs). Our immediate goal is to monitor biological signaling in real time with excellent spatial resolution and molecular precision in physiologically relevant environments. Our long-term goal is to apply these new probes to live cells and animals to understand communications relevant to toxicity of chemicals, cancer development and progression, cognition and behavior, and neurological disorders.

Education and training

- 07/2008-06/2011 Postdoctoral Fellow, The Scripps Research Institute, La Jolla, USA Advisor: Peter G. Schultz
- 09/2003-06/2008 Ph.D. in Chemical Biology from Department of Chemistry, University of Alberta, Edmonton, Canada
Advisor: Robert E. Campbell; Thesis titled “New Fluorescent Proteins and Genetically Encoded Biosensors”
- 09/1999-07/2003 B.Sc. from Department of Chemistry, Tsinghua University, Beijing, China

Publications

Publications at UCR

41. Y. Fan, and H-w. Ai*, “Monitoring thioredoxin redox in live cells with genetically encoded red fluorescent protein biosensors”, manuscript in preparation for *Nat. Chem. Biol.*.
40. H.W. Yeh, O. Karmach, M. Martins-Green, and H-w. Ai*, “Engineered luciferase-luciferin pairs for improved bioluminescence imaging *in vitro* and *in vivo*”, manuscript in preparation for *Nat. Commun.*.
39. Z. Chen, and H-w. Ai*, “Single Fluorescent Protein Based Biosensors for Zinc Ion”, *Anal. Chem.*, 2016, DOI: 10.1021/acs.analchem.6b01653.

38. S. Youssef, W. Ren, and H-w. Ai*, "A Genetically Encoded FRET Sensor for Hypoxia and Prolyl Hydroxylases", **ACS Chem. Biol.**, 2016, DOI: 10.1021/acscchembio.6b00330.
37. Z. Chen, Z. Tian, K. Kallio, A.L. Oleson, A. Ji, D. Borchardt, D. Jiang, S.J. Remington, H-w. Ai*. "The N-B Interaction: Understanding the Chemoselectivity of a Fluorescent Protein Based Probe for Peroxynitrite". **J. Am. Chem. Soc.**, 2016, 138: 4900–4907.
36. W. Ren, and H-w. Ai*, "Photocontrol of the Src Kinase in Mammalian Cells with a Photocaged Intein", **Meth. Mol. Biol.**, 2016, 1495: DOI 10.1007/978-1-4939-6451-2_14.
35. Y. Fan, and H-w. Ai*, "Development of redox-sensitive red fluorescent proteins for imaging redox dynamics in cellular compartments", **Anal. Bioanal. Chem.**, 2016, 408: 2901-2911. *Selected by the Editor as a "Paper in Forefront". In a special issue featuring 'Young Investigators in Analytical and Bioanalytical Science'*
34. W. Ren, A. Ji, O. Karmach, D. Carter, M. Martins-Green*, and H-w. Ai*, "A Membrane-Activatable Near-Infrared Fluorescent Probe with Ultra-Photostability for Imaging Mitochondrial Membrane Potential", **Analyst**, 2016, 141: 3679-3685. *In a special issue featuring 'Analyst Emerging Investigators' (Royal Society of Chemistry).*
33. W. Ren, A. Ji, and H-w. Ai*, "Expanding the Genetic Code for a Dinitrophenyl Hapten", **ChemBioChem**, 2015, 16: 2007-2010.
32. W. Ren, T. Truong and H-w. Ai*, "Study of the Binding Energies between Unnatural Amino Acids and Engineered Orthogonal Tyrosyl-tRNA Synthetases", **Sci. Rep.**, 2015, 5: 12632.
31. Y. Fan,[§] Z. Chen,[§] and H-w. Ai*, "Monitoring Redox Dynamics in Living Cells with a Redox-Sensitive Red Fluorescent Protein", **Anal. Chem.**, 2015, 87: 2802–2810. ([§]equal contribution)
30. W. Ren,[§] A. Ji,[§] and H-w. Ai*, "Light Activation of Protein Splicing with a Photocaged Fast Intein", **J. Am. Chem. Soc.**, 2015, 137: 2155–2158. ([§]equal contribution)
29. Z. Chen, T. Truong and H-w. Ai*, "Development of Fluorescent Probes for the Detection of Peroxynitrite", book chapter in **Challenges and Advances of Peroxynitrite Detection in Biological Media**. Royal Society of Chemistry (RSC) Publishing. Published on Oct. 21, 2015.
28. H-w. Ai*, "Fluorescent protein-based probes: General principles and practices", **Anal. Bioanal. Chem.**, 2014, 2015, 407: 9-15.
27. H-w. Ai*, "Editorial: Fluorescent Sensors for Biological Applications", **Sensors**, 2014, 14: 17829-17831.
26. Z. Chen and H-w. Ai*, "A Highly Responsive and Selective Fluorescent Probe to Image Physiological Hydrogen Sulfide", **Biochemistry**, 2014, 53: 5966-5974.
25. A. Ji,[§] W. Ren,[§] and H-w. Ai*, "A Highly Efficient Oxidative Condensation Reaction for Selective Protein conjugation", **Chem. Commun.**, 2014, 50: 7469-7472 ([§]equal contribution)
24. H-w. Ai, M.A. Baird, Y. Shen, M.W. Davidson and RE Campbell*, "Engineering and characterizing monomeric fluorescent proteins for live-cell imaging applications", **Nature Protocols**, 2014, 9: 910-928.
23. W. Ren, and H-w. Ai*, "Genetically encoded fluorescent redox probes", **Sensors**, 2013, 13: 15422-15433.
22. Z. Chen, W. Ren, Q.E. Wright and H-w. Ai*, "Genetically Encoded Fluorescent Probe for

- the Selective Detection of Peroxynitrite”, *J. Am. Chem. Soc.*, 2013, 135: 14940-14943.
21. A. Chatterjee, H. Xiao, M. Bollong, H-w. Ai and P.G. Schultz*, “Efficient viral delivery system for unnatural amino acid mutagenesis in mammalian cells”, *Proc. Natl. Acad. Sci. USA.*, 2013, 110: 11803-11808.
 20. S. Chen, Z. Chen, W. Ren and H-w. Ai,* “Reaction-based genetically encoded fluorescent hydrogen sulfide sensors”, *J. Am. Chem. Soc.*, 2012, 134: 9589-9592.
 19. W. Ren and H-w. Ai,* “Ribosomal Incorporation of Unusual Amino Acids: Learning from Mother Nature”, book chapter in *Ribosomes: Molecular Structure, Role in Biological Functions and Implications for Genetic Diseases*. Nova Science Publishers. Published on May 3, 2013.
 18. H-w. Ai,* “Biochemical analysis with the expanded genetic lexicon”, *Anal. Bioanal. Chem.*, 2012, 403: 2089-2102. *Special Issue Featuring 'Young Investigators in Analytical and Bioanalytical Science'*.

Before coming to UCR

17. M. Kang,[§] K. Light,[§] H-w. Ai,[§] W. Shen, C.H. Kim, P.R. Chen, H.S. Lee, E.I. Solomon, and P.G. Schultz, “Evolution of Iron(II)-Finger Peptides by Using a Bipyridyl Amino Acid”, *ChemBioChem*, 2014, 15: 822-825. ([§]equal contribution)
16. Y. Ding, H-w. Ai, H. Hoi, and R.E. Campbell, “FRET-based biosensors for multiparameter ratiometric imaging of Ca²⁺ dynamics and caspase-3 activity in single cells”, *Anal. Chem.*, 2011, 83: 9687-9693.
15. H-w. Ai[§], W. Shen[§], A. Sagi, P.R. Chen and P.G. Schultz, “Probing protein-protein interactions with a genetically encoded photocrosslinking amino acid”, *ChemBioChem*, 2011, 12: 1854–1857. ([§]equal contribution)
14. H-w. Ai[§], J.W. Lee[§], and P.G. Schultz, “A method to site-specifically introduce methyllysine into proteins in *E. coli*”, *Chem. Comm.*, 2010, 46: 5506-5508. ([§]equal contribution)
13. H-w. Ai, W. Shen, E. Brustad, and P.G. Schultz, “Genetically encoded alkenes in yeast”, *Angew. Chem. Int. Ed.*, 2010, 49: 935-937.
12. D.E. Johnson[§], H-w. Ai[§], P. Wong, J.D. Young, R.E. Campbell and J.R. Casey, “Red fluorescent protein pH biosensor to detect concentrative nucleoside transport”, *J. Biol. Chem.*, 2009, 284: 20499-20511. ([§]equal contribution)
11. H-w. Ai, K.L. Hazelwood, M.W. Davidson and R.E. Campbell, “Fluorescent protein FRET pairs for ratiometric imaging of dual biosensors”, *Nature Methods*, 2008, 5: 401-403. *News story featured on the cover of October 2008 issue of Biophotonics.*
10. H-w. Ai, S.G. Olenych, P. Wong, M.W. Davidson, and R.E. Campbell, “Hue-shifted monomeric variants of *Clavularia* cyan fluorescent protein: identification of the molecular determinants of color and applications in fluorescence imaging”, *BMC Biology*, 2008, 6, 13. **‘Highly accessed’ article.**
9. Y. Li, A.M. Sierra, H-w. Ai, and R.E. Campbell, “Identification of sites within a monomeric red fluorescent protein that tolerate peptide insertion and testing of corresponding circular permutations”, *Photochemistry and Photobiology*, 2008, 84, 111-119.
8. H-w. Ai, and R.E. Campbell, “Teal fluorescent proteins: Characterization of a reversibly photoswitchable variant”, *Proceedings of SPIE*, 2008, 6868:68680D.

7. H-w. Ai and R.E. Campbell, "More than just pretty colors: the growing impact of fluorescent proteins in the life sciences", **Biotechnology Focus**, 2007, 10 (11), 16-18.
6. H-w. Ai, N.C. Shaner, Z. Cheng, R.Y. Tsien and R.E. Campbell, "Exploration of new chromophore structures leads to the identification of improved blue fluorescent proteins", **Biochemistry**, 2007, 46, 5904-5910. *The 9th of Biochemistry's most accessed articles in 2007.*
5. J.N. Henderson, H-w. Ai, R.E. Campbell, and S.J. Remington, "Structural basis for reversible photobleaching of a green fluorescent protein homologue", **Proc. Natl. Acad. Sci. USA.**, 2007, 14, 6672-6677. *News story in June 2007 issue of Biophotonics and April 2007 ScienceDaily online.*
4. H-w. Ai, J.N. Henderson, S.J. Remington, and R.E. Campbell, "Directed evolution of a monomeric, bright, and photostable version of *Clavularia* cyan fluorescent protein: structural characterization and applications in fluorescence imaging", **Biochem. J.**, 2006, 400, 531-540.
3. J.Y. Bao, H-w. Ai, H. Fu, Y.Y. Jiang, Y.F. Zhao and C. Huang, "Peptide sequencing through N-terminal phosphorylation and electrospray ionization mass spectrometry", **J. Mass Spec.**, 2005, 40, 772-776.
2. H-w. Ai, H. Fu, and Y.F. Zhao, "Novel synthetic method of phosphoramidate peptides and its application in peptide sequencing via multistage mass spectrometry", **Chem. Comm.**, 2003, 21, 2724-2725.
1. Z.W. Miao, H. Fu, G.Z. Tu, J.G. Zhu, H-w. Ai, and Y.F. Zhao, "A stepwise one-pot synthesis of aryl N-phosphoramidothionate derivatives of nucleosides", **Hetero. Chem.**, 2003, 14, 62-66.

Patent and technology transfer

1. H-w. Ai and Hsien-Wei Yeh, "Mutants of *Oplophorus* Luciferase and Methods of Use thereof", Patent disclosure in preparation, UC case # 2016-710.
2. pnGFP (publication #21), hsGFP (publication #25), pMAH2-CageCys (publications #30 and #36), rxRFPs (publications #29 and #35) and several other inventions are distributed through Addgene (Cambridge, MA; http://www.addgene.org/Huiwang_Ai/).
3. R.E. Campbell and H-w. Ai, "Teal Fluorescent Proteins" United States Patent Application No. 11/419,437. Filed: May 19, 2006. Issued 7 September 2010; US Patent No: 7,790,868 (Issued September 7, 2010) and 7,935,801 (Issued May 3, 2011). *Allele Biotech* (San Diego, CA) is the licensed distributor of the genes encoding mTFP1 and mWasabi.
4. Anaptys Biosciences (La Jolla, CA) has licensed the right to use the gene encoding mTFP1 (publication #4) for private research; Genentech (Oceanside, CA) has been approved for the usage of EBFP2 (publication #6) for research purpose; mKalama1 and EBFP2 (publication #6), mAmetrine (publication #11), and mNectarine (publication #12) are distributed through Addgene (Cambridge, MA).

Awards and honors

- UCR Academic Senate Regents' Faculty Development Award, July 2016.
- The Chinese-American Chemistry & Chemical Biology Professors Association (CAPA) Distinguished Junior Faculty Award, 2016
- Emerging Investigator, The Analyst Themed Issue, 2016
- Young Investigator in Analytical and Bioanalytical Science, Analytical and Bioanalytical Chemistry Themed Issue, 2016
- National Science Foundation CAREER award, May 2014
- Hellman Fellows Award, The Hellman Fellows Fund, July 2013
- Young Investigator in Analytical and Bioanalytical Science, Analytical and Bioanalytical Chemistry Themed Issue, 2012
- UCR Academic Senate Regents' Faculty Fellowship (RFF), June 2012.
- The Chinese American Faculty Association (CAFA) Robert T. Poe Faculty Development Award, February 2012.
- *Andrew Stewart* Memorial Graduate Prize, Faculty of Graduate Studies and Research, University of Alberta, May 2008.
- Professional Development Grant, University of Alberta, May 2007
- *Mary Louise Imrie* Graduate Student Award, University of Alberta, March 2007

Oral presentations

42. H-w. Ai, "Illuminating redox signaling with genetically encoded fluorescent probes", *Department of Pharmaceutical Science, East China University of Science and Technology*, Shanghai, China, June 30, 2016.
41. H-w. Ai, "Illuminating redox signaling with genetically encoded fluorescent probes", *Department of Chemical Biology, Peking University*, Beijing, China, June 21, 2016.
40. H-w. Ai, "Illuminating redox signaling with genetically encoded fluorescent probes", *Department of Chemistry, Tsinghua University*, Beijing, China, June 20, 2016.
39. H-w. Ai, "Imaging redox and Zn^{2+} signaling with genetically encoded fluorescent probes", *Department of Biochemistry and Biophysics, Oregon State University*, Corvallis, OR, May 4, 2016.
38. H-w. Ai, "Imaging redox and Zn^{2+} signaling with genetically encoded fluorescent probes", *Department of Chemistry, Texas A&M*, College Station, TX, April 29, 2016.
37. H-w. Ai, "Imaging redox and Zn^{2+} signaling with genetically encoded fluorescent probes", *Department of Pharmacology, Baylor College of Medicine*, Houston, TX, April 27, 2016.
36. H-w. Ai, "Fluorescent probes to probe redox and Zn^{2+} signaling", *Department of Chemistry and Biochemistry, California State University Long Beach*, Long Beach, CA, April 6, 2016.
35. H-w. Ai, "Fluorescent probes to probe redox and Zn^{2+} signaling", *Department of Chemistry and Biochemistry, University of Missouri*, Columbia, MO, April 4, 2016.
34. H-w. Ai, "Fluorescent probes to probe redox and Zn^{2+} signaling", *Department of Chemistry, University of Kansas*, Lawrence, KS, April 1, 2016.
33. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, University of Alberta*, Edmonton, AB, March 23, 2016.

32. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *The 251th ACS National Meeting and Exposition*, San Diego, California, March 13, 2016.
31. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, University of Pittsburgh*, Pittsburgh, PA, March 3, 2016.
30. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry and Chemical Biology, University of New Mexico*, Albuquerque, NM, Feb. 26, 2016.
29. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, University of California Davis*, Davis, CA, Feb. 24, 2016.
28. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Society of Western Analytical Professors 2016 Meeting*, Riverside, CA, Jan. 30, 2016.
27. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, University of Southern California*, Los Angeles, CA, Jan. 28, 2016.
26. H-w. Ai, "Molecular Probes for redox signaling and nitrosative stress". *Pacificchem 2015*, Honolulu, Hawaii, Dec. 15, 2015.
25. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry and Biochemistry, University of Notre Dame*, Notre Dame, IN, Dec. 4, 2015.
24. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, Purdue University*, West Lafayette, IN, Dec. 1, 2015.
23. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, Boston College*, Boston, MA, Nov. 10, 2015.
22. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, Boston University*, Boston, MA, Nov. 9, 2015.
21. H-w. Ai, "Directed Protein Evolution in the Ai Lab at UCR". *City of Hope-UC Riverside Biomedical Research Initiative Workshop*, City of Hope, Duarte, CA, Oct. 17, 2015.
20. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, University of Texas at El Paso*, El Paso, TX, Sep. 25, 2015.
19. H-w. Ai, "Molecular Probes for redox signaling and oxidative stress". *Department of Chemistry, Tongji University*, Shanghai, China, Sep. 1, 2015.
18. H-w. Ai, "A fluorescent toolkit for redox signaling and oxidative stress". *UCR Biomedical Sciences Seminar, University of California Riverside*, Riverside, California, June 5, 2015.
17. H-w. Ai, "Expanding genetically encoded fluorescent protein-based redox probes" *CMDDB Seminar, University of California Riverside*, Riverside, California, Jan. 5, 2015.
16. H-w. Ai, "A Membrane-Activatable Near-Infrared Fluorescent Probe for Mitochondrial Membrane Potential". *Department of Chemistry, University of California Riverside*, Riverside, California, Oct. 10, 2014.
15. H-w. Ai, "Fluorescent Protein Based Redox Probes". *The 248th ACS National Meeting and Exposition*, San Francisco, California, Aug. 11, 2014.
14. H-w. Ai, "Fluorescent Protein Based Probes: an Unnatural Approach". *The 97th Canadian Chemistry Conference and Exhibition*, Vancouver, British Columbia, June 5, 2014.
13. H-w. Ai, "Fluorescence Redox Probes for Imaging Signaling in Living Cells". *Society of Western Analytical Professors 2014 Meeting*, Arizona State University, Tempe, Arizona, Jan. 10, 2014.
12. H-w. Ai, "Fluorescent Tools for Cell Redox Signaling and a Click-Type Bioconjugation

- Reaction". *Department of Chemistry, Colorado State University*, Fort Collins, Colorado, Oct. 9, 2013.
11. H-w. Ai, "Fluorescence Imaging of Redox Signaling in Living Cells". *Department of Chemistry, University of California Riverside*, Riverside, California, Oct. 3, 2013.
 10. H-w. Ai, "Fluorescence Imaging of Redox Signaling in Living Cells". *Environmental Toxicology Seminar, University of California Riverside*, Riverside, California, May 29, 2013.
 9. H-w. Ai, "Fluorescent Probes for Intracellular ROS and H₂S". *Department of Chemistry, University of California Riverside*, Riverside, California, Oct. 18, 2012.
 8. H-w. Ai, "Novel Encodable Probes for Fluorescence Imaging of ROS and H₂S in Cells", *Institute for Integrative Genome Biology (IIGB), University of California Riverside*, California, Oct 5, 2012.
 7. H-w. Ai, "Fluorescence imaging of H₂S and ROS in cells: an indicative pathway to S-sulphydration", invited departmental seminar, *Department of Chemistry and Biochemistry, San Diego State University*, San Diego, California, September 28, 2012.
 6. H-w. Ai, "Reaction-based fluorescent biosensors for H₂S and H₂O₂", the *American Chemical Society 243rd National Meeting & Exposition*, San Diego, California, March 25-29, 2012.
 5. H-w. Ai, "Fluorescent biosensors for chemicals of environmental and biological interests". *Department of Chemistry, University of California Riverside*, Riverside, California, Oct. 06, 2011.

Before coming to UCR

4. H-w. Ai, "Fluorescent proteins and expanded genetic codes: analyzing cellular dynamics with genetically encoded molecular tools". Job search talks in eleven U.S. and Canadian universities, from October 2010 to February 2011.
3. H-w. Ai, "Expanding the fluorescent protein 'toolkit': new FRET pairs for live cell imaging". Invited oral presentation in *Division of Analytical and Environmental Toxicology, Faculty of Medicine and Dentistry, University of Alberta*, Edmonton, Alberta, June 20, 2008.
2. H-w. Ai, "Selecting fluorescent proteins for photostability: new colors and FRET pairs". Oral presentation at the *BiOS (Biomedical Optics Symposium) 2008 of SPIE*, San Jose, CA, Jan. 19-24, 2008.
1. H-w. Ai, "Improved blue and cyan fluorescent proteins with tyrosine-derived chromophores". Oral presentation at the *2006 Volcano Bioorganic Conference*, Pack Forest Washington, Feb. 25-26, 2006.

Poster presentations

8. H-w. Ai*, "Red, Far-red, and Infrared(IR) Fluorescent Redox Sensors". Poster presentation at the *2015 Gordon Research Conference in Bioorganic Chemistry*, June 7-12, 2015, Proctor Academy, Andover, NH.
7. H-w. Ai*, "Reaction-based genetically encoded fluorescent hydrogen sulfide and peroxide sensors". Poster presentation at the *2012 Gordon Research Conference for Thiol-Based Redox Regulation & Signaling*, July 29-Aug 3, 2012, Bates College, Lewiston, ME.
6. H-w. Ai, and P.G Schultz. "Engineering protein structural elements and mapping protein-protein interactions with the expanded genetic code". Poster presentation at the *2010 Bioorganic Chemistry Gordon Research Conference*, June 13-18, 2010, Proctor Academy,

Andover, NH.

5. H-w. Ai, and R.E. Campbell. "New members in the fluorescent protein toolbox: evolution and application". Poster presentation at the *Janelia Farm Research Campus conference on Fluorescent Proteins & Biological Sensors*, Oct. 28-31, 2007, Howard Hughes Medical Institute, Ashburn, VA.
4. H-w. Ai, and R.E. Campbell, "Filling the fluorescent protein toolbox: new colors for construction of orthogonal biosensors". Poster presentation at the *2007 Graduate Student Recruitment poster session*, Aug. 29, 2007. Also presented by REC at the *2007 Bioorganic Gordon Conference* held at Proctor Academy, Andover, New Hampshire, June 10-15, 2007.
3. H-w. Ai, P. Wong and R.E. Campbell, "New genetically encoded fluorophores for multicolor live cell imaging". Poster presentation at the *American Chemical Society 233rd National Meeting & Exposition*, Chicago, March 25-29, 2007.
2. H-w. Ai and R.E. Campbell, "Improved blue and cyan fluorescent proteins with tyrosine-derived chromophores". Poster presentation at the *6th International Conference of the Canadian Proteomics Initiative*, Edmonton, Alberta, May 10-12, 2006. Also presented by REC at the *4th annual CIHR Institute of Genetics New Principal Investigators meeting*, Jackson's Point, Ontario, Nov 4-6, 2005.
1. H-w. Ai and R.E. Campbell, "An improved cyan fluorescent protein with a tyrosine-derived chromophore". Poster presentation at the *48th CSBMCB Annual Meeting on Cellular Dynamics*, Banff, Alberta, March 16-20, 2005.

Meetings

- Howard Hughes Medical Institute Janelia Conference, "Fluorescent Proteins and Biological Sensors V", Janelia Research Campus, Ashburn, VA, Nov. 6-9, 2016.
- The 12th SINO-US Chemistry Professors Conference, Sun Yat-sen University, Guangzhou, China, June 23-25, 2016.
- The 251th ACS National Meeting and Exposition, San Diego, California, March 13-17, 2016.
- Society of Western Analytical Professors 2016 Meeting, Riverside, CA, Jan. 29-30, 2016.
- Pacifichem 2015, Honolulu, Hawaii, Dec. 15-20, 2015.
- City of Hope-UC Riverside Biomedical Research Initiative Workshop, City of Hope, Duarte, CA, Oct. 17, 2015.
- The 2015 Bioorganic Chemistry Gordon Research Conference, Proctor Academy, Andover, NH, June 7-12, 2015.
- The 248th ACS National Meeting and Exposition, San Francisco, California, Aug. 10-14, 2014
- The 97th Canadian Chemistry Conference and Exhibition, Vancouver, British Columbia, June 1-5, 2014.
- Society of Western Analytical Professors 2014 Meeting, Arizona State University, Tempe, Arizona, Jan 9-10, 2014.
- The 2012 Gordon Research Conference for Thiol-Based Redox Regulation & Signaling, July 29-Aug 3, 2012, Bates College, Lewiston, ME.
- The 243rd American Chemical Society National Meeting, San Diego, CA, March 25-29, 2012
- The 2010 Bioorganic Chemistry Gordon Research Conference, Proctor Academy, Andover, NH, June 13-18, 2010.
- The BiOS (Biomedical Optics Symposium) 2008, San Jose, CA, Jan. 19-24, 2008.

- The Janelia Farm Research Campus Conference on Fluorescent Proteins & Biological Sensors, Howard Hughes Medical Institute, Ashburn, VA, Oct. 28-31, 2007,
- The First Canada-China Symposium on Analytical Chemistry for Life Sciences, Edmonton, Alberta August 20-23, 2007.
- The 2007 American Chemical Society National Meeting, Chicago, March 25-29, 2007
- The Canadian Proteomics Initiative, Edmonton, Alberta, May 10-12, 2006.
- The 2006 Volcano Bioorganic Conference, Pack Forest Washington, Feb. 25-26, 2006.
- The 48th CSBMCB Annual Meeting, Banff, Alberta, March 16-20, 2005
- CIHR group in protein structure and function special symposium on Frontiers in Structural Biology, Faculte St. Jean, University of Alberta, May 6-7, 2004

Additional trainings

- HHMI/National Academies Scientific Teaching Summer Institute, Riverside, CA, June 22-27, 2014
- NIH (NIGMS) Mentoring Workshop for New Faculty in Organic and Biological Chemistry, Dallas, TX, June 25-27, 2012
- Teaching Workshop by the UCR Academy of Distinguished Teachers, April 20, 2012.
- The International 3D microscopy of Living cells Course, Vancouver, British Columbia, June 10-25, 2006.

Teaching experience

- Winter 2016, Chemical Biology (CHEM 143)
- Winter 2015, Bioorganic Chemistry (CHEM 143)
- Fall 2013, Fall 2014, and Spring 2016 Optical Spectroscopy (CHEM 221B)
- Fall 2012, Fall 2013, Fall 2014 and Fall 2015, Instrumental Methods of Analysis- Laboratory (CHEM 125L)
- Winter 2012 and Winter 2013, General Chemistry (CHEM 1B)
- Fall 2011 and Fall 2012, Introduction to Bioanalytical Chemistry (CHEM 221E)

Experience to review grants

- NIH EBIT-90 “Enabling Imaging Technologies” Study Section, Oct. 14, 2016, San Francisco.
- NSF Peer Review Panel “Chemical Probes of Biological Processes-P151195”, Feb 2015
- Ad hoc Reviewer for Canada Foundation for Innovation, September 2012
- Ad hoc Reviewer for Czech Science Foundation, September, 2012

Other experience and professional memberships

- 2007-present Member, American Chemical Society (ACS)
- 2012-present Member, American Association for the Advancement of Science (AAAS)
- 2013-present Referee Editor for *Frontiers in Chemistry* (Chemical Biology section)
- 2014-present Member of the AB SCIEX Innovation Advisory board
- 03/2016 Symposium Chair, the 251st ACS National Meeting. Symposium titled: “Luminescent proteins, dyes, and sensors”
- 01/2016 Co-organizer, the 47th annual meeting for the Society of Western

Analytical Professors (SWAP)

- 08/2014 Associate Symposium Chair, the 248th ACS National Meeting. Session titled: "Pro-fluorogenic probe-based methods for disease detection"
- 03/2013 Guest Editor for the journal *Sensors* (ISSN 1424-8220) for a special issue on "fluorescent biosensors"
- 03/2012 Symposium Chair, the 243rd ACS National Meeting. Symposium titled: "Fluorescent imaging of cellular structures and dynamics"

Additional activities

- Reviewer for *Nature Chemical Biology*, *Journal of the American Chemical Society (JACS)*, *ACS Chemical Biology*, *Analytical Chemistry*, *Analyst*, *Biochemistry*, *Chemical Communications*, *Chemical Science*, *Organic & Biomolecular Chemistry*, *Organic Letters*, *Molecular BioSystems*, *Journal of Materials Chemistry*, *Chemical Society Reviews*, etc.
- Consultant for SafeWhite, Inc (2015)
- Graduate Student Admission Committee Member of UCR ETOX (2011-2014), CMDDB (2012) and Chemistry (2014)
- UCR Department of Chemistry Kohler Lecturer Committee Member (2012)
- UCR Committee on International Education Member (since 2014)
- Qualifying/Oral Exam Committee member, Thesis Committee member, and 2nd Year Oral Exam Committee member for more than 20 UCR graduate students in various graduate programs.

Research Support (Ongoing):

National Institute of Health R01GM118675	Ai (PI)	05/10/2016-03/31/2020
A Fluorescent Toolkit for Imaging Reactive Oxygen Species (ROS)		
Role: PI		\$1,225,869
National Institute of Health R21EB021651	Ai (PI)	08/01/2016-06/30/2018
Expansion of Unnatural Fluorescent Protein Probes		
Role: PI		\$387,500
National Science Foundation CHE-1351933	Ai (PI)	05/01/2014-04/30/2019
CAREER: Expanding the Toolbox of Encodable Fluorescent Probes to Image Macrophage Redox Dynamics		
Role: PI		\$600,000
National Science Foundation REU supplement	Ai (PI)	07/01/2016-04/30/2019
Role: PI		\$12,000
National Institute of Health R03EB020211	Ai (PI)	03/01/2015-12/31/2016
Lentiviral Systems for Controlled Mammalian Expression of Unnatural Fluorescent Protein Probes		
Role: PI		\$152,000

UCR Academic Senate Faculty Development Award	Ai (PI)	07/01/2016-06/30/2018
Genetically Encoded Fluorescent Biosensors for Serotonin		
Role: PI		\$7,500
Yetongren Medical Group	Ai (PI)	07/01/2013-06/30/2016
Unlimited Research Gift		
Role: PI		\$145,000

Research/Education Support (Completed):

Collaborative Seed Grant, UCR	Ai (PI)	07/01/2015-12/31/2015
Redox Reporter-Modified Human Stem Cells for Assessing Environmentally Induced Oxidative Stress		
Role: PI		\$10,000 (1/2 to Ai)
Collaborative Seed Grant, UCR	Pirrung (PI)	07/01/2015-12/31/2015
Luciferin Engineering for Bioassays		
Role: Co-PI		\$10,000 (1/2 to Ai)
Collaborative Seed Grant, UCR	Ge (PI)	07/01/2014-12/31/2014
Convert Electricity to Chemicals by Novel Biocatalysts		
Role: Co-PI		\$12,000 (1/3 to Ai)
<i>Robert T. Poe</i> Faculty Development Grant	Ai (PI)	02/01/2012-01/31/2013
Genetically Encoded Biosensors for Hydrogen Sulfide		
Role: PI		\$1,500
UCR Academic Senate Regents' Faculty Fellowship	Ai (PI)	07/01/2012-06/30/2014
Novel Encodable Fluorescent Biosensors for Imaging Cell Redox Homeostasis		
Role: PI		\$3,500
Hellman Fellowship	Ai (PI)	07/01/2013-06/30/2014
Spatiotemporal Control of Metal Ion Signaling with Engineered Fluorescent Proteins		
Role: PI		\$30,000
Beckman Coulter Life Sciences	Zhong/Ai (PI)	11/2012
A "Biopharma to Education" grant to acquire a capillary electrophoresis (CE) instrument for teaching		
Role: co-PI		A CE Instrument

Training of students and postdoctoral researchersCurrent Graduate Students:

- Yichong Fan (Graduate Student in ETOX Ph.D. Program, since 09/2012; Awards: 2016 UCR Dissertation Year Fellowship, and Presentation award in 2016 UCR ETOX symposium)
- Shen Zhang (Graduate Student in CHEM Ph.D. Program, since 09/2013)

- Tan Truong (Graduate Student in CMDDB Ph.D. Program, since 04/2014)
- Andy Yeh (Graduate Student in CHEM Ph.D. Program, since 09/2014; Award: *Graduate scholarship from [Yin Chin Foundation of USA](#)*)

Current Postdoctoral Researcher:

- Dr. Ao Ji (since 01/2013)
- Dr. Qi Qian (since 01/2016)

Current Undergraduate Students:

- Merna Makar (Award: *2015 Kuwana-Sawyer Award for Undergraduate Researchers*)
- Maria Erika Gonzales
- Ramsey Batarseh
- Cebrina Nolan

Former Group Members:

- Dr. Zhijie Chen: Graduate Student in CHEM Ph.D. Program, 09/2011-06/2016; Awards: *Chinese Government Award for Outstanding Self-Financed Students Abroad; Sawyer Award for Analytical Chemistry Graduate Students; James Merrill and Adeline Wallace Annual Prize*; Currently appointed as a postdoc fellow by Prof. Carlos Bustamante at UC Berkeley
- Dr. Suzan Youssef: Graduate Student in CHEM Ph.D. Program, 09/2011-06/2016; Currently appointed as a Lecturer at Crafton Hills Community College
- Dr. Wei Ren: Graduate Student in CHEM Ph.D. Program, 09/2012-06/2016; Award: *Sawyer Award for Analytical Chemistry Graduate Students*; Currently at UCLA Anderson School of Management
- Dr. Si Chen: Postdoctoral Researcher from 09/2011 to 11/2012; currently at Humanwell Pharmaceutical Co., Ltd
- Dr. Yunhua Liu: Staff Research Assistant, 2013-2014; currently at Shanghai Agrobiological Gene Center
- Kansas Morgan: 2012 Summer Undergraduate RISE Program Researcher
- Kevin Micko Cheang: Undergraduate Student Researcher from 09/2011 to 06/2012
- Philip Lee: Undergraduate Student Researcher from 09/2012 to 08/2014; received 2014 Kuwana-Sawyer Award for Undergraduate Researchers; currently at UCI
- Quintin Wright: Undergraduate Student Researcher from 09/2011 to 06/2014; currently at the UCSF PharmD program
- Uyen Truong, Undergraduate Student Researcher from 01/2012 to 04/2015
- Jared Yasutake, Undergraduate Student Researcher from 04/2013 to 04/2015
- Gabriela Mamani, Undergraduate Student Researcher from 01/2015 to 07/2015; currently at Kaiser Permanente

High School Students:

Liana Amaro-Diaz (summer 2014); Jolie Carreon (summers 2014, 2015); Tyler Reagn (summers 2014, 2015); Michael Wang (summers 2014, 2015, 2016); Aislin Liu (summer 2016); Vaibhavi Shah (summer 2016); Jeanessa Mendoza (summer 2016)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Mark Alber

POSITION TITLE: Distinguished Professor of Mathematics, University of California at Riverside (UCR)

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Moscow Institute of Technology, Moscow, Russia	Honors M.S.	1983	Applied Mathematics
University of Pennsylvania, Philadelphia, PA	Ph.D.	1990	Mathematics

A. Personal Statement

My research focuses on coupling multi-scale modeling and experiments to generate new hypotheses about biological mechanisms. I have been PI on several NIH and NSF funded collaborative projects on coupling novel multi-scale modeling of biological problems with biophysical experiments. In particular, my interdisciplinary group has developed and calibrated several multi-scale models of blood clot formation, epithelial tissue growth, chicken limb development, cell culture aggregation, bacterial swarming and microtubule dynamics. Many approaches developed by the group involve methods from biophysics, statistical physics and nonlinear dynamics. The information and articles below indicate my expertise in the areas of research relevant to the Biophysical Ph.D. proposal.

2009 – 2016	Vincent J. Duncan Family Professor of Applied Mathematics, University of Notre Dame
2003 – 2016	Concurrent Professor of Physics, University of Notre Dame
2011 – current,	Elected Fellow, American Association for the Advancement of Science (AAAS)
2015 – current	Deputy Editor, PLoS Computational Biology
2008 - 2012	Member of the Editorial Board, Journal of Statistical Physics

Selected Publications related to Biophysics:

Mark Alber, Section Editor for Mathematical and Computational Methods in Bio-sciences and Medicine of the Encyclopedia of Applied and Computational Mathematics, Springer, 2016, 1676 p. In 2 volumes.

Special Issue on Applications to Biology of the Journal of Statistical Physics, Mark Alber, Ray Goldstein, Erwin Frey, Editors, Springer, Volume 128, Issue 1-2, July 2007.

Special Issue of the Journal: Biofilms, Clay Fuqua, James A. Glazier, Yves Brun and Mark S. Alber, Editors, Cambridge University Press, Volume 1, Number 4, 2004.

Morgen E. Anyan, Aboutaleb Amiri, Cameron W. Harvey, Giordano Tierra, Nydia Morales-Soto, Callan M. Driscoll, Mark S. Alber, Joshua D. Shrout [2014], Type IV Pili Interactions Promote Intercellular Association and Moderate Swarming of *Pseudomonas aeruginosa*, Proc. Natl. Acad. Sci. USA vol. 111, no. 50, 18013-18018 (authors for correspondence: J. Shrout and M. Alber).

Wu Z, Xu Z, Kim O, Alber M. [2014], Three-dimensional multi-scale model of deformable platelets adhesion to vessel wall in blood ow. Philosophical Transactions of the Royal Society A 372: 20130380.

Chunlei Li, Jun Li, Holly V. Goodson and Mark S Alber [2014], Microtubule Dynamics Instability: the Role of Cracks between Proto_faments, Soft Matter 10, 2069-2080.

Gupta, K., Li, C., Duan, A.R., Alberic, E.O., Kim, O.V., Alber M.S., and Goodson, H. V. [2013], A mechanism for the catastrophe-promoting activity of the microtubule destabilizer Op18/stathmin, *Proc. Natl. Acad. Sci. USA*, 2013 Dec 17;110(51):20449-54. doi: 10.1073/pnas.1309958110.

Oleg V. Kim, Zhiliang Xu, Elliot D. Rosen and Mark S. Alber [2013], Fibrin Networks Regulate Protein Transport during Thrombus Development, *PLoS Computational Biology* 9 (6), e1003095.

Cameron Harvey, Mark Alber, Lev Tsimring, Igor Aronson [2013], Continuum modeling of clustering of myxobacteria, *New Journal of Physics* 15, 035029.

Huijing Du, Zhiliang Xu, Morgen Anyan, Oleg Kim, W. Matthew Leevy, Joshua D. ShROUT and Mark Alber [2012], High density waves of the bacterium *Pseudomonas aeruginosa* in propagating swarms result in efficient colonization of surfaces, *Biophysical Journal* 103(3), 601-609.

Richard Gejji, Pavel Lushnikov and Mark Alber [2012], Macroscopic model of self-propelled bacteria swarming with regular reversals, *Physical Review E* 85, 021903 (highlighted in Faculty of 1000).

Christopher R. Sweet, Santanu Chatterjee, Zhiliang Xu, Katharine Bisordi, Elliot D. Rosen and Mark Alber [2011], Modeling Platelet-Blood Flow Interaction Using Subcellular Element Langevin Method, *Journal of the Royal Society Interface* 8 (65), 1760-71.

Yilin Wu, Yi Jiang, A. Dale Kaiser, Mark Alber [2011], Self-organization in bacterial swarming: Lessons from Myxobacteria, *Physical Biology* 8 (5), 055003.

Cameron W. Harvey, Faruck Morcos, Christopher R. Sweet, Dale Kaiser, Santanu Chatterjee, Xiaomin Lu, Danny Chen and Mark Alber [2011], Study of elastic collisions of *M. xanthus* in swarms, *Physical Biology* 8, 026016.

Gennady Margolin, Holly V. Goodson, and Mark S. Alber [2011], Mean-field study of the role of lateral cracks in microtubule dynamics, *Physical Review E* 83, 041905.

Xu, Z., J. Lioi, J. Mu, X. Liu, M.M. Kamocka, E.D. Rosen, D.Z. Chen and M.S. Alber [2010], A Multiscale Model of Venous Thrombus Formation with Surface-Mediated Control of Blood Coagulation Cascade, *Biophysical Journal* 98, 9, 1723{1732.

Zhenyu Shi, Nan Chen, Yanan Du, Ali Khademhosseini and Mark Alber [2009], Stochastic model of self-assembly of cell-laden hydrogels, *Phys. Rev. E* 80 061901.

Lushnikov, P.P., Chen, N., and M.S. Alber [2008], Macroscopic dynamics of biological cells interacting via chemotaxis and direct contact, *Phys. Rev. E* 78, 061904 (highlighted in the Faculty of 1000 Biology).

Alber, M., Chen, N., Lushnikov, P., and S. Newman [2007], Continuous macroscopic limit of a discrete stochastic model for interaction of living cells, *Physical Review Letters* 99, 168102.

Chen, N., Glazier, J.A., Izaguirre, J.A. and M.S. Alber [2007], A Parallel Implementation of the Cellular Potts Model for Simulation of Morphogenesis, *Computer Physics Communications* 176 670{681.

Margolin, G., Gregoret, I., H. Goodson, and Alber, M. [2006], Analysis of a microscopic stochastic model of microtubule dynamic instability *Phys. Rev. E* 74 041920.

Alber, M., Chen, N., Glimm, T., and P. Lushnikov [2006], Multiscale dynamics of biological cells with chemotactic interactions: From a discrete stochastic model to a continuous description, *Phys. Rev. E* 73 051901.

Sozinova, O., Y. Jiang, D. Kaiser, and M. Alber [2005], A Three-Dimensional Model of Myxobacterial Aggregation by Contact-mediated Interactions, *Proc. Natl. Acad. Sci. USA* 102 No.32, 11308-11312.

Alber, M., Chen, N., Glimm, T., and P. Lushnikov [2006], Multiscale dynamics of biological cells with chemotactic interactions: From a discrete stochastic model to a continuous description, Phys. Rev. E. 73 051901.

Kiskowski, M.A., Y. Jiang, M.S. Alber [2004], Role of Streams in Myxobacteria Aggregate Formation, Physical Biology 1 173-183.

Alber, M.S., M.A. Kiskowski, and Y. Jiang [2004], Two-stage aggregate formation via streams in myxobacteria, Phys. Rev. Lett. 93 068301.

B. Positions and Honors

Positions and Employment

Summer 1990	Instructor, University of Pennsylvania
1990 – 1996	Assistant Professor, Department of Mathematics, University of Notre Dame (UND)
1993–1994	On Sabbatical leave at UC Berkeley and Mathematical Sciences Research Institute (MSRI) and Institute for Advanced Study, Princeton, NJ
Summer 1993	Visiting Fellow, Fields Institute for Research in Mathematical Sciences, Canada
June 1994	Visiting Scientist, CNLS, Los Alamos National Lab., NM
1995, 1996	Visiting Fellow, Hewlett-Packard Research Lab., Bristol, UK
1996 – 2001	Tenured Associate Professor, Department of Mathematics, UND
1997 – 2012	Member of the Executive Committee of the Notre Dame Center for Applied Mathematics
2000 – 2001	Sabbatical leave at Stanford University, Palo Alto, CA
2001	Senior Fellow, Institute for Pure and Applied Mathematics (IPAM), UCLA
2001 – 2006	Professor, Department of Mathematics, UND
2001-2002	Associate Director, Interdisciplinary Center for the Study of Biocomplexity (ICSB), UND
2002 –	Director, ICSB, UND
2003 –	Concurrent Professor, Department of Physics, UND
2006 – 2007	Member of the University of Notre Dame Graduate Council, UND
2006 – 2009	Notre Dame University Professor of Applied Mathematics, UND
2009 –	Vincent J. Duncan Family Professor of Applied Mathematics, UND
2012 –	Concurrent professor of Computer Science and Engineering, UND
2013 – 2015	Director of graduated studies, Department of Applied and Computational Mathematics and Statistics, UND
2016 –	Distinguished Professor of Mathematics, University of California, Riverside (UCR)

Other Experience and Professional Memberships

2008 – 2012	Member of the Editorial Board, Journal of Statistical Physics
2010 –	Review Editor of Frontiers in Computational Physiology and Medicine
2010 –	Member of the Committee of the American Mathematical Society (AMS) on Human Rights of Mathematicians
2013 – 2016	Representative of the AMS to the AAAS Human Rights Coalition (HRC) and member of the Council of the HRC
2011 – 2013	Member of the Editorial Board, PLoS Computational Biology
2009 – 2016	Section Editor for Mathematical and Computational Methods in Biosciences and Medicine of the Encyclopedia of Applied and Computational Mathematics (Springer)
2009 – 2016	Member of 9 NIH Panels and 3 NSF Panels
2010 –	Member of the Editorial Board, Bulletin of Mathematical Biology
2013 –	Deputy Editor, PLoS Computational Biology

Honors

2006 – 2009	Notre Dame University Professor of Applied Mathematics, UND
2011 –	Elected Fellow, American Association for the Advancement of Science (AAAS)
2009 – 2016	Vincent J. Duncan Family Professor of Applied Mathematics, UND
2013	Distinguished Lecture in Applied Mathematics, U of Massachusetts, Amherst, MA
2016	Keynote Speaker, 8th International Bio-fluid Mechanics Symposium, Caltech, Pasadena, CA
2016 –	Distinguished Professor of Mathematics, University of California, Riverside (UCR)

C. Contribution to Science

My research focused on coupling multi-scale modeling and experiments to generate new biologically relevant hypotheses for the following main projects.

Combined multi-scale modeling and experimental study of blood clot formation

Unlike current experimental approaches that can only explore the effects of one or two components, an interplay between experiment and a validated simulation of thrombogenesis could provide a framework to study the complex network of factors and processes involved in thrombus development. We developed in Sweet et al. [2011] and Wu et al. [2014] two and three-dimensional multi-scale models coupling detailed submodels for cells and blood and used them to simulate receptor-mediated adhesion of deformable platelets at the site of vascular injury under different shear rates of blood flow. Fibrin is a protein polymer that forms a 3D filamentous network, a major structural component of protective physiological blood clots as well as life threatening pathological thrombi. It plays an important role in wound healing, tissue regeneration and is widely employed in surgery as a sealant and in tissue engineering as a scaffold. The network permeability and the protein diffusivity were shown in Kim et al. [2013] to be important factors determining the transport of proteins through the fibrin network. Rheological measurements described in Kim et al. [2014] revealed nonlinear changes of fibrin network viscoelastic properties under dynamic compression, resulting in network softening followed by its dramatic hardening.

1. Wu Z, Xu Z, Kim O, Alber M. [2014], Three-dimensional multi-scale model of deformable platelets adhesion to vessel wall in blood flow. *Philosophical Transactions of the Royal Society A* 372: 20130380.
1. Oleg V. Kim, Rustem I. Litvinov, John W. Weisel and Mark S. Alber [2014], Structural basis for the nonlinear mechanics of fibrin networks under compression, *Biomaterials* 35, 6739-6749.
1. Oleg V. Kim, Zhiliang Xu, Elliot D. Rosen and Mark S. Alber [2013], Fibrin Networks Regulate Protein Transport during Thrombus Development, *PLoS Computational Biology* 9 (6), e1003095.
2. Christopher R. Sweet, Santanu Chatterjee, Zhiliang Xu, Katharine Bisordi, Elliot D. Rosen and Mark Alber [2011], Modeling Platelet-Blood Flow Interaction Using Subcellular Element Langevin Method, *J. R. Soc. Interface* 8 (65), 1760-71.

Multi-scale modeling of early chicken limb development

Developing organs have both discrete and continuous aspects; they may undergo changes according to deterministic or stochastic rules. Some embryonic tissues are planar and can be approximated as 2D sheets, whereas other tissues are space-filling and inherently 3D. Some developmental processes are synchronized over a spatial domain whereas others sweep across a region over time. In some cases, one developmental process will relax much faster or much slower than another, so that the two can be treated essentially independently of one another. In other cases, the only accurate representation is to treat the processes as mutually determinative and conditioning. Each of these possibilities presents a distinct problem for the modeler, and it is becoming increasingly clear that a fully satisfactory model for the development of any living organ must embody all of them. That is, it will be inescapably hybrid, mathematically and computationally. We developed a multi-scale simulation environment [Cickovski et al. 2005, 2007, Zhu et al. 2010 and Zhang et al. 2013] of a chicken limb and used it to simulate cell rearrangement as an individual based module in the presence of morphogen fields and cell-state transition rules based on simplifications of system of equations described above. This strategy permitted us to generate 3D simulations with authentic developmental properties.

1. Yong-Tao Zhang, Mark S. Alber and Stuart A. Newman [2013], Mathematical Modeling of Vertebrate Limb Development, *Mathematical Biosciences* 243, 117.
2. Jianfeng Zhu, Yong-Tao Zhang, Mark S. Alber and Stuart A. Newman [2010], Bare bones pattern formation: a core regulatory network in varying geometries reproduces major features of vertebrate limb development and evolution, *PLoS ONE* (5): e10892.
3. Newman, S., Christley, S., Glimm, T., Hentschel, H.G.E., Kazmierczak, B., Zhang, Y.T., Zhu, J., and M. Alber [2008], Multiscale Models for Vertebrate Limb Development, *Curr Top Dev Biol.* 81 311-340.
4. Chaturvedi, R., C. Huang, B. Kazmierczak, T. Schneider, J. A. Izaguirre, T. Glimm, H.G.E. Hentschel, J. A. Glazier, S. A. Newman, M. Alber [2005], On Multiscale Approaches to 3-Dimensional Modeling of Morphogenesis, *Journal of the Royal Society Interface* 2 3, 237-253.

Combined multi-scale modeling and experimental study of spread of infection

Pseudomonas aeruginosa is an opportunistic pathogen responsible for both acute and persistent infections in susceptible individuals, as exemplified by those for burn victims and people with cystic fibrosis. A key aspect of these infections is the formation of bacterial swarms, which are surface-associated, socially organized communities of cells. We developed biologically justified cell-based multi-scale models to generate and test hypothesized mechanisms leading to pathogen *P. aeruginosa* swarming observed in experiments. In the recent paper [Anyan et al. 2014, PNAS] we combined laboratory and computational methods to probe the physical interactions of Type IV pili (TFP) during flagellar-mediated swarming and found that TFP of one cell strongly interact with TFP of other cells, which limits swarming expansion rate. Hence, wild-type *P. aeruginosa* use cell-cell physical interactions via their TFP to control self-organization within motile swarms. This collective mechanism of cell-cell coordination using TFP allows for moderation of swarming direction of individual cells and avoidance of a toxic environment.

1. Morgen E. Anyan, Aboutaleb Amiri, Cameron W. Harvey, Giordano Tierra, Nydia Morales-Soto, Callan M. Driscoll, Mark S. Alber, Joshua D. Shrout [2014], Type IV Pili Interactions Promote Intercellular Association and Moderate Swarming of *Pseudomonas aeruginosa*, *Proc. Natl. Acad. Sci. USA* vol. 111, no. 50, 18013-18018 (authors for correspondence: J. Shrout and M. Alber).
2. Huijing Du, Zhiliang Xu, Morgen Anyan, Oleg Kim, W. Matthew Leevy, Joshua D. Shrout and Mark Alber [2012], High density waves of the bacterium *Pseudomonas aeruginosa* in propagating swarms result in efficient colonization of surfaces, *Biophysical Journal* 103(3), 601-609.
3. Huijing Du, Zhiliang Xu, Joshua D. Shrout and Mark Alber [2011], Multiscale Modeling of *Pseudomonas aeruginosa* Swarming, *Mathematical Models and Methods in Applied Sciences*, Vol. 21, Suppl. 939-954.
4. Morales-Soto, N., Anyan, M. E., Mattingly, A. E., Madukoma, C. S., Harvey, C. W., Alber, M., Dziel, E., Kearns, D. B., and J.D. Shrout [2015], Preparation, Imaging, and Quantification of Bacterial Surface Motility Assays. *Journal of Visualized Experiments*, (98), e52338, doi:10.3791/52338.

Study of the interplay of motility mechanisms during swarming of *Myxococcus xanthus*

The main goal of this interdisciplinary project is to combine simulations using new three-dimensional multi-scale modeling environment and specifically designed experiments to study basic coordination events of *M. xanthus* swarming, which is essential to understanding how millions of bacteria function in real environments. Research program focuses on the role of flexibility of cells, viscosity of extracellular polysaccharide, slime adhesivity and directional reversals in resolving collisions, increasing alignment and optimizing swarming rate for *M. xanthus*. In particular, we demonstrated in Harvey et al. [2014] (*J. Bacteriol.*) interconnection of division, motility, and polarity for the bacterium *Myxococcus xanthus*.

1. Cameron W. Harvey, Chinedu S. Madukoma, Shant Mahserejian, Mark S. Alber and Joshua D. Shrout [2014], Cell Division Resets Polarity and Motility for the Bacterium *Myxococcus xanthus*, *Journal of Bacteriology* 196, 22, 3853-3861.
2. Cameron W Harvey, Huijing Du, Zhiliang Xu, Dale Kaiser, Igor Aranson, Mark Alber [2012], Interconnected Cavernous Structure of Bacterial Fruiting Bodies, *PLoS Computational Biology* 8 (12), e1002850.
3. Yilin Wu, Yi Jiang, A. Dale Kaiser, Mark Alber [2011], Self-organization in bacterial swarming: Lessons from *Myxobacteria*, *Physical Biology* 8 (5), 055003.
4. Wu, Y., Jiang, Y., Kaiser, D., and M. Alber [2009], Periodic reversal of direction allows *Myxobacteria* to swarm, *Proc. Natl. Acad. Sci. USA* 106 4 1222-1227 (featured in the Nature News, January 20th, 2009, doi:10.1038/news.2009.43).

Experimental and computational studies of MT dynamics and regulation by binding proteins

The long-term goal of this collaborative project is to develop a comprehensive understanding of MT dynamics and its regulation by MT binding proteins through a coordinated program of multiscale computational modeling and experiment. The specific goals of this project are to 1) use combined experiment and modeling to establish fundamental principles for how groups of MT Binding Proteins (MTBPs) work together; 2) define the relationship between the behavior of the bulk polymer and that of the individual MTs, and 3) develop freely available software packages to allow students and researchers at remote sites to use our models. In particular, in the papers Gupta

et al. [2013] (PNAS) and Li et al. [2014] (Soft Matter) we introduced two models for studying the catastrophe-promoting activity of the microtubule destabilizer Op18/stathmin and to study in detail to investigate the connection between cracks and MT dynamic instability.

1. Chunlei Li, Jun Li, Holly V. Goodson and Mark S Alber [2014], Microtubule Dynamics Instability: the Role of Cracks between Protofilaments, *Soft Matter* 10, 2069-2080.
2. Gupta, K., Li, C., Duan, A.R., Alberic, E.O., Kim, O.V., Alber M.S., and Goodson, H. V. [2013], A mechanism for the catastrophe-promoting activity of the microtubule destabilizer Op18/stathmin, *Proc. Natl. Acad. Sci. USA*, 2013 Dec 17;110(51):20449- 54. doi: 10.1073/pnas.1309958110.
3. Gennady Margolin, Ivan V. Gregoretti, Trevor M. Ciskovski, Chunlei Li, Wei Shi, Mark S. Alber and Holly V. Goodson [2012], The Mechanisms of Microtubule Catastrophe and Rescue: Implications from analysis of a dimer-scale computational model, *Molecular Biology of the Cell*, 23:4 642-656.
4. Gennady Margolin, Holly V. Goodson, and Mark S. Alber [2011], Mean-field study of the role of lateral cracks in microtubule dynamics, *Physical Review E* 83, 041905.

Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/1Xt9sryY5mXkT/bibliography/50131426/public/?sort=date&direction=ascending>

D. Research Support

Ongoing Research Support

U01 HL116330	Alber (PI)	07/26/2014 - 07/30/2019

Multiscale modeling and empirical study of a mechanism limiting blood clot growth. This interdisciplinary collaborative project integrates multiscale modeling and experiments to examine novel hypothesis related to the role of fibrin networks in processes halting thrombus growth. This will help physicians to estimate risk of thrombotic disease for an individual patient by identifying critical values of parameters of processes regulating thrombogenesis.

R01GM095959	Alber (PI)	04/01/2012 - 12/31/2016

Combined multiscale modeling and experimental study of bacterial swarming. A key aspect of bacterial infections is the formation of bacterial swarms, which are surface-associated, socially organized communities of cells. This combined multiscale modeling and laboratory study of bacterial behavior on surfaces will provide new critical information needed for the eradication, prevention and treatment of the *P. aeruginosa* infections.

NSF Grant CBET-1403887	Zartman (PI), Alber and Hoelzle (Co-PIs)	05/01/14 - 04/30/17

Decoding organ-level intercellular signaling in an active, regulated microenvironment. The team develops novel biophysical methods combined with computer simulations for testing novel hypothesis that intercellular calcium waves encode information on the size, differentiation state and overall physiology of epithelia.

NSF grant MCB-1244593	Goodson (PI), Alber (Co-PI)	2017 07/01/13 - 06/30/17

BioMaPS: Experimental and Computational Studies of Microtubule Dynamics and Regulation by Binding Proteins. The long-term goal of this collaborative project is to develop a comprehensive understanding of MT dynamics and its regulation by MT binding proteins through a coordinated program of multiscale computational modeling and experiment.

Recently Completed Research Support

R01GM100470	Alber (PI)	06/01/11 - 06/01/14

Study of the interplay of motility mechanisms during swarming of *Myxococcus xanthus*. The main goal of this interdisciplinary project was to combine simulations using new three-dimensional multiscale modeling

environment and specifically designed experiments to study basic coordination events of *M. xanthus* swarming, which is essential to understanding how millions of bacteria function in real environments.

NSF grant MCB-0951264

Goodson (PI), Alber (Co-PI)

03/15/10 - 03/15/13

Cellular Organization, Computational and Experimental Studies of Microtubule Dynamics and Regulation by Binding proteins. The project resulted in development of a multi-scale MT model and getting predictive and quantitative understanding of the MT cytoskeleton and its regulation by MTBPs.

NSF Grant DMS-0800612

Alber (PI)

09/01/08-09/01/11

Integrating Multiscale Modeling and in vivo Experiments for Studying Blood Clot Development, The focus of this project was on studying interplay and impact of viscous, incompressible blood plasma, activated and non-activated platelets, as well as other blood cells, activating chemicals, fibrinogen and vessel walls on the internal structure of the developing blood clot.

Postdoctoral Researcher
2012 - 2016
Massachusetts Institute of Technology
Ragon Institute of MGH, MIT & Harvard
Adviser: Arup K Chakraborty

PhD, Physics
2006 - 2012
Rutgers, The State University of New Jersey
Adviser: Joel L Lebowitz

BS, Physics & Mathematics
2002 - 2006
Duke University
Magna cum laude
Honors thesis adviser: M Ronen Plesser

Research Interests
I use methods from statistical mechanics and machine learning to study pathogen evolution and human immunity. I am particularly interested in highly mutable pathogens such as HIV, and the dynamical interactions between microbes and the immune system.

Publications
2016
Lorenzi JCC⁼, Cohen YZ⁼, Cohn LB, Kreider EF, **Barton JP** et al. Paired quantitative and qualitative assessment of the replication-competent HIV-1 reservoir and its relationship to integrated proviral DNA. PNAS 113 (49) E7908-E7916.

Barton JP[†], De Leonardis E, Coucke A, Cocco S[†]. ACE: Adaptive cluster expansion for maximum entropy graphical model inference. Bioinformatics 32(20): 3089-3097. Code: github.com/johnbarton/ACE.

Barton JP, Goonetilleke N, Butler TC, Walker BD, McMichael AJ, Chakraborty AK. Relative rate and location of intra-host HIV evolution to evade cellular immunity is predictable. Nature Communications 7:11660.

Butler TC⁼, **Barton JP**⁼, Kardar M, Chakraborty AK. Identification of drug resistance mutations in HIV from constraints on natural evolution. Physical Review E 93(2): 022412.

Barton JP, Chakraborty AK, Cocco S, Jacquin H, Monasson R. On the entropy of protein families. Journal of Statistical Physics 162(5): 1267-1293.

- Part of the special issue "Information Processing in Living Systems"

2015 **Barton JP**, Kardar M, Chakraborty AK. Scaling laws describe memories of host-pathogen riposte in the HIV population. PNAS 112(7): 1965-1970.

- Awarded MIT Postdoctoral Association Travel Grant, APS March Meeting
- Highlighted on the MIT Postdoctoral Association website

2014 Mann JK⁼, **Barton JP**⁼, Ferguson AL⁼, Omarjee S, Walker BD, Chakraborty AK, Ndung'u T. The fitness landscape of HIV-1 Gag: Advanced modeling approaches and validation of model predictions by in vitro testing. PLoS Computational Biology 10(8): e1003776.

- 2014 **Barton JP**, Cocco S, De Leonardis E, Monasson R. Large pseudocounts and L_2 -norm penalties are necessary for the mean-field inference of Ising and Potts models. *Physical Review E* 90(1): 012132.
- Shekhar K, Ruberman CF, Ferguson AL, **Barton JP**, Kardar M, Chakraborty AK. Spin models inferred from patient-derived viral sequence data faithfully describe HIV fitness landscapes. *Physical Review E* 88(6): 062705.
- 2013 **Barton JP**, Sontag ED. The energy costs of insulators in biochemical networks. *Biophysical Journal* 104(6): 1380-1390.
- Barton J**, Cocco S. Ising models for neural activity inferred via selective cluster expansion: structural and coding properties. *Journal of Statistical Mechanics* 2013(03): P03002.
- Part of the special issue "Statistical Physics and Neuroscience"
- 2011 **Barton J**, Lebowitz JL, Speer ER. Phase diagram of a generalized ABC model on the interval. *Journal of Statistical Physics* 145(3): 763-784.
- Barton J**, Lebowitz JL, Speer ER. The grand canonical ABC model: a reflection asymmetric mean-field Potts model. *Journal of Physics A: Mathematical and Theoretical* 44: 065005.
- Included in the *Journal of Physics A* Highlights of 2011 collection
- Current work Rajkoomar E⁺, **Barton JP**⁺, Mann JK, Ndung'u T, Chakraborty AK. Modeling and in vitro testing of the HIV-1 Nef fitness landscape. Submitted.
- Chakraborty AK, **Barton JP**. Rational design of effective vaccine targets and strategies for HIV: a crossroad of statistical physics, biology, and medicine. Submitted.
- Barton JP**, Chakraborty AK, Shrinivas K. Modeling the effects of human immunity on pathogen evolution. In preparation.
-
- Invited talks 116th Statistical Mechanics Conference, Rutgers University
- 2016 Initiative for the Theoretical Sciences, CUNY (declined for family reasons)
Department of Microbiology, University of Pennsylvania School of Medicine
Coevolution in Proteins and RNA, Theory and Experiments Workshop
Keystone Systems Immunology Meeting (short talk selected from abstracts)
- 2015 Systems Immunology Workshop,
Cincinnati Children's Hospital Medical Center
Mathematical Physics Seminar, Rutgers University
Center for Biophysics and Computational Biology, Temple University
Keystone HIV Vaccines Meeting (short talk selected from abstracts)
Monday Meeting, Ragon Institute of MGH, MIT and Harvard
- 2014 Institute for Advanced Study Focused Program on Computational and Experimental Immunology, Hong Kong University of Science and Technology
Monday Meeting, Ragon Institute of MGH, MIT and Harvard
- 2013 Harvard Microbial Evolution Group, Harvard University

Contributed presentations	2016	IMES Research Progress Meeting Koch Institute Immune Engineering Symposium, MIT APS March Meeting
	2015	Forecasting Evolution Conference (short talk invitation declined) Third Annual Winter Q-Bio Meeting
	2014	112th Statistical Mechanics Conference, Rutgers University MIT Biophysics Retreat MIT-MGH Meeting on IBD, Microbiome and Autoimmune Disease
	2013	First Annual Winter Q-Bio Meeting
	2012	108th Statistical Mechanics Conference, Rutgers University 107th Statistical Mechanics Conference, Rutgers University
	2011	106th Statistical Mechanics Conference, Rutgers University
Honors & Awards		eLife Early-Career Reviewer (2016) Lindau Nobel Laureate Meeting Attendee, Siemens AG Fellow (2015) MIT Postdoctoral Association Travel Grant (2014) Rutgers University Departmental Graduate Assistantship (2010, 2012) GAANN Fellowship, Rutgers University (declined) Phi Beta Kappa, National honor society Sigma Pi Sigma, National physics honor society Phi Eta Sigma, National honor society
Teaching Experience		Teaching assistant, Honors Physics III (Physics 273), Rutgers University (2011) Senior teaching assistant, Extended General Physics (Physics 201), Rutgers University (2010) Teaching assistant, Extended General Physics (Physics 201/202), Rutgers University (2006 - 2009) Teaching assistant, General Physics I-II (Physics 52L-54L), Duke University (2003 - 2004)

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5489 Boyce Hall, University of California, Riverside, CA 92521
Phone: (951) 827-3832, Fax: (951) 827-4294, email: gregor.blaha@ucr.edu

Professional Preparation

University of Vienna, Austria	Chemistry/Chemistry	Mag.rer.nat., 1997
Vienna University of Technology, Austria	Technical Sciences	Dr. techn., 2001
Yale University, New Haven, CT	Macromolecular Crystallography	2001 – 2008

Appointments

2012- Present	University of California, Riverside, Assistant Professor, Department of Biochemistry
2008-2011	Yale University, New Haven, CT, Research Associate
2001-2008	Yale University, New Haven, CT, Postdoctoral Fellow
2001	Max Planck Institute for Molecular Genetics, Berlin, Germany, Postdoctoral Fellow

Five Relevant Publications

- 1) **G. Blaha**, R.E. Stanley, and T.A. Steitz. Formation of the first peptide bond: the structure of EF-P bound to the 70S ribosome. *Science*, 325: 966-970, 2009. (doi: 10.1126/science.1175800)
- 2) Y.S. Polikanov, **G.M. Blaha**, and T.A. Steitz. How hibernation factors RMF, HPF, and YfiA turn off protein synthesis. *Science*, 336: 915-918, 2012. (doi: 10.1126/science.1218538)
- 3) R.N. Evans, **G. Blaha**, S. Bailey, and T.A. Steitz. The structure of LepA, the ribosomal back translocase. *Proc. Natl. Acad. Sci. U. S. A.*, 105:4673-4678, 2008. (doi: 10.1073/pnas.0801308105)
- 4) C.M.T. Spahn, **G. Blaha**, R.K. Agrawal, P. Penczek, R.A. Grassucci, C.A. Trieber, S.R. Connell, D.E. Taylor, K.H. Nierhaus, and J. Frank. Localization of the ribosomal protection protein Tet(O) on the ribosome and the mechanism of tetracycline resistance. *Mol. Cell*, 7: 1037-1045, 2001.
- 5) T.M. Wendrich, **G. Blaha**, D.N. Wilson, M.A. Marahiel, and K.H. Nierhaus. Dissection of the mechanism for the string factor RelA. *Mol. Cell*, 10: 779-88, 2002.

Other Significant Publications

- 1) H. Fan, J. Hahm, S. Diggs, J. J. P. Perry, and **G. Blaha**. Structural and Functional Analysis of BipA, a Regulator of Virulence in enteropathogenic *Escherichia coli*. *J. Biol. Chem.*, 290 (34): 20856-64, 2015.(DOI: 10.1074/jbc.M115.659136)
- 2) D. Tu, **G. Blaha**, P.B. Moore, and T.A. Steitz. Structures of MLSBK antibiotics bound to mutated large ribosomal subunits provide a structural explanation for resistance. *Cell*, 121: 257-270, 2005.
- 3) D. Tu, **G. Blaha**, P.B. Moore, and T.A. Steitz. Gene replacement in *Haloarcula marismortui*: construction of a strain with two of its three chromosomal rRNA operons deleted. *Extremophiles*, 9: 427-435, 2005.
- 4) R.E. Stanley, **G. Blaha**, R.L. Grodzicki, M.D. Strickler, and T.A. Steitz. The structures of the anti-tuberculosis antibiotics viomycin and capreomycin bound to the 70S ribosome. *Nat. Struct. Mol. Biol.*, 17: 289-293, 2010. (doi: 10.1038/nsmb.1755)
- 5) **G. Blaha**, U. Stelzl, C.M.T. Spahn, R.K. Agrawal, J. Frank, and K.H. Nierhaus. Preparation of functional ribosomal complexes and effect of buffer conditions on tRNA positions observed by cryoelectron microscopy. *Methods Enzymol.*, 317: 292-309, 2000.

Synergistic Activities

Faculty mentor for the Minority Access to Research Careers - Undergraduate Student Training in Academic Research (Marc U*), the Louis Stokes California Alliance for Minority Participation in Science, Engineering and Mathematics (CAMP), and Summer Research in Science and Engineering program at UCR (RISE).

Faculty advisor for high school students (UCR discovery day, 2011-present), graduate students (microbiology graduate program, 2013), and post-doctoral researchers (UCR Career Day, 2012).

Co-organizer of the 2014 and organizer of the 2016 Biochemistry Summer Academy High School Teachers

Science Fair Judge for Riverside Unified School District and for the Riverside, Inyo, Mono, and San Bernardino counties competitions.

Advised and consulted in the development of an alignment tool for high throughput capillary mounting of protein crystals (MiTeGen LLC, Ithaca, NY; 2010-2011 URL: <http://www.mitegen.com/products/micrort/micrort.shtml>.)

CURRICULUM VITAE

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The University of California
Riverside, California 92521
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FAX: (951)-827-4286
e-mail: cardullo@ucr.edu

ACADEMIC POSITIONS

2014 – present	Associate Vice Provost, Undergraduate Education, University of California, Riverside
2014 – present	Howard H Hays Jr Chair, University Honors, University of California, Riverside
2012 – 2014	Honors Faculty Member, University of California, Riverside
2009 – 2012	Divisional Dean of Life Sciences, College of Natural and Agricultural Sciences, University of California, Riverside
2004 – 2009	Chair, Department of Biology, University of California, Riverside
2006 - present	Distinguished Teaching Professor of Biology, University of California, Riverside
2002 – present	Professor of Biology, University of California, Riverside
1996 – 2002	Associate Professor of Biology, University of California, Riverside
1991 - 1996	Assistant Professor of Biology, University of California, Riverside
1987 - 1991	Senior Research Associate The Worcester Foundation for Experimental Biology, Shrewsbury, MA
1985 - 1987	Postdoctoral Fellow Department of Anatomy and Cellular Biology, Harvard Medical School

EDUCATION

1981 - 1985	Ph.D. Biophysics, May 1985 Department of Biophysics, The Johns Hopkins University, Baltimore, Md. Advisor: Dr. Richard Cone
1979 - 1981	M.S. Physics, May 1981 Department of Physics, University of Massachusetts, Amherst
1976 - 1979	B.S. Physics (concentration in Biophysics), April 1979 Department of Biophysics, University of Michigan, Ann Arbor

AWARDS, FELLOWSHIPS, AND HONORS

1981 - 1985 NIH predoctoral fellowship at Johns Hopkins
1984 - 1985 Dean's fellowship at Johns Hopkins
1987 NIH training grant at Harvard in Reproductive Biology
1987 - 1988 NIH training grant at the Worcester Foundation in Cell Biology
1988 - 1990 NIH National Research Service Award recipient
1991 Recipient, James Shannon Award (NIH)
1998 Organizer and International Advisor for VIII International Congress of Spermatology
1999 UCR Distinguished Teaching Award
1999-2001 President, UCR Chapter of Sigma Xi
2000 Visiting Professor, Scripps Oceanographic Research Institute
2003 Vice Chair, Gordon Conference on *Fertilization and Activation of Development*
2005 Chair, Gordon Conference on *Fertilization and Activation of Development*
2006 HHMI/National Academy of Sciences Teaching Fellow in the Life Sciences
2006 Awarded title of Distinguished Teaching Professor at UC-Riverside
2007 HHMI/National Academy of Sciences Teaching Mentor in the Life Sciences
2009-present Chair, Board of Directors, Biological Sciences Curriculum Study
2012-present HHMI/NIH/NSF Vision & Change Fellow
2012-present Executive Committee and Council, AAAS - Pacific Division
2013-2015 President, American Association for the Advancement of Science - Pacific Division
2014 Visiting Professor, Department of Molecular Biology and Genetics, Cornell University
2014-present Howard H Hays Jr. Endowed Chair, University Honors, UC-Riverside

EXTRAMURAL GRANT AND AWARD HISTORY

Glycosylation events during spermatogenesis in the mouse, R.A. Cardullo, Principal Investigator
National Institutes of Health, National Research Service Award, April, 1988 - May 1990

James Shannon Award, R.A. Cardullo, Principal Investigator
National Institutes of Health (NICHD), R55 HD27244, \$100,000, October, 1991 - July, 1992

Receptor dynamics during fertilization in the mouse, R.A. Cardullo, Principal Investigator
National Institutes of Health (NICHD), RO1 HD27244, \$527,834, August, 1992 - present

Development of an optical microscope for the simultaneous measurement of ligand-receptor dynamics and signal transduction pathway in living cells, R.A. Cardullo, Principal Investigator
The Whitaker Foundation, Biomedical Research Grant, \$234,388, June, 1992 - May 1995

Biophysical and biochemical characterization of sperm-egg binding, R.A. Cardullo, Sponsor for Dr. Catherine Thaler, The Lalor Foundation, Postdoctoral Fellowship, \$20,000, July 1, 1994 - June 30, 1995.

Carbohydrate determinants during fertilization. R.A. Cardullo, Principal Investigator
National Institutes of Health (NICHD), RO3 HD36234, \$147,321, March, 1998 - February, 1999.

Graduate Assistance in Areas of National Need, R.A. Cardullo, Program Director
The Department of Education, Biology Training Grant, \$721,321, October, 1998 - September, 2001.

Mathematical Achievement through Collaboration with Teachers and Students, R.A. Cardullo, Principal Investigator, National Science Foundation, \$5,200,000, November, 2002 - October, 2007.

Graduate Assistance in Areas of National Need, R.A. Cardullo, Program Director
The Department of Education, Biology Training Grant, \$809,000, October, 2003 - September, 2008.

Mathematical Achievement through Collaboration with Teachers and Students, R.A. Cardullo, Principal Investigator, National Science Foundation, \$199,000, November 2007 – October 2009.

Partners in Outstanding Science Education (POSE), R.A. Cardullo, Principal Investigator, California Math Science Partnerships, U.S. Department of Education, \$2,500,000, July 2009 - June 2012.

California Alliance for Minority Participation in STEM Fields, R.A. Cardullo, Principal Investigator, National Science Foundation, \$450,000, July 2011 – June 2016.

LSAMP Bridge to the Doctorate Training Grant, R.A. Cardullo, Principal Investigator, National Science Foundation, \$987,000, July 2011 – June 2014.

California Science Project, R.A. Cardullo, Principal Investigator, University of California, \$443,961, July 2011 – June 2014.

Enhancing STEM Transfer and Success Through the STEM Pathways Program, R.A. Cardullo, co-Principal Investigator, U.S. Department of Education, \$3,800,000, October 2011 – September 2016.

Phenotypic Responses of the Lung to Hypoxia in Deer Mice Living at High Altitude, R.A. Cardullo, Principal Investigator, National Science Foundation, \$480,082, January 2015 –December 2017.

Molecular Dissection of Sperm Motility: MAPK Targets and Control of Waveform, R.A. Cardullo, co-Principal Investigator, National Institutes of Health, \$1,480,949, January 2017 – December 2020, Pending.

PUBLICATIONS

Cardullo, R.A., and Cone, R.A. 1986. Mechanical immobilization of rat sperm does not change their oxygen consumption rate. *Biol. Reprod.* 34:820-830.

Djakiew, D., and **Cardullo, R.A.** 1986. Lower temperature of the cauda epididymis facilitates the storage of sperm by enhancing oxygen availability. *Gamete Res.* 15:237-245.

Cardullo, R.A., Armant, D.R., and Millette, C.F. 1987. Quantitation of macromolecular binding using size exclusion filters: Application to a fucosyltransferase assay. *Anal. Biochem.* 161:57-63.

Cardullo, R.A., Agrawal, S., Flores, C., Zamecnik, P.C., and Wolf, D.E. 1988. Detection of nucleic acid hybridization using nonradiative fluorescence resonance energy transfer. *Proc. Natl. Acad. Sci. USA* 85:8790-8794.

Cardullo, R.A., Armant, D.R., and Millette, C.F. 1988. Characterization of fucosyltransferase activity during mouse spermatogenesis: Evidence for a cell surface fucosyltransferase. *Biochemistry.* 28:1611-1617.

Ram, P.A., **Cardullo, R.A.**, and Millette, C.F. 1988. Expression and topographical localization of cell surface fucosyltransferase activity during epididymal sperm maturation in the mouse. *Gamete Res.* 22:321-332.

- Millette, C.F., **Cardullo, R.A.**, Armant, D.R., and Gerton, G.L. 1988. Fucosylation events during mammalian spermatogenesis. In Cell Biology of the Testis and Epididymis (M.-C. Orgebin-Crist and B.J. Danzo, eds.). *Annals of the New York Academy of Sciences*, 513:58-73.
- Baltz, J.M. and **Cardullo, R.A.** 1989. On the number and rate of formation of sperm zona bonds in the mouse. *Gamete Res.* 24:1-8.
- Cardullo, R.A.**, Agrawal, S., Bocian, K.M., McKinnon, C.A., and Wolf, D.E. 1990. Synthesis, purification, and characterization of 2,4,6-Trinitrophenyl-UDP-galactose: A fluorescent substrate for galactosyltransferase. *Anal. Biochem.* 188:305-309.
- Wolf, D.E., Mungovan, R.M., and **Cardullo, R.A.** 1990. Using quantitative microscopy to study mammalian sperm. In: Optical Microscopy for Biology (B. Herman and K. Jacobsen, eds.), Wiley-Liss, New York, pp. 373-382.
- Cardullo, R.A.**, and Baltz, J.M. 1991. Metabolic regulation in mammalian sperm: mitochondrial volume determines sperm length and flagellar beat frequency. *Cell Motil. Cytoskel.* 19:180-188.
- Cardullo, R.A.**, and Wolf, D.E. 1991. The sperm plasma membrane: A little more than mosaic, a little less than fluid. In: Ciliary and Flagellar Membranes (R. Bloodgood, ed.). Plenum Press, New York, pp. 305-336.
- Cardullo, R.A.**, Mungovan, R.M., and Wolf, D.E. 1991. Imaging membrane organization and dynamics. In: Biophysical and Biochemical Aspects of Fluorescence Spectroscopy (G. Dewey, ed.). Plenum Press, New York, pp. 231-260.
- Cardullo, R.A.** 1992. Nonradiative fluorescence resonance energy transfer. In: Nonradiative detection and labeling of macromolecules (T. Kessler, ed.) Springer-Verlag, pp. 414-423.
- Cardullo, R.A.** and Wolf, D.E. 1992. Biophysical determinants of cell surface events leading to sperm-zona adhesion and induction of the acrosome reaction. In: Comparative Spermatology (B. Baccetti, ed.). Raven Press, pp. 547-553.
- Wolf, D.E., and **Cardullo, R.A.** 1992. Physical properties of the mammalian sperm plasma membrane. In: Comparative Spermatology (B. Baccetti, ed.). Raven Press, pp. 559-604.
- Cardullo, R.A.**, and Florman, H.M. 1993. Strategies and methods for evaluating acrosome reactions. *Meth. Enzymol.* 225:136-153.
- Cardullo, R.A.**, Herrick, S.B., Peterson, M.J., and Dangott, L.J. 1994. Speract receptors are localized on sea urchin flagella using a fluorescent peptide analog. *Dev. Biol.* 162:600-607.
- Thaler, C.D., and **Cardullo, R.A.** 1995. Biochemical characterization of a glycosylphosphatidylinositol-linked hyaluronidase on mouse sperm. *Biochemistry.* 34:7788-7795.
- Cardullo, R.A.**, and Wolf, D.E. 1995. Distribution and dynamics of mouse sperm surface galactosyltransferase: Implications for mammalian fertilization. *Biochemistry.* 34:10027-10035.

- Cardullo, R.A.**, and Thaler, C.D. 1995. The mammalian sperm surface: molecular and cellular aspects. In: Cambridge Reviews in Human Reproduction: The Spermatozoon (J. Gruzinkas, ed.). Cambridge Press, London, pp. 20-44.
- Thaler, C.D., and **Cardullo, R.A.** 1996. The initial interaction between mouse sperm and the zona pellucida is a complex binding event. *J. Biol. Chem.*, 45:535-546.
- Thaler, C.D., and **Cardullo, R.A.** 1996. Defining oligosaccharide specificity for initial sperm-zona pellucida adhesion in the mouse. *Molec. Reprod. Devel.*, 45:535-546.
- Arnoult, C., **Cardullo, R.A.**, Lemos, J.R., and Florman, H.M. 1996. Activation of mouse sperm T-type Ca^{2+} channels by adhesion to the zona pellucida. *Proc. Natl. Acad. Sci. USA*, 93:13004-13009.
- Cardullo, R.A.** and Alm, E.J. 1998. Introduction to Image Processing. *Meth. Cell Biol.*, 56:91-115.
- Cardullo, R.A.**, and Dandala, S.R.. 1999. Correcting for artifacts in complex aqueous solutions when using the pH-sensitive dye 2',7'-bis-(2-carboxyethyl)-5-(and-6)carboxyethylfluorescein. *Anal. Biochem.*, 266, 351-356.
- Cardullo, R.A.**, and Thaler, C.D. 1999. The Mammalian Egg's Extracellular Matrix, In: Fertilization (D. Garbers and D. Hardy, eds), Academic Press, pp. 119-152.
- Cardullo, R.A.** 1999. Characteristics of the sperm-zona interaction: Identifying key issues for determining receptors for ZP3, In: The male gamete: basic biology and clinical applications (C. Gagnon, ed.), Cache River Press, pp. 237-247.
- Hammond, K.A., Chappell, M.A., **Cardullo, R.A.**, Lin, R., and Johnsen, T.S. 2000. The mechanistic basis of aerobic performance variation in red junglefowl. *J. Exp. Biol.*, 203:2053-2064.
- Kingan, T.G., **Cardullo, R.A.**, and Adams, M.E. 2001. Signal transduction in eclosion hormone-induced secretion of ecdysis-triggering hormone. *J. Biol. Chem.* 276:25136-25142.
- Hutt, D.M., **Cardullo, R.A.**, Baltz, J.M., and Ngsee, J.K. 2002. Synaptotagmin VIII is localized to the mouse sperm head and may function in acrosomal exocytosis. *Biol. Reprod.* 66:50-56.
- Baker, S.S., **Cardullo, R.A.**, and Thaler, C.D. 2002. Sonication of mouse sperm membranes reveals distinct protein domains. *Biol. Reprod.*, 66:57-64.
- Thaler, C.D., and **Cardullo, R.A.** 2002. Distinct membrane fractions from mouse sperm bind different zona pellucida glycoproteins. *Biol. Reprod.*, 66(1):65-69.
- Cardullo, R.A.** 2003. Fundamentals of image processing in light microscopy. *Meth. Cell Biol.*, 72:217 – 242.
- Cardullo, R.A.**, and Parpura, V. 2003. Fluorescence resonance energy transfer microscopy: theory and instrumentation. *Meth. Cell Biol.*, 72:415-430.
- Herrick, S.B., Schweissinger, D.L., Kim, S.W., Bayan, K.R., Mann, S., and **Cardullo, R.A.** 2005. The acrosomal vesicle of mouse sperm is a calcium store. *J. Cell Physiol.* 202:663-671.

- Blackledge, T.A., **Cardullo, R.A.**, and Hayashi, C. Y. 2005. Polarized light microscopy, variability in spider silk diameters, and the mechanical characterization of spider silk. *Invertebrate Biol.* 124: 165-173.
- Hammond, K.A., **Cardullo, R.A.**, Ghalamboor, C. K. 2006. The role of developmental plasticity in comparative physiology: mechanism and process, In: Comparative Developmental Physiology. Contributions, Tools, and Trends (S. J. Warburton, W. W. Burggren, B. Pelster, C. L. Reiber, and J. Spicer, eds.), Oxford University Press, New York, pp. 58–70.
- Chappell, M.A., Hammond, K.A., **Cardullo, R.A.**, Russell, G.A., Rezende, E. L., and Miller, C. 2007. Deer mouse aerobic performance across altitudes: effects of developmental history and temperature acclimation. *Physiol. Bioch. Zool.* 80:652-662.
- Cardullo, R.A.**, and Hinchcliffe, E.H. 2007. Digital manipulation of brightfield and fluorescence images: noise reduction, contrast enhancement, and feature extraction. *Meth. Cell Biol.* 81:285-314.
- Cardullo, R.A.** 2007. Theoretical principles and practical considerations for fluorescence resonance energy transfer microscopy. *Meth. Cell Biol.* 81:479-494.
- Bryant, M.J., Hammond, K.A., Bocian, K.M., Rettig, M.F., Miller, C.A., and **Cardullo, R.A.** 2008. Assessment. School performance will fail to meet legislated benchmarks. *Science.* 26:1782-1782.
- Fast, L.A., Lewis, J.A., Bryant, M.J., Bocian, K.M., Rettig, M.A., **Cardullo, R.A.**, and Hammond, K.A. 2010. Does math self-efficacy mediate the effect of the perceived classroom environment on standardized math test performance? *J. Educ. Psych.* 102:729-740.
- Fraire-Zamora and **Cardullo, R.A.** 2010. The physiological acquisition of amoeboid mobility in nematode sperm. Is the tail the only thing the sperm lost? *Molec. Reprod. Dev.* 77:739-750.
- Miyata, H., Noda, N., Fairbairn, D.J., Oldenbourg, R., **Cardullo, R.A.** 2011. Assembly of the fluorescent acrosomal matrix and its fate in fertilization in the water strider, *Aquarius remigis*. *J. Cellular Physiol.* 226:999-1006.
- Fraire-Zamora, J.J., Broitman-Maduro, G., Maduro, M.F., **Cardullo, R.A.** 2011. Evidence for phosphorylation in the MSP cytoskeletal filaments of amoeboid spermatozoa. *Int. J. Biochem. and Molec. Biol.* 2:263-273.
- Lewis, J.L., Ream, R.K., Bocian, K.M., **Cardullo, R.A.**, Hammond, K.A., Fast, L.A. 2012. Con Cariño: Teacher caring, math self-efficacy and math achievement among Hispanic English learners. *Teachers College Record.* 114(7):37-42.
- Miyata, H., Thaler, C.D., Haimo, L.T., **Cardullo, R.A.** 2012. Protease activation and the signal transduction pathway regulating motility in sperm from the water strider *Aquarius remigis*. *Cytoskeleton*, 69:207-220.
- Fraire-Zamore, J.J., Tran, T., and **Cardullo, R.A.** 2012. Cholesterol-enriched microdomains regulate pseudopod extension in the MSP-based cytoskeleton of amoeboid sperm. *Biochem. Biophys. Res. Comm.* 427:478-484.
- Thaler, C.D., Miyata, H., Haimo, L.T., and **Cardullo, R.A.** 2013. Waveform generation is controlled by

phosphorylation and swimming direction is controlled by Ca^{2+} in sperm from the mosquito *Culex quinquefasciatus*. *Biol. Reprod.* 89:135: p.1-11.

Cardullo, R.A., and Hinchcliffe, E.H. 2013. Post-processing for statistical image analysis in light microscopy. *Meth. Cell Biol.* 114:285-315.

Ott, G., Shirkey, N., Haimo, L.T., **Cardullo, R.A.**, and Thaler, C.D. 2015. Germ-cell hub position in a heptopteran testis correlates with the sequence and location of spermatogenesis and production of elaborate sperm bundles. *Molec. Reprod. Dev.*, 82:295-304.

De Los Santos, C., Chang, W-C., Mycek, M-A, and **Cardullo, R.A.** 2015. FRAP, FLIM, and FRET: Detection and analysis of cellular dynamics on a molecular scale using fluorescence microscopy. *Molec. Reprod. Dev* 2:587-604.

Cardullo, R.A., and Wong, J. 2015. Beyond the limits of sight, *Molec. Reprod. Dev.*, 82:i-iv.

Stephens, K., Thaler, C.D., and **Cardullo, R.A.** 2015. Glycosidase characterization on the plasma membrane of *Aquarius remigis* *Insect Bioch. Mol. Biol.* 60:78-85.

PATENTS

Agrawal, S., **Cardullo, R.A.**, and Wolf, D.E., 1992, 5'[2'(3')-O-(2,4,6-Trinitrophenyl)pyrimidine nucleoside]diphosphate 1-glycosides, U.S. Patent #5,109,126.

Chick, W.L., Wolf, D.E., and **Cardullo, R.A.**, 1994. Method and device for detecting and quantifying glucose in body fluids, U.S. Patent #5,342,789.

Chick, W.L., Wolf, D.E., and **Cardullo, R.A.**, 2000. Method and device for detecting and quantifying glucose in body fluids, U.S. Patent # 6,040,194

TEACHING

Undergraduate

Biochemistry 100 (Introductory Biochemistry), 2015

Biology 2 (Cellular Biology for non-majors), 2005, 2008-2010

Biology 5A (Introduction to Cell and Molecular Biology), 1992-2001, 2004, 2006, 2007, 2009-2012

Biology 5B (Introduction to Organismal Biology), 2003-2007, 2010-2013

Biology 110 (Biology of Human Problems), 2001, 2003, 2004

Biology 111 (Cell Biology), 1997-1999

Biology 114 (Advanced Cell Biology), 2000, 2001, 2002, 2004, 2007, 2010

Biology 171 (Human Physiology), 2008, 2009, 2011, 2012, 2013

HNPG 1A (Transition of an Honors Student), 2014

HNPG 15 (Honors Ignition Seminar on the Nature of Discovery and Creativity), 2012, 2013

HNPG 15 (Honors Ignition Seminar on Drivers of Change), 2014

HNPG 15 (Honors Ignition Seminar on the Anthropocene)

HNPG 150 (Introduction to Research), 2012, 2013, 2015

HNPG 151 (Honors Research Seminar), 2013, 2015

NASC 93 (Freshman Advising Seminar), 2010, 2011

Graduate

Biology 200A (Graduate Course in Cellular Biology), 1995

Biology 203 (Cellular Biophysics), 1993, 1994, 1996, 1995, 1998, 2004

Biology 303 – (Philosophy and Pedagogy of Teaching Undergraduate Life Science) 2010, 2012

Various topical graduate seminars, approximately 1 per year

Postgraduate

Analytical and Quantitative Light Microscopy at MBL (Woods Hole) , 1990 to 2010.

HHMI/National Academy of Life Sciences Summer Institute (Madison, WI), 2007

CURRENT GRADUATE STUDENTS

Carla del los Santos, Ph.D. Candidate (Bioengineering)

Kimberly Stephens, Ph.D. Candidate (Entomology)

Nathan Robinett, Ph.D. Candidate (Evolutionary Biology, joint doctoral program San Diego State University)

Nhi Tran, M.S. Candidate (Biochemistry)

COMPLETED GRADUATE AND POSTGRADUATE STUDENT TRAINING**Graduate Students:**

Eric Alm, M.S (Biology)

Cathrine Castillo, M.S. (Cell, Molecular, and Developmental Biology)

Qin Chen, M.S. (Biology)

Alejandro Cortez, M.S. (Biology)

Juan Fraire-Zamora, Ph.D. (Evolution, Ecology, and Organismal Biology)

Scott Herrick, Ph.D. (Biology)

Ruei- Shuian Lin, Ph.D. (Biology)

Haruhiko Miyata, Ph.D. (Evolution, Ecology, and Organismal Biology)

Joya Paul, M.S. (Biology)

In addition I have served on 63 Ph.D. qualifying examination committees, 36 Ph.D. student advisory committees, 19 Ph.D. dissertation committees, and 14 M.S. thesis committees in various graduate programs.

Postdoctoral Fellows:

Lisa A. Fast, Ph.D.

Juan Fraire-Zamora, Ph.D.

Catherine D. Thaler, Ph.D.

PROFESSIONAL SERVICE

Member, Organizing Committee for International Congress on Spermatology, 1998

Vice Chair, Gordon Research Conference on Fertilization and the Activation of Development, 2003

Chair, Gordon Research Conference on Fertilization and the Activation of Development, 2005

Associate Editor, *Molecular Reproduction and Development*, 2009 – present

Editor, *International Journal of Biochemistry and Molecular Biology*, 2010 – present

Editor, *American Journal of Molecular Biology*, 2011-present

Teaching Fellows Selection Committee, Knowles Scientific Teaching Foundation, 2010, 2012, 2013, 2014, 2015

Scientific Society Membership

American Association for the Advancement of Science, American Society for Cell Biology, Biophysical Society, Sigma Xi, Society of General Physiologists, Society for the Study of Reproduction.

Manuscript Reviews

Biochemical Journal, Biochemistry, Biology of Reproduction, Biophysical Journal, Contraception, Development, Developmental Biology, Journal of the American Optical Society, Journal of Andrology, Journal of Biological Chemistry, Journal of Cell Biology, Journal of Cell Science, Journal of Cellular Physiology, Molecular Reproduction and Development, Nature, PLoS One, PNAS USA, Science.

Grant Reviews

Reviewer, Jeffress Research Grant (1993)

Outside Reviewer, NSF (1994 - 2011)

Reviewer, Lalor Foundation (1992, 1994, 1995, 1997, 2004, 2005, 2006)

Reviewer, South Plains Foundation (1996)

Panel Member, Cellular and Molecular Biology, NASA Division Wide Research Grants (1995, 1996, 1997)

Panel Member, Shared Instrumentation Grants for Confocal Microscopy, NIH (1996)

Site Visit Member, Program Project Grant in Reproductive Biology at Stanford, NIH (1996)

Panel Member, Biomedical Engineering, NSF (2002, 2003, 2004)

Panel Member, Cellular and Molecular Imaging Study Section, NIH (2003)

Panel Member, Novel Contraceptive Methods, NIH (2003)

Site Visit Member, Comprehensive Math Science Partnerships, NSF (2003)

Panel Member, Targeted Math Science Partnerships, NSF (2003, 2004)

Panel Member, Science Education Partnership Awards, NIH (2005, 2006, 2007, 2009)

Panel Member, Wallenberg Foundation Global Learning Network (2005, 2006, 2007, 2008, 2009)

Panel Member, Cellular, Molecular and Integrative Reproduction Study Section, NIH (2011, 2013, 2016)

Panel Member, Louis Stokes Alliance for Minority Participation Centers, NSF (2011)

Panel Member, R15 Special Emphasis Panel, NIH (2013)

Panel Member, IUSE, NSF (2014)

Invited Talks

1985 Department of Anatomy and Cellular Biology, Harvard Medical School

1986 Department of Biophysics, Johns Hopkins University

Boston Area Cell Motility Club, Harvard University

1987 Department of Biology, Boston University

Laboratory of Human Reproduction and Reproductive Biology, Harvard Medical School

Beth Israel Hospital, Boston

Department of Anatomy and Cell Biology, Duke University

Department of Anatomy, Yale University

1989 American Society of Cell Biology, Subgroup meeting on *Ligand -induced exocytosis*

1990 Department of Physiology, The University of Texas Southwestern at Dallas

VI International Congress on Spermatology, Siena, Italy

1991 Department of Biochemistry, Georgetown University

Department of Cell and Developmental Biology, Harvard University

Department of Biology, The University of California - Riverside

Division of Reproductive Biology, The University of Pennsylvania Medical School

Gordon Conference on *Fertilization and the Activation of Development*

1992 Loeb Biomedical Research Institute, Ottawa, Canada

Boston Biomedical Research Institute

1993 Department of Biophysics and the Beckman Laser Institute, Univ. of California - Irvine

- Symposium, annual meeting of the Society for the Study of Reproduction, Fort Collins
Genetics Program, University of California - Riverside
- 1994 Department of Biology, Pomona College
Department of Chemistry, University of California - Riverside
Department of Cell and Molecular Biology, Loma Linda University Medical School
- 1995 Department of Cellular Biology, The University of California - Davis
Department of Cell and Molecular Biology, Loma Linda Medical Center
Gordon Conference on *Fertilization and the Activation of Development*
Department of Biology, California State University, Fullerton
- 1996 Department of Cellular and Developmental Biology, The University of California - Santa Barbara
Department of Biochemistry, The University of California - Riverside
- 1998 Department of Physics, The University of California - Riverside
NSF Conference on Computing in Life Sciences, Claremont, CA
Department of Anatomy and Cell Biology, Tufts University Medical School, Boston, MA
VIII International Congress on Spermatology, Montreal, Canada
Department of Biomedical Sciences, The University of California-Riverside
- 1999 Departments of Biology and Physics, Occidental College
- 2000 Department of Biochemistry, Texas Tech University, Lubbock
- 2002 Department of Molecular Biology and Biochemistry, Johns Hopkins University
Department of Veterinary and Animal Sciences and Biology, University of Massachusetts
Department of Biology, University of California, Riverside
- 2003 Gordon Conference on *Fertilization and Activation of Development*
“How People Learn for developing courses and curricula” National Research Council,
Washington, D.C.
- 2004 Department of Biological Sciences, Notre Dame University
- 2005 Gordon Research Conference on *Fertilization and Activation of Development*
- 2007 Center for Conservation and Research for Endangered Species, San Diego
- 2008 Keynote speaker, Math Science Partnership Conference (NSF), Washington, D.C.
- 2009 Annual Meeting for the American Society for Cell Biology, San Diego, CA
National Evolutionary Synthesis Center, Durham, NC
- 2010 College of Science and Mathematics, Wright State University, Dayton, OH
Cellular Dynamics Program, Marine Biological Laboratory, Woods Hole, MA
- 2011 Gordon Conference on *Fertilization and Activation of Development*
Beckman Center, City of Hope, Duarte, CA
International Relations, California State University, Fullerton, CA
Molecular Genetics Graduate Program, Loma Linda University
- 2012 American Society for Andrology Annual Meeting, Tucson, CA
Department of Obstetrics and Gynecology, University of Pennsylvania, Philadelphia, PA
- 2013 Department of Biology, California Lutheran University, Thousand Oaks, CA
Department of Veterinary and Animal Sciences, University of Massachusetts, Amherst, MA
- 2014 Department of Cell Biology and Biochemistry, Texas Tech University, Lubbock, TX
Department of Anatomy and Cell Biology, Kansas University Medical Center, Kansas City, KS
UCR Citizens University Committee, Riverside, CA
Department of Molecular Biology and Genetics, Cornell University, Ithaca, NY
Department of Biological Sciences and the RNA Institute, University of Albany, NY

DEPARTMENTAL COMMITTEES

Member, Electron Microscopy Committee, 1992 – 1994

Co-chair, Seminar Committee, Winter, 1993; Fall, 1993; Fall, 1994; Fall 1995, Fall, 1997, Fall, 1998
Chair, Computer Committee, 1991 – 2002
Member, Graduate Advisory Committee, 1993 – present
Editor, Graduate Brochure, 1994 – 1995
Graduate Poster in Cell and Molecular Biology, 1995
Faculty Advisor, Cell and Molecular Ph.D. Qualifying Examination, 1995
Graduate Advisor, Department of Biology (Recruitment), 1996 – 1999
Chair, Space Committee, 1998-2003
Graduate Advisor, Department of Biology (Continuing Students), 2001 – 2003
Chair, Faculty Search Committee in Developmental Biology, 2001
Chair, Department of Biology, 2004 – 2009
Editor, Biology Department Newsletter, 2006 - 2010
Faculty Advisor, Physiology Ph.D. Written Qualifying Examination, 2007
Chair, Development committee, 2008 – present
Chair, EEOB Graduate Program Teaching Committee, 2010 – 2013
Chair, Biology Curriculum Committee, 2014 - present

CAMPUS COMMITTEES

Member, Academic Computer Committee, 1992 – 1994
Chair, Academic Computer Committee, 1995 – 1996
Member, Institute for Molecular Biomedical Research Planning Committee, 1993 – 1995
Member, Strategic Planning Subcommittee for College of Natural and Agricultural Sciences, 1994
Member, Scholarship Committee, 1996 - 1999
President, Riverside Chapter of Sigma Xi, 1998 - 2000
Member, Graduate Program Reorganization Committee, 1996 - 1997
Member, Academic Senate Educational Policy Committee, 1997 - 2000
Vice Chair, Academic Senate Educational Policy Committee, 1998 - 2000
Member, Distinguished Teaching Committee, 2002 – 2005
Member, Life Science Committee of Chairs, 2004 - 2009
Member, Committee on Committees, 2006 – 2009
Member, Academy of Distinguished Teachers, 2006 – 2011
Co-Chair, Search Committee for Endowed Chair in Innovative Teaching Across Disciplines, 2007
Member, General Education Planning Committee, 2007
Member, School of Medicine Curriculum Planning Committee, 2007
Member, Academic Senate General Education Committee, 2008 - 2011
Chair, Academic Senate Committee on Committees, 2008 - 2009
CNAS Faculty Representative, Campus Budget Advisory Committee, 2009 - 2010
Member, University Strategic Planning Committee on Community Engagement, 2009 – 2010
Member, Academic Senate Committee on Academic Personnel, 2014
Member, Academic Senate Committee on International Education, 2014 -

UNIVERSITY COMMITTEES

Representative, Information Technology and Telecommunication Policy, 1995 - 1996
Member, Teaching and Learning Technologies and the Future of the University, 1997
Member, UC System-wide Committee on Committees, 2008 - 2009

PUBLIC SERVICE AND OUTREACH

Provider, School University Partnership Teacher In-service, Alvord Unified School District, 1997-2001
Member, Board of Directors, Inland Empire Chapter Juvenile Diabetes Research Foundation, 1998 - 2001

Coordinator, Riverside Unified School District Science Fair, 1999 - 2002

Judge, Riverside Unified School District Science Fair, 1995 - present

Coordinator, Weekly Summer Science Institute for Teachers and Students at UCR, 1999 - 2008 (Project ALIAS)

Judge, Alvord Unified School District Science Fair, 1998 - 2001

Judge, Jurupa Unified School District Science Fair, 2002 - 2007

Judge, California State Science Fair (Biochemistry), 2004, 2006

Judge, California State Science Fair (Zoology), 2005

Coordinator, 2-week Summer Science Institute for Teachers and Students in Ontario-Montclair Unified School District (Project POSE), 2009 – 2012

Coordinator, 2-week Summer Science Institute for Teachers in Riverside County (Project SCAN), 2011-2014

Chia-en A. Chang

April, 2016

Department of Chemistry,
University of California, Riverside
Phone: 951-827-7263
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<http://www.chem.ucr.edu/chang>

Research Interests

- Non-covalent binding kinetics and thermodynamics
- Modeling and design of multi-enzyme complexes for enhanced catalysis
- Molecular recognition and protein dynamics
- Physical chemistry and statistics mechanism of biomolecules
- Computer-aided drug and peptide inhibitor design

Employment

- Associate Professor, Department of Chemistry, University of California, Riverside, 7/2014 – present.
- Assistant Professor, Department of Chemistry, University of California, Riverside, 2008-2014.

Education and Training

- Postdoctoral research, Department of Chemistry and Biochemistry, University of California, San Diego and HHMI. Advisor: Dr. J. Andrew McCammon, 2/2005-11/2007.
- Research Associate, University of Maryland Biotechnology Institute, Rockville, MD, Advisor: Dr. Michael Gilson, 7/2003 –11/2004.
- Graduate School, University of Maryland, College Park, Ph.D. Physical Chemistry, Dissertation title: *Empirical Ligand Discovery and Novel Modeling Techniques*. Advisor: Dr. Michael Gilson. 9/1998-6/2003
- Graduate School, Ohio State University, Columbus, OH, M.S. Civil and Environmental Engineering, 9/1995-6/1997
- Undergraduate, National Taiwan University, Taiwan, B.S. Plant Biology, 9/1991-6/1995.

Research Recognition and Honors

- Career Award, National Science Foundation, 2014
- Faculty Development Award, University of California, 2012
- Omnibus Travel Award, Academic Senate Research, University of California, 2012, 2014
- Robert T Poe Faculty Development Award, 2009
- HP Outstanding Junior Faculty Award, American Chemical Society, 2009

- Regents' Faculty Fellowship, University of California, 2008
- Outstanding Graduate Student, University of Maryland Biotechnology Institute, 2003.
- College Travel Award, University of Maryland at College Park, 2002.

Extramural Funding

- National Science Foundation, *CAREER: Development and Application of Multi-scale Modeling for Biomolecular Association*, 2014-2019
- National Institutes of Health R01: *Computational and theoretical characterization of ligand-protein binding mechanism*. 2014-2019.
- National Institutes of Health R01 Supplement Equipment Fund: *Computational and theoretical characterization of ligand-protein binding mechanism*. 2015-2016.
- National Institutes of Health R01 (co-PI; L. Mueller PI): *Enhancing Chemically-rich structure and dynamics in the active site of tryptophan synthase*, 2011-2016.
- Expired: National Science Foundation, *Modeling and Theory of Biomolecular Association*, 2009-2013.

Service (selected)

- Member, NSF, NSF BIO/MCB Computational Biochemistry, 2016
- Member, NSF, NSF BIO/MCB Molecular and Cellular Biosciences, 2015
- Member, National Academies of Sciences, Study of Molecular Dynamics 2015
- Member, NIH NIAID Special Emphasis Panel ZA1 Sm-MJ-2 R21/R33 study section, 2013
- Reviewer for NSF, 2009-present, ad hoc.
- Reviewer for ACS petroleum fund, 2011-2012
- Reviewer for Cottrell college science award, 2012
- Oversight Board committee, University of California Shared Research Technology, 2009-2012

Service as referee for the following journals (selected):

Applied Biochemistry and Biotechnology, BBA - Proteins and Proteomics, Biochemistry, Biochemical and Biophysical Research Communications, Bioinformatics, Bioorganic & Medicinal Chemistry Letters, Biophysical J., Biopolymers, BMC Biophysics, Catalysts, Cell reports, Chemical Biology & Drug Design, Current Topics in Medicinal Chemistry, European Biophysics Journal, International Journal of Molecular Sciences, J. of Biological Physics, J. of Chemical Information and Modeling, J. of Chemical Theory and Computation, J. of Computer Aided Molecular Design, J. of Computational Chemistry, J. of Chemical Physics, J. of Molecular Biology, J. of Molecular Graphics and Modelling, J. of Molecular Recognition, J. of Natural Products, J. of Physical Chemistry, J. of Physical Chemistry Letters, J. of the American Chemical Society, Langmuir, ACS Medicinal Chemistry Letter, Molecular Simulation, Physical biology, PLoS Computational Biology, PLoS One, PNAS, Proteins, Protein Sciences, Science Advances.

Visiting scholars in the group

- Wei Chen, Visiting assistant professor (1/2015 – present)

Students and postdoctoral researchers advised

Current group members:

- Chris Roberts, Postdoctoral fellow (1/2015 – present)
- Zhiye Tang, Graduate student (9/2011 – present)
- Wanli You, Graduate student (9/2012 – present)
- Mary Raymundo, Graduate student (9/2015 – present)
- Yuliana Bosken, Graduate student (9/2015 – present)
- Viktoriia Liu, Graduate student (7/2016 – present)
- Tim Cholko, Graduate student (8/2016 – present)
- Jennifer Clark, undergraduate (9/2014 – present)

Former group members:

- Safieh Ladani, Postdoctoral fellow (4/2015 – 4/2016)
- Xuqing Liu, Master student (9/2014 – 4/2016)
- Steven Ahrendt, Graduate student (9/2010 – 6/2015, UC Berkeley)
- Chris Roberts, Graduate student (6/2010 – 12/2014, UCR)
- Mindy Huang, Graduate student (9/2009 – 8/2014, UCSD)
- Rizi Ai, Graduate student (1/2008 – 8/2012, UCSD)
- Myungshim Kang, Postdoc (9/2009 – 2/2013, CUNY)
- Lawrence Pointer, undergraduate (1/2013 – 6/2013)
- Sean Jayasekera, undergraduate (9/2012 – 6/2013)
- Jaspreet Kaur, undergraduate (Summer 2011)
- Sepideh Yaghmaeim, Postdoc (2/2011– 12/2011, community college lecturer)
- Qaiser Fatmi, Postdoc (6/2008 – 10/2010, Quaid-e-Azam University in Pakistan)
- Alfonso Lam, Postdoc (7/2008 – 6/2009, subsequently, UC, Irvine)
- Kirmanj Atrushi, undergraduate (Summer 2008)
- Sunny Lee, undergraduate (6/2009 – 6/2011, school of pharmacy, U. of the Pacific)
- Kevin Kim, undergraduate (Summer 2010)
- Wai Thant, undergraduate (6/2008 – 6/2011)
- Shivali Gowda, Georgette Sabbah and Ashraf Sabbah, High school students (summer 2013)
- Apoorva Panse, high school student (6/2012 – 5/2014, UCLA)
- Alejandro Cabian, undergraduate (6/2013 – 9/2014, high school teacher)

Invited Talks (recent and selected)

- *Modeling molecular recognition: from host-guest binding kinetics and thermodynamics to large enzyme nanostructure design*, Institut für Physik, Humboldt Universität zu Berlin, 6/2016.
- *Understand non-covalent binding: enthalpy, entropy, thermodynamics and kinetics*, Centre of New Technologies, University of Warsaw, 6/2016.
- *Modeling ligand-protein binding kinetics: the continuous and dynamical processes in*

ligand association/dissociation, 1st SoCal TheoChem, San Diego, 6/2016.

- *Insights from Drug-Protein Binding Free Energy Calculations: Entropy, Enthalpy and Inhibitor Design*, School of Pharmacy, University of Maryland, Baltimore, 5/2016.
- *Computer-aided Inhibitor Discovery and Experimental Design*, Harbor UCAL and LABioMed, Torrance, 4/2016.
- *Modeling ligand-protein binding kinetics: the continuous and dynamical processes in ligand association/dissociation*. ACS Spring National Meeting, San Diego, 3/2016.
- *Modeling molecular recognition: multi-scale simulations for ligand-receptor binding processes*. Seminar, Sichuan University, Chengdu, China, 10/2015.
- *Modeling of enhanced catalysis in multienzyme nanostructures: effect of molecular scaffolds, spatial organization, and concentration*. Multiple faces of Biomolecular Electrostatics Workshop, Columbus, OH, 10/2015.
- *Simulations of Biomolecular Systems: from small ligand binding affinity prediction to large enzyme nanostructure design*. Seminar, School of Chemistry, University of Edinburgh, UK, 6/2015.
- *Simulations of Biomolecular Systems: Protein Dynamics, Docking, and Inhibitor Discovery*. CEPCEB Symposium, UCR, 12/2014.
- *Insights from Free Energy Calculations: DFG-in and -out Conformational Equilibrium and Driving Forces*, ACS Fall National Meeting, 8/2014.
- *Effect of Spatial Organization and Molecular scaffoldings on the Diffusional Activity of substrates in Enzyme Nanostructures*. AAAS Regional Meeting, Riverside, CA, 6/2014.
- *Binding kinetics Studies for Cryptophane Host-Guest and Ligand-Protein Complexes*, CECAM, Genoa, Italy, 6/2014.
- *Free Energy Calculations for Modular domain and Phosphopeptide Recognition*, Free Energy Calculation Meeting, Boston, 5/2014.
- *Insights from Drug-protein Binding Free Energy Calculations and Ligand Binding Processes*, Seminar, Rutgers University, 4/2014.
- *Modeling of Biomolecular Systems: Protein Dynamics, Binding Affinity Calculation, and Inhibitor Design*, Seminar, Temple University, 4/2014.
- *Modeling of Biomolecular Systems: Protein Dynamics, Binding Affinity Calculation, and Inhibitor Design*, Seminar, National Taiwan University, 3/2014.
- *Insights from Drug-protein Binding Free Energy Calculations and Ligand Binding Processes*, Seminar, The Chinese University of Hong Kong, 3/2014.
- *Modeling of Biomolecular Systems: Protein Dynamics, Binding Affinity Calculation, and Inhibitor Design*, Seminar, UC, Riverside, 1/2014.
- *Insights from Free Energy Calculations: Protein Conformational Equilibrium, Driving Forces and Ligand Binding Processes*, Seminar, Georgia State University, 11/2013.
- *Insights from Free Energy Calculations: Ligand Binding Driving Forces and Binding Processes*, Seminar, Georgia Institute of Technology, 11/2013.
- *Simulations of Biomolecular Systems: Protein Dynamics, Binding Affinity Prediction, and Inhibitor Design*, Seminar, California State U. San Bernardino, 10/2013.
- *Efficient Method to Elucidate Ligand Binding Pathways: Binding Kinetics Studies for Cryptophane Host-Guest Complexes*, ACS Fall National Meeting, Indianapolis, 9/2013.
- *Insights from Free Energy Calculations*, AAAS Regional Meeting, Las Vegas, 6/2013.
- *Simulations of Biomolecular Systems: Protein Dynamics, Binding Affinity Prediction, and Inhibitor Design*, Biochemistry Seminar, UCLA, 6/2013.

- *Insights from Free Energy Calculations: Protein Conformational Equilibrium, Driving Forces and Ligand Binding Processes*, Laboratory of Computational Biology, NIH, 5/2013.
- *Insights from Free Energy Calculations*, Verachem LLC, 5/2013.
- *Insights from Free Energy Calculations*, Biotechnology High Performance Computing Software Applications Institute, 5/2013.
- *Modeling Molecular Association: Diffusion, Gating and Hydrogen-bonding*, Florida State University, 4/2013.
- *Modeling Molecular Association: Diffusion, Gating and Hydrogen-bonding*, UC, Berkeley, 4/2013.
- *Modeling Molecular Association: Diffusion, Gating and Intermolecular Interactions*, UC, Santa Barbara, 10/2012.
- *Insights from Free Energy Calculations: Protein Conformational Equilibrium, Driving Forces and Ligand Binding Processes*, UC, Irvine, 10/2012.
- *Modeling Molecular Association*, Material Science Center, Caltech, 6/2012.
- *Insights from Free Energy Calculations: Protein Conformational Equilibrium, Driving Forces and Ligand Binding Processes*, UCSF, 6/2012.
- *Insights from Free Energy Calculations: Protein Conformational Equilibrium, Driving Forces and Ligand Binding Processes*, Free Energy Calculation Meeting, Boston, 5/2012.
- *Modeling Molecular Association: Diffusion, Gating and Intermolecular Interactions*, Spring ACS National Meeting, San Diego, 3/2012.
- *Modeling Molecular Association: Diffusion, Conformational Changes and Intermolecular Interactions*, Laboratory of Chemical Physics, NIH, 3/2012.

Publications (referred, with a few exceptions as noted)

1. Chang, C.-E and Gilson, M. K., Tork: A Conformational Analysis Method for Molecules and Complexes, *J. of Comput Chem*, **2003**, 24, 1987-1998.
2. DeJong, E. S. [#], Chang, C.-E[#], Gilson, M. K., Marino, J. P., Proflavine Acts as a Rev Inhibitor by Targeting the High-Affinity Rev Binding Site of the Rev-Responsive Element of HIV-1, *Biochemistry*, **2003**, 42, 8035-8046. ([#] co-first authors)
3. Chang, C.-E., Potter, M. J. and Gilson, M. K., Direct Calculation of Conformational Free Energies in All Degrees of Freedom, *J. Phys. Chem. B.*, **2003**, 107, 1048-1055.
4. Chang, C-E., and Gilson, M. K., Free Energy, Entropy, and Induced Fit in Host-Guest Recognition. *J. Am. Chem. Soc.* **2004**, 126, 13156–13164.
5. Chen, W., Chang, C-E., and Gilson, M. K., Calculation of Cyclodextrin Binding Affinities: Energy, Entropy and Implication in Drug Design. *Biophysical J*, **2004**, 87:3035-3049.
6. Minh, D.L., Bui, J.M., Chang, C-E., Jain T., and McCammon J.A., The Entropic Cost of Protein-Protein Association: A Case Study on Acetylcholinesterase Binding to Fasciculin-2. *Biophysical J*, **2005**, 89:L25-L27.
7. Chang, C-E., Chen, W., and Gilson, M. K., Evaluating the accuracy of the quasiharmonic approximation. *J. of Chemical Theory and Computation*, **2005**, 1, 1017-1028.
8. Chen, W., Chang, C-E., and Gilson, M. K., Concepts in Receptor Optimization: Targeting the Peptide RGD . *J. Am. Chem. Soc.*, **2006**, 128: 4675-4687.

9. Chang C-E.*, Shen T., Trylska J., Tozzini T. and McCammon J. A., Gated Binding of Ligands to HIV-1 Protease: Brownian Dynamics Simulations in a Coarse-Grained Mode. *Biophysical J*, **2006**, 90: 3880-3885.
10. Minh D.D, Chang C-E., Trylska J., Tozzini V, and McCammon J.A., The Influence of Macromolecular Crowding on HIV-1 Protease Molecular Dynamics. *J. Am. Chem. Soc.* **2006**, 128, 6006-6007
11. Tozzini, T., Trylska J., Chang C-E., and McCammon J. A. Flap Opening Dynamics in HIV-1 Protease Explored with a Coarse-grained Model, *J. or Structural Biology*, **2007**, 157: 606-605.
12. Tozzini, T., Trylska J., Chang C-E., and McCammon J. A. Coarse-grained molecular dynamics study of HIV-1 protease substrate capture and product release, *Biophysical J.* **2007**, 92: 4179-4187.
13. Chang, C-E.*, Trylska J., Tozzini T. and McCammon J. A., Towards Understanding the Binding Pathways of Ligand to HIV-1 Protease, *Chemical Biology and Drug Design.*, **2007**, 1: 5-13. [cover art]
14. Chang, C-E., Chen, W. and Gilson, M. K., Analysis of the Change in Ligand Entropy upon Protein Binding. *Proc. Natl. Acad. Sci. U. S. A.*, **2007**, 104: 1534-1539.

Publications after joining UCR

15. Chang, C-E. A.*, McLaughlin W. A., Baron R., Wang W., and J. Andrew McCammon J.A., Entropic contributions and the influence of the hydrophobic environment in promiscuous protein-protein association. *Proc. Natl. Acad. Sci. U. S. A.*, **2008**, 105:7456-7461.
16. Cheng, Y, Chang C-E. A., Yu Z., Zhang Y., Leyhk T. S., Holst M. J. and McCammon J. A., Substrate Channeling in the Sulfate Activating Complex: Combined Continuum Modeling and Coarse-grained Brownian Dynamics Studies. *Biophysical J.* **2008**, 95: 4659-4667.
17. Gorfe[#], A. A., Chang^{#*}, C-E. A., Ivanov I and McCammon J. A., Dynamics of the Acetylcholinesterase Tetramer. *Biophysical J.* **2008**, 94: 1144-1154. ([#]co-first authors)
18. Garcia, A., Borchardt, D, Chang, C-E. A. and Marsella, M. J., Thermal Isomerization of Cannabinoid Analogues. *J. Am. Chem. Soc.*, **2009**, 131, 16640-16641.
19. Fatmi, M.Q, Ai, R., and Chang, C-E. A.*, Synergistic Regulation and Ligand-Induced Conformational Changes of Tryptophan Synthase *Biochemistry*, **2009**. 48, 9921-9931.
20. Peterson, F. C., Burgie, E. S., Park, S-Y, Jensen, D. R., Weiner, J. J., Bingman, C. A., Chang, C-E. A, Cutler, S. R., Phillips Jr, G. N. and Volkman, B. F., Structural basis for selective activation of ABA receptors., *Nature Structural & Molecular Biology*, **2010**, 17, 1109 – 1113
21. Ai, R., Fatmi, M., and Chang, C-E. A.*, T-Analyst, a program for efficient analysis of protein conformational changes. *J Comput Aided Mol Des*, **2010**. 24, 819-827.
22. Fatmi, M.Q., Chang, C-E. A*. The role of oligomerization and cooperative regulation in protein function: The case of tryptophan synthase. *PLos Computational Biology*, **2010**, 6, e1000994

23. Lai, J., Niks, D., Wang, Y., Domratcheva, T., Barends, T. R. M., Schwarz, F., Olsen, R. A., Elliott, D. W., Fatmi, M. Q., Chang, C-E. A., Schlichting, I., Dunn, M. F. and Mueller, L. J., X-ray and NMR Crystallography in an Enzyme Active Site: The Indoline Quinonoid Intermediate in Tryptophan Synthase, *J. Am. Chem. Soc.*, **2011**, 133 (1), 4–7
24. Huang, Y.M.M and Chang, C-E. A.*, Mechanism of PhosphoThreonine/Serine Recognition and Specificity for Modular Domains from All-atom Molecular Dynamics, *BMC Biophysics*, **2011**, 4, 12-25.
25. Chang, C-E. A.*, Ai, R., Gutierrez, M., Marsella, M. J., Successful biomedical applications: cannabinoid analogues for therapeutic use. Computer-Aided Drug Design, *Methods in Molecular Biology*, book editor: Baron, R. **2012**, 819, 595-613. (invited review)
26. Kang, M., Roberts, C., Cheng, Y. and Chang, C-E. A.* Gating and Intermolecular Interactions in Ligand-protein Association: Coarse-grained Modeling of HIV-1 Protease, *J. of Chemical Theory and Computation*, **2011**, 10:3438-3446
27. Ai, R., and Chang, C-E. A.*, Ligand-Specific Homology Modeling of Human Cannabinoid (CB1) Receptor. *Journal of Molecular Graphics and Modelling*. **2012**, 38, 155-164.
28. Huang, Y.M.M, Chen, W., Potter, M. P., and Chang, C-E. A.*, Insights from Free-Energy Calculations: Protein Conformational Equilibrium, Driving Forces, and Ligand-Binding Modes., *Biophysical J.*, **2012**, 103, 342-351.
29. Huang, Y.-M. M., Kang, M., and Chang, C-E. A.*. Mechanistic insights into phosphopeptide-binding BRCT domains: preorganization, flexibility and phosphate recognition. *J. of Physical Chemistry B*, **2012**, 116, 10247-10258.
30. Yaghmaei, S., Roberts, C. C., Ai, R., Mizwicki, M. T., and Chang, C-E. A.* Agonist and Antagonist Binding to the Nuclear Vitamin D Receptor: Dynamics, Mutation Effects and Functional Implications, *In Silico Pharmacology*, **2013**, 1, 2.
31. Science Kumar, E. A., Chen, Q., Kizhake, S., Kolar, C., Kang, M., Chang, C-E. A., Borgstahl, G. E. O., and Natarajan, A., The Paradox of Conformational Constraint in the Design of Cbl(TBk)-binding peptides. *Scientific Reports*, **2013**, 3:1639.
32. Roberts, C. C. and Chang, C-E. A.* Ligand Binding Pathways Elucidation for Cryptophan Host-Guest Complexes, *J. of Chemical Theory and Computation*, **2013**, 9:2010-2019.
33. Chang, C-E. A.*, and Huang, Y-M. M. Atomistic Modeling of Phosphopeptide Recognition of Modular Domains, Ralph A. Wheeler, editors: *Annual Reports in Computational Chemistry*, **2013**, Vol. 9, 61-84. (invited review)
34. Zeng, S., Huang, Y-M. M., Chang, C-E. A.*, and Zhong, W*. Protein Binding for Detection of Small Changes on Nanoparticle Surface, *Analyst*, **2014**, 139, 1364-1371 [cover art]
35. Axe, J. M., Yezdimer, E. M., O'Rourke, K. F., Kerstetter, N. E., You, W. Chang, C.-E. A. and Boehr, D. D. *J. Am. Chem. Soc.*, **2014**, 136, 6818-6821.
36. Huang, Y.-M. M. and Chang, C-E. A.*, Achieving Specificity and Promiscuity by Loop

Recognition: Case of the FHA domains. *PLoS ONE*, **2014**, 9, e98291

37. Huang, Y.-M. M., Kang, M., and Chang, C.-E. A.*, Swithes of hydrogen-bonds During Ligand-protein Association Processes as Determinants of Binding Kinetics, *Journal of Molecular Recognition*, **2014**, 27, 537-548.
38. Tang, Z., Zhang, Q., Yin, Y., Chang, C.-E. A.*, Facet Selectivity of Ligands on Silver Nanoplates: Molecular Mechanics Study. *J. of Physical Chemistry C*, **2014**, 118, 21589-21598.
- 39 Protonation states of the tryptophan synthase internal aldimine active site from solid-state NMR spectroscopy: direct observation of the protonated Schiff base linkage to pyridoxal-5'-phosphate. Caulkins, B.G., Bastin, B., Yang, C., Neubauer, T.J., Young, R.P., Hilario, E., Huang, Y.M., Chang, C.-E. A., Fan, L., Dunn, M.F., Marsella, M.J., Mueller, L.J., *J. Am. Chem. Soc.* **2014**, 136, 12824-12827.
- 40 Zhang, X., Niu, D., Carbonell, A., Wang, A., Lee, A., Tun, V., Wang, Z., Carrington, J., Chang, C.-E. A. and Jin, H., Argonaute PIWI domain and microRNA duplex structure regulate small RNA sorting in Arabidopsis. *Nature Communications*, **2014**, 5, 5468.
- 41 Roberts, C. C. and Chang, C.-E. A.*, Modeling of Enhanced Catalysis in Multi-enzyme Nanostructures: Effect of Molecular Scaffolds, Spatial Organization, and Concentration, *J. of Chemical Theory and Computation*, **2015**, 11, 286-292.
- 42 Gao, Y., Roberts, C. C., Zhu, J., Lin, J.-Y., Chang, C.-E. A. and Wheeldon, I., Tuning Enzyme Kinetics through Designed Intermolecular Interactions Far from the Active Site. *ACS Catalysis* **2015**, 5, 2149–2153.
- 43 Huang, Y.M., You, W., Caulkins, B.G., Dunn, M.F., Mueller, L., Chang, C.A*. Protonation states and catalysis: Molecular dynamics studies of intermediates in tryptophan synthase. *Protein Sciences*. **2016**, 25, 166-183.
- 44 Zhang, C., Brown, M. Q., ... Huang, Y. M., Ghang, Y.J., ung, N., Li, R., Isley, J., Morikis, D., Song, J., Guo, W., Holley, R. J., Chang, C.-E. A., Yang, Z., Zarsky, V., Muday, G. K., Hicks, G. R., Raikhel, N. V. Endosidin2 targets conserved exocyst complex subunit EXO70 to inhibit exocytosis. *Proc. Natl. Acad. Sci. U. S. A.*, **2015**, E41-E50.
- 45 Hilario, E., Caulkins, B. G. , Huang, Y. M. M., You, W., Chang, C.-E. A., Mueller, L. J., Dunn, M. F., Fan, L. Visualizing the tunnel in tryptophan synthase with crystallography: Insights into a selective filter for accommodating indole and rejecting water. *Biochim Biophys Acta*, **2016**, 268-279.
- 46 André S. Bachmann, John Opoku-Ansah, Tannya R. Ibarra-Rivera, Lisette P. Yco, Sudhakar Ambadi, Christopher C. Roberts, Chia-en A. Chang, and Michael C. Pirrung. Syrbactin Structural Analog TIR-199 Blocks Proteasome Activity and Induces Tumor Cell Death. *The Journal of Biological Chemistry*, **2016**. 291, 8350–8362 [cover art]

- 47 Chang, C-E. A.*, Huang, Y-M. M., Mueller, L. J. and You, W, Catalyst Investigation of Structural Dynamics of Enzymes and Protonation States of Substrates Using Computational Tools, *Catalyst*, **2016**, 6, 82-103.
- 48 Gao, Y., Roberts, C. C., Zhu, J., Toop, A., Chang, C-E. A. and Wheeldon, I Mechanisms of Enhanced Catalysis in Enzyme–DNA Nanostructures Revealed through Molecular Simulations and Experimental Analysis, *ChemBioChem*, **2016**, 17, 1430-1436 [back cover, Very Important Paper]
- 49 Roberts, C. and Chang C-E. A.*, Analysis of Ligand–Receptor Association and Intermediate Transfer Rates in Multienzyme Nanostructures with All-Atom Brownian Dynamics Simulations, *J. Phys. Chem. B.*, **2016**
- 50 You, W., Huang Y-M. M, Kizhake, S., Natarajan, A., Chang, C-E. A.*, Characterization of Promiscuous Binding of Phosphor Ligands to Breast-Cancer-Gene 1 (BRCA1) C-Terminal (BRCT): Molecular Dynamics, Free Energy, Entropy and Inhibitor Design. *PLOS Computational Biology*, **2016**, 12(8): e1005057

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Education and Training

California Institute of Technology	Chemistry	B.S.	1977
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University of California, San Diego	Chemistry	Ph.D.	1985
MSU-DOE Plant Research Laboratory Michigan State University	Plant Molecular Biology	Postdoctoral Fellow	1985-1988

Research and Professional Experience

1977-1985	Research Assistant, Departments of Physics & Chemistry, University of California, San Diego
1985-1988	Postdoctoral Fellow, MSU-DOE Plant Research Laboratory, Michigan State University
1988-1995	Assistant Professor, Department of Biochemistry, University of California, Riverside
1995-2001	Associate Professor, Department of Biochemistry, University of California, Riverside
2001-present	Professor, Department of Biochemistry, University of California, Riverside
2006-present	Cooperating Faculty Member, Department of Chemistry, University of California, Riverside,
2006-2007	Interim Chair, Department of Biochemistry, University of California, Riverside
2008-2010	Vice Chair, Department of Biochemistry, University of California, Riverside
2010-present	Chair, Department of Biochemistry, University of California, Riverside

Honors

NSF Postdoctoral Fellow in Plant Biology, 1986-1988.
 Fellow, American Association for the Advancement of Science (Elected 2009)

Publications

Peer-Reviewed Technical Journal Articles (numbering corresponds to that in UCR's eFile system)

- A1. **Debus, R. J.**, Valkirs, G. E., Okamura, M. Y. and Feher, G. (1982) "Localization of the Secondary Quinone Binding Site in Reaction Centers from *Rhodopseudomonas sphaeroides* R-26.1 by Antibody Inhibition of Electron Transfer," *Biochim. Biophys. Acta* **682**, 500-503 (<http://www.sciencedirect.com/science/article/pii/0005272882900676>).
- A2. **Debus, R. J.**, Feher, G. and Okamura, M. Y. (1985) "The LM complex from *Rhodopseudomonas sphaeroides* R-26.1: Characterization and Reconstitution with the H Subunit," *Biochemistry* **24**, 2488-2500 (<http://pubs.acs.org/doi/abs/10.1021/bi00331a015>).
- A3. Lubitz, W., Abresch, E. C., **Debus, R. J.**, Isaacson, R. A., Okamura, M. Y. and Feher, G. (1985) "Electron Nuclear Double Resonance of Semiquinones in Reaction Centers of *Rhodopseudomonas sphaeroides*," *Biochim. Biophys. Acta* **808**, 464-469 (<http://www.sciencedirect.com/science/article/pii/0005272885901550>).
- A4. Okamura, M. Y., Abresch, E. C. and **Debus, R. J.** (1985) "Reaction Centers from Triazine-Resistant Strains of *Rhodopseudomonas sphaeroides*: Localization of the Mutation Site by Protein Hybridization Experiments," *Biochim. Biophys. Acta* **810**, 110-113 (<http://www.sciencedirect.com/science/article/pii/0005272885902117>).
- A5. **Debus, R. J.**, Feher, G. and Okamura, M. Y. (1986) "Iron-Depleted Reaction Centers from *Rhodopseudomonas sphaeroides* R-26.1: Characterization and Reconstitution with Fe²⁺, Mn²⁺, Co²⁺, Ni²⁺, Cu²⁺, and Zn²⁺," *Biochemistry* **25**, 2276-2287 (<http://pubs.acs.org/doi/abs/10.1021/bi00356a064>).

- A6. Kirmaier, C., Holten, D., **Debus, R. J.**, Feher, G. and Okamura, M. Y. (1986) "Primary Photochemistry of Iron-Depleted and Zinc-Reconstituted Reaction Centers from *Rhodospseudomonas sphaeroides*," *Proc. Natl. Acad. Sci.(USA)* **83**, 6407-6411 (<http://www.pnas.org/content/83/17/6407.full.pdf?sid=be7ed47c-7247-47be-8136-99bd210d9205>).
- A7. Jansson, C., **Debus, R. J.**, Osiewacz, H. D., Gurevitz, M. and McIntosh, L. (1987) "Construction of an Obligate Photoheterotrophic Mutant of the Cyanobacterium *Synechocystis* 6803: Inactivation of the *psbA* Gene Family," *Plant Physiology* **85**, 1021-1025 (<http://www.plantphysiol.org/content/85/4/1021.full.pdf+html?sid=008e398b-b495-457b-a895-90054d15bf4b>).
- A8. **Debus, R. J.**, Barry, B. A., Babcock, G. T. and McIntosh, L. (1988) "Site-Directed Mutagenesis Identifies a Tyrosine Radical Involved in the Photosynthetic Oxygen Evolving System," *Proc. Natl. Acad. Sci. (USA)* **85**, 427-430 (<http://www.pnas.org/content/85/2/427.full.pdf?sid=be7ed47c-7247-47be-8136-99bd210d9205>).
- A9. **Debus, R. J.**, Barry, B. A., Sithole, I., Babcock, G. T. and McIntosh, L. (1988) "Directed Mutagenesis Indicates that the Donor to P_{680}^{+} in Photosystem II is Tyrosine-161 of the D1 polypeptide," *Biochemistry* **27**, 9071-9074 (<http://pubs.acs.org/doi/abs/10.1021/bi00426a001>).
- A10. Boerner, R. J., Nguyen, A. P., Barry, B. A. and **Debus, R. J.** (1992) "Evidence from Directed Mutagenesis that Aspartate 170 of the D1 Polypeptide Influences the Assembly and/or Stability of the Manganese Cluster in the Photosynthetic Water-Splitting Complex," *Biochemistry* **31**, 6660-6672 (<http://pubs.acs.org/doi/abs/10.1021/bi00144a005>).
- A11. Boerner, R. J., Bixby, K. A., Nguyen, A. P., Noren, G. H., **Debus, R. J.** and Barry, B. A. (1993) "Removal of Stable Tyrosine Radical D⁺ Alters the Structure or Redox Properties of Tyrosine Z in Manganese-depleted Photosystem II Particles from *Synechocystis* 6803," *J. Biol. Chem.* **268**, 1817-1823 (<http://www.jbc.org/content/268/3/1817.full.pdf+html?sid=d7448ae6-1ed4-479b-917a-d497bd569e5d>).
- A12. MacDonald, G. M., Boerner, R. J., Everly, R. M., Cramer, W. A., **Debus, R. J.** and Barry, B. A. (1994) "Comparison of Cytochrome *b*-559 Content in Photosystem II Complexes from Spinach and *Synechocystis* sp. PCC 6803," *Biochemistry* **33**, 4393-4400 (<http://pubs.acs.org/doi/abs/10.1021/bi00180a037>).
- A13. Chu, H.-A., Nguyen, A. P. and **Debus, R. J.** (1994) "Site-Directed Photosystem II Mutants with Perturbed Oxygen Evolving Properties. 1. Instability or Inefficient Assembly of the Manganese Cluster *In Vivo*," *Biochemistry* **33**, 6137-6149 (<http://pubs.acs.org/doi/abs/10.1021/bi00186a013>).
- A14. Chu, H.-A., Nguyen, A. P. and **Debus, R. J.** (1994) "Site-Directed Photosystem II Mutants with Perturbed Oxygen Evolving Properties. 2. Increased Binding or Photooxidation of Manganese in the Absence of the Extrinsic 33-kDa Polypeptide *In Vivo*," *Biochemistry* **33**, 6150-6157 (<http://pubs.acs.org/doi/abs/10.1021/bi00186a014>).
- A15. Bernard, M. T., MacDonald, G. M., Nguyen, A. P., **Debus, R. J.** and Barry, B. A. (1995) "A Difference Infrared Study of Hydrogen Bonding to the Z⁺ Tyrosyl Radical of Photosystem II," *J. Biol. Chem.* **270**, 1589-1594 (<http://www.jbc.org/content/270/4/1589.full.pdf+html?sid=d7448ae6-1ed4-479b-917a-d497bd569e5d>).
- A16. Chu, H.-A., Nguyen, A. P., and **Debus, R. J.** (1995) "Amino Acid Residues that Influence the Binding of Manganese or Calcium to Photosystem II. 1. The Lumenal Inter-Helical Domains of the D1 Polypeptide," *Biochemistry* **34**, 5839-5858 (<http://pubs.acs.org/doi/abs/10.1021/bi00017a016>).
- A17. Chu, H.-A., Nguyen, A. P., and **Debus, R. J.** (1995) "Amino Acid Residues that Influence the Binding of Manganese or Calcium to Photosystem II. 2. The Carboxy-Terminal Domain of the D1 Polypeptide," *Biochemistry* **34**, 5859-5882 (<http://pubs.acs.org/doi/abs/10.1021/bi00017a017>).
- A18. Campbell, K. A., Peloquin, J. M., Pham, D. P., **Debus, R. J.**, and Britt, R. D. (1998) "Parallel Polarization EPR Detection of an S₁-state 'Multiline' EPR Signal in Photosystem II Particles from *Synechocystis* sp. PCC 6803," *J. Am. Chem. Soc.* **120**, 447-448 (<http://pubs.acs.org/doi/abs/10.1021/ja972693y>).
- A19. Campbell, K. A., Gregor, W., Pham, D. P., Peloquin, J. M., **Debus, R. J.**, and Britt, R. D. (1998) "The 23 and 17 kDa Extrinsic Proteins of Photosystem II Modulate the Magnetic Properties of the S₁-State Manganese Cluster," *Biochemistry* **37**, 5039-5045 (<http://pubs.acs.org/doi/abs/10.1021/bi9800552>).

- A20. Hays, A.-M. A., Vassiliev, I. R., Golbeck, J. H., and **Debus, R. J.** (1998) "Role of D1-His190 in Proton-Coupled Electron Transfer Reactions in Photosystem II: A Chemical Complementation Study," *Biochemistry* **37**, 11352-11365 (<http://pubs.acs.org/doi/abs/10.1021/bi980510u>).
- A21. Hundelt, M., Hays, A.-M. A., **Debus, R. J.**, and Junge, W. (1998) "Oxygenic Photosystem II: The Mutation D1-D61N in *Synechocystis* sp. PCC 6803 Retards S-State Transitions without Affecting Electron Transfer from Y_Z to P_{680}^+ ," *Biochemistry* **37**, 14450-14456 (<http://pubs.acs.org/doi/pdf/10.1021/bi981164j>).
- A22. Qian, M., Dao, L., **Debus, R. J.**, and Burnap, R. L. (1999) "Impact of Mutations within the Putative Ca^{2+} -Binding Lumenal Interhelical a-b Loop of the Photosystem II D1 Protein on the Kinetics of Photoactivation and H_2O -oxidation in *Synechocystis* sp. PCC 6803," *Biochemistry* **38**, 6070-6081 (<http://pubs.acs.org/doi/abs/10.1021/bi982331i>).
- A23. Hays, A.-M. A., Vassiliev, I. R., Golbeck, J. H. and **Debus, R. J.** (1999) "Role of D1-His190 in the proton-coupled oxidation of tyrosine Y_Z in manganese-depleted photosystem II," *Biochemistry* **38**, 11851-11865 (<http://pubs.acs.org/doi/abs/10.1021/bi990716a>).
- A24. **Debus, R. J.**, Campbell, K. A., Peloquin, J. M., Pham, D. P. and Britt, R. D. (2000) "Histidine 332 of the D1 polypeptide Modulates the Magnetic and Redox Properties of the Manganese Cluster and Tyrosine Y_Z in Photosystem II" *Biochemistry* **39**, 470-478 (<http://pubs.acs.org/doi/abs/10.1021/bi9917737>).
- A25. Komenda, J., Hassan, H. A. G., Diner, B. A., **Debus, R. J.**, Barber, J., and Nixon, P. J. (2000) "Degradation of the Photosystem II D1 and D2 Proteins in Different Strains of the Cyanobacterium *Synechocystis* sp. PCC 6803 Varying with Respect to the Type and Level of *psbA* Transcript," *Plant Mol. Biol.* **42**, 635-645 (http://download.springer.com/static/pdf/557/art%253A10.1023%252FA%253A1006305308196.pdf?originUrl=http%3A%2F%2Flink.springer.com%2Farticle%2F10.1023%2FA%3A1006305308196&token2=exp=1443235151~acl=%2Fstatic%2Fpdf%2F557%2Fart%25253A10.1023%25252FA%25253A1006305308196.pdf%3ForiginUrl%3Dhttp%253A%252F%252Flink.springer.com%252Farticle%252F10.1023%252FA%253A1006305308196*~hmac=6b37e379f4b4302cc84a0c42860b7efd3a01feb0629e1215d4cd07dd4fdbf67e).
- A26. **Debus, R. J.**, Campbell, K. A., Pham, D. P., Hays, A.-M. A., and Britt, R. D. (2000) "Glutamate 189 of the D1 polypeptide Modulates the Magnetic and Redox Properties of the Manganese Cluster and Tyrosine Y_Z in Photosystem II" *Biochemistry* **39**, 6275-6287 (<http://pubs.acs.org/doi/abs/10.1021/bi992749w>).
- A27. Chu, H.-A., **Debus, R. J.**, and Babcock, G. T. (2001) "D1-Asp170 is Structurally Coupled to the Oxygen Evolving Complex in Photosystem II as Revealed by Light-Induced Fourier Transform Infrared Difference Spectroscopy," *Biochemistry* **40**, 2312-2316 (<http://pubs.acs.org/doi/abs/10.1021/bi0022994>).
- A28. **Debus, R. J.**, Campbell, K. A., Gregor, W., Li, Z.-L., Burnap, R. L., and Britt, R. D. (2001) "Does Histidine 332 of the D1 Polypeptide Ligate the Manganese Cluster in Photosystem II? An Electron Spin Echo Envelope Modulation Study," *Biochemistry* **40**, 3690-3699 (<http://pubs.acs.org/doi/abs/10.1021/bi002394c>).
- A29. Clausen, J., Winkler, S., Hays, A.-M. A., Hundelt, M., **Debus, R. J.**, and Junge, W. (2001) "Photosynthetic Water Oxidation in *Synechocystis* sp. PCC 6803: Mutations D1-E189K, R, and Q are without Influence on Electron Transfer at the Donor Side of Photosystem II," *Biochim. Biophys. Acta (Bioenergetics)* **1506**, 224-235 (<http://www.sciencedirect.com/science/article/pii/S0005272801002171>).
- A30. Faller, P., **Debus, R. J.**, Brettel, K., Sugiyama, M., Rutherford, A. W., and Boussac, A. (2001) "Rapid Formation of the Stable Tyrosyl Radical in Photosystem II," *Proc. Natl. Acad. Sci. USA* **98**, 14368-14373 (<http://www.pnas.org/content/98/25/14368.full.pdf?sid=be7ed47c-7247-47be-8136-99bd210d9205>).
- A31. Faller, P., Rutherford, A. W., and **Debus, R. J.** (2002) "Tyrosine D Oxidation at Cryogenic Temperature in Photosystem II" *Biochemistry* **41**, 12914-12920 (<http://pubs.acs.org/doi/abs/10.1021/bi026588z>).
- A32. **Debus, R. J.**, Aznar, C., Campbell, K. A., Gregor, W., Diner, B. A., and Britt, R. D. (2003) "Does Aspartate 170 of the D1 Polypeptide Ligate the Manganese Cluster in Photosystem II? An EPR and ESEEM Study," *Biochemistry* **42**, 10600-10608 (<http://pubs.acs.org/doi/abs/10.1021/bi034859f>).

- A33. Clausen, J., **Debus, R. J.**, and Junge, W. (2004) "Time-Resolved Oxygen Production by Photosystem II: Chasing Chemical Intermediates," *Biochim. Biophys. Acta (Bioenergetics)* **1655**, 184-194 (<http://www.sciencedirect.com/science/article/pii/S0005272803001944>).
- A34. Chu, H.-A., Hillier, W., and **Debus, R. J.** (2004) "Evidence that the C-Terminus of the D1 Polypeptide of Photosystem II is Ligated to the Manganese Ion that Undergoes Oxidation During the S_1 to S_2 Transition: An Isotope-Edited FTIR Study," *Biochemistry* **43**, 3152-3166 (<http://pubs.acs.org/doi/abs/10.1021/bi035915f>).
- A35. **Debus, R. J.**, Strickler, M. A., Walker, L. M., and Hillier, W. (2005) "No Evidence from FTIR Difference Spectroscopy That Aspartate-170 of the D1 Polypeptide Ligates a Manganese Ion That Undergoes Oxidation during the S_0 to S_1 , S_1 to S_2 , or S_2 to S_3 Transitions in Photosystem II," *Biochemistry* **44**, 1367-1374 (<http://pubs.acs.org/doi/abs/10.1021/bi047558u>).
- A36. Strickler, M. A., Walker, L. M., Hillier, W., and **Debus, R. J.** (2005) "Evidence from Biosynthetically Incorporated Strontium and FTIR Difference Spectroscopy that the C-Terminus of the D1 Polypeptide of Photosystem II Does Not Ligate Calcium," *Biochemistry* **44**, 8571-8577 (<http://pubs.acs.org/doi/abs/10.1021/bi050653y>).
- A37. Strickler, M. A., Hillier, W., and **Debus, R. J.** (2006) "No Evidence from FTIR Difference Spectroscopy that Glutamate-189 of the D1 Polypeptide Ligates a Mn Ion that Undergoes Oxidation During the S_0 to S_1 , S_1 to S_2 , or S_2 to S_3 Transitions in Photosystem II," *Biochemistry* **45**, 8801-8811 (<http://pubs.acs.org/doi/abs/10.1021/bi060583a>).
- A38. Strickler, M. A., Walker, L. M., Hillier, W., Britt, R. D., and **Debus, R. J.** (2007) "No Evidence from FTIR Difference Spectroscopy that Aspartate-342 of the D1 Polypeptide Ligates a Mn Ion that Undergoes Oxidation During the S_0 to S_1 , S_1 to S_2 , or S_2 to S_3 Transitions in Photosystem II," *Biochemistry* **46**, 3151-3160 (<http://pubs.acs.org/doi/abs/10.1021/bi062195e>).
- A39. Hwang, H. J., Dilbeck, P., **Debus, R. J.**, Burnap, R. L. (2007) "Mutation of Arginine-357 of the CP43 Protein of Photosystem II Severely Impairs the Catalytic S-state Cycle of the H_2O -Oxidation Complex," *Biochemistry* **46**, 11987-11997 (<http://pubs.acs.org/doi/abs/10.1021/bi701387b>).
- A40. Hwang, H. J., McLain, A., **Debus, R. J.**, and Burnap, R. L. (2007) "Photoassembly of the Manganese Cluster in Mutants Perturbed in the High Affinity Mn-Binding Site of the H_2O -Oxidation Complex of Photosystem II," *Biochemistry* **46**, 13648-13657 (<http://pubs.acs.org/doi/abs/10.1021/bi700761v>).
- A41. Yeagle, G. J., Gilchrist, M. L., Jr., Walker, L. M., **Debus, R. J.**, and Britt, R. D. (2008) "Multifrequency Electron Spin Echo Envelope Modulation Studies of Nitrogen Ligation to the Manganese Cluster of Photosystem II," *Philosophical Transactions of the Royal Society, Series B* **363**, 1157-1166 (<http://rstb.royalsocietypublishing.org/content/royptb/363/1494/1157.full.pdf>).
- A42. Strickler, M. A., Hwang, H. J., Burnap, R. L., Yano, J., Walker, L. M., Service, R. J., Britt, R. D., Hillier, W., and **Debus, R. J.** (2008) "Glutamate-354 of the CP43 Polypeptide Interacts with the Oxygen-Evolving Mn_4Ca cluster of Photosystem II: A Preliminary Characterization of the Glu354Gln Mutant," *Philosophical Transactions of the Royal Society, Series B* **363**, 1179-1188 (<http://rstb.royalsocietypublishing.org/content/royptb/363/1494/1179.full.pdf>).
- A43. Singh, S., **Debus, R. J.**, Wydrzynski, T., and Hillier, W. (2008) "Investigation of Substrate Water Interactions at the High Affinity Mn Site in the Photosystem II Oxygen Evolving Complex." *Philosophical Transactions of the Royal Society, Series B* **363**, 1229-1235 (<http://rstb.royalsocietypublishing.org/content/royptb/363/1494/1229.full.pdf>).
- A44. Stull, J. A., Stich, T. A., Service, R. J., **Debus, R. J.**, Mandal, S. K., Armstrong, W. H., and Britt, R. D. (2010) " ^{13}C ENDOR Reveals That the D1 Polypeptide C-Terminus is Directly Bound to Mn in the Photosystem II Oxygen Evolving Complex," *J. Am. Chem. Soc.* **132**, 446-447 (<http://pubs.acs.org/doi/abs/10.1021/ja908688t>).
- A45. Service, R. J., Hillier, W., and **Debus, R. J.** (2010) "Evidence from FTIR Difference Spectroscopy of an Extensive Network of Hydrogen Bonds near the Oxygen-Evolving Mn_4Ca Cluster of Photosystem II involving D1-Glu65, D2-Glu312, and D1-Glu329," *Biochemistry* **49**, 6655-6669 (<http://pubs.acs.org/doi/abs/10.1021/bi100730d>).
- A46. Service, R. J., Yano, J., McConnell, I., Hwang, H. J., Niks, D., Hille, R., Wydrzynski, T., Burnap, R. L., Hillier, W., and **Debus, R. J.** (2011) "Participation of Glutamate-354 of the CP43 Polypeptide in the Ligation of Mn and the Binding of Substrate Water in Photosystem II," *Biochemistry Biochemistry* **50**, 63-81 (<http://pubs.acs.org/doi/abs/10.1021/bi1015937>).

- A47. Yano, J., Walker, L. M., Strickler, M. A., Service, R. J. Service, Yachandra, V. K., and **Debus, R. J.** (2011) "Altered Structure of the Mn₄Ca Cluster in the Oxygen-Evolving Complex of Photosystem II by a Histidine Ligand Mutation," *J. Biol. Chem.* 286, 9257-9267 (<http://www.jbc.org/content/286/11/9257.full.pdf+html?sid=d7448ae6-1ed4-479b-917a-d497bd569e5d>).
- A48. Stich, T. A., Yeagle, G. J., Service, R. J., **Debus, R. J.**, and Britt, R. D. (2011) "Ligation of D1-His332 and D1-Asp170 to the Manganese Cluster of Photosystem II from *Synechocystis* Assessed by Multifrequency Pulse EPR Spectroscopy," *Biochemistry* 50, 7390-7404 (<http://pubs.acs.org/doi/abs/10.1021/bi2010703>).
- A49. Pokhrel, R., Service, R. J., **Debus, R. J.**, and Brudvig, G. W. (2013) "Mutation of Lysine 317 in the D2 Subunit of Photosystem II Alters Chloride Binding and Proton Transport," *Biochemistry* 52, 4758-4773 (<http://pubs.acs.org/doi/abs/10.1021/bi301700u>).
- A50. Service, R. J., Yano, J., Dilbeck, P. L., Burnap, R. L., Hillier, W., and **Debus, R. J.** (2013) "Participation of Glutamate-333 of the D1 Polypeptide in the Ligation of the Mn₄CaO₅ Cluster in Photosystem II," *Biochemistry* 52, 8452-8464 (<http://pubs.acs.org/doi/abs/10.1021/bi401339f>).
- A51. Service, R. J., Hillier, W., and **Debus, R. J.** (2014) "A Network of Hydrogen Bonds near the Oxygen-Evolving Mn₄CaO₅ Cluster of Photosystem II Probed with FTIR Difference Spectroscopy," *Biochemistry* 53, 1001-1017 (<http://pubs.acs.org/doi/abs/10.1021/bi401450y>).
- A52. **Debus, R. J.** (2014) "Evidence from FTIR Difference Spectroscopy That D1-Asp61 Influences the Water Reactions of the Oxygen-Evolving Mn₄CaO₅ Cluster of Photosystem II," *Biochemistry* 53, 2941-2955 (<http://pubs.acs.org/doi/abs/10.1021/bi500309f>).
- A53. Pokhrel, R., **Debus, R. J.**, and Brudvig, G. W. (2015) "Probing the Effect of Mutations of Asparagine 181 in the D1 Subunit of Photosystem II," *Biochemistry* 54, 1663-1672 (<http://pubs.acs.org/doi/abs/10.1021/bi501468h>).
- A54. Oyala, P. H., Stich, T. A., Debus, R. J., and Britt, R. D. (2015) "Ammonia Binds to the Dangler Manganese of the Photosystem II Oxygen-Evolving Complex," *J. Am. Chem. Soc.* 137, 8829-8837 (<http://pubs.acs.org/doi/abs/10.1021/jacs.5b04768>).
- A55. Vinyard, D. J., Askerka, M., **Debus, R. J.**, Batista, V. S. and Brudvig, G. W. (2016) "Ammonia Binding in the Second Coordination Sphere of the Oxygen-Evolving Complex of Photosystem II," *Biochemistry*, 55, 4432-4436 (<http://pubs.acs.org/doi/abs/10.1021/acs.biochem.6b00543>).

Book Chapters (numbering corresponds to that in UCR's eFile system)

- B1. Okamura, M. Y., **Debus, R. J.**, Kleinfeld, D. and Feher, G. (1982) "Quinone Binding Sites in Reaction Centers from Photosynthetic Bacteria," in *Function of Quinones in Energy Conserving Systems* (B. L. Trumpower, ed.) Academic Press, New York, pp. 299-317 (peer reviewed) (<http://www.sciencedirect.com/science/article/pii/B9780127012803500281>).
- B2. Jansson, C., **Debus, R. J.**, Osiewacz, H. D., Gurevitz, M. and McIntosh, L. (1987) "Genetic Modification of *psbA* Genes in the Cyanobacterium *Synechocystis* 6803," in *Plant Gene Systems and Their Biology* (J. L. Key and L. McIntosh, eds.) Alan R. Liss, Inc., New York, pp. 371-381 (peer reviewed).
- B3. Babcock, G. T., Barry, B. A., dePaula, J. C., El-Deeb, M., Petersen, J., **Debus, R. J.**, Sithole, I., McIntosh, L., Bowlby, N. R., Dekker, J. and Yocum, C. F. (1990) "Structures and Organization on the Oxidizing Side of Photosystem II," in *Current Research In Photosynthesis* (M. Baltscheffsky, ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands, Vol. I, pp. 239-246.
- B4. Ravnikar, P., Sithole, I., **Debus, R. J.**, Babcock, G. T. and McIntosh, L. (1990) "The Molecular Biology of Site-Directed Modification of Photosystem II in the Unicellular Cyanobacterium *Synechocystis* sp. PCC 6803," in *Current Research In Photosynthesis* (M. Baltscheffsky, ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands, Vol. III, pp. 499-507.
- B5. Barry, B. A., El-Deeb, M., Sithole, I., **Debus, R. J.**, McIntosh, L. and Babcock, G. T. (1990) "Structural Studies of the Stable Tyrosine Radical, Y_D⁺, in Photosystem II," in *Current Research In Photosynthesis* (M. Baltscheffsky, ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands, Vol. I, pp. 483-486.
- B6. **Debus, R. J.**, Nguyen, A. P. and Conway, A. B. (1990) "Identification of Ligands to Manganese and Calcium in Photosystem II by Site-Directed Mutagenesis," in *Current Research In Photosynthesis* (M. Baltscheffsky, ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands, Vol. I, pp. 829-832.

- B7. Chu, H.-A., Nguyen, A. P., and **Debus, R. J.** (1995) "An Improved Host Strain of *Synechocystis* sp. PCC 6803 for Introducing Site-Directed Mutations into the D1 Protein of Photosystem II," in *Photosynthesis: from Light to Biosphere* (P. Mathis, ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands, Vol. II, pp. 439-442.
- B8. Britt, R. D., Force, D. A., Campbell, K. A., Randall, D. W., Gilchrist, L. M., Jr., Clemens, K. L., Gingell, D. M., Peloquin, J. M., Pham, D. P., **Debus, R. J.** (1998) "Progress in Characterization of the Photosystem II Oxygen Evolving Complex Using Advanced EPR Methods", in *Spectroscopic Methods in Bioinorganic Chemistry* (E. I. Solomon and K. O. Hodgson, eds.), American Chemical Society, Washington, D. C., pp. 272-285 (peer-reviewed) (<http://pubs.acs.org/doi/abs/10.1021/bk-1998-0692.ch015>).
- B9. **Debus, R. J.**, Campbell, K. A., Pham, D. P., Hays, A.-M., A, Peloquin, J. M., and Britt, R. D. (1998) "Influence of D1-Glu189 on the Properties of Y_Z and the Manganese Cluster in Photosystem 2," in *Photosynthesis: Mechanisms and Effects* (G. Garab, ed.), Vol. II, pp. 1375-1378, Kluwer Academic Publishers, Dordrecht, The Netherlands.
- B10. Hundelt, M., Hays, A.-M. A., **Debus, R. J.**, and Junge, W. (1998) "The Mutation D1-D61N in PS II of *Synechocystis*: Retardation of ET From OEC $\rightarrow$ Y_Z^{ox} and No Effect on $Y_Z\rightarrow P_{680}^+$," in *Photosynthesis: Mechanisms and Effects* (G. Garab, ed.), Vol. II, pp. 1387-1390, Kluwer Academic Publishers, Dordrecht, The Netherlands.
- B11. Chu, H. A., Babcock, G. T., and **Debus R. J.** (2001) "Possible Ligation of the Mn Cluster in Photosystem II by the Carboxyl-Terminus of the D1 Polypeptide: An FTIR Study," in *PS2001 Proceedings: 12th International Congress on Photosynthesis*, CSIRO Publishing, Melbourne, Australia (published in the web: www.publish.csiro.au/PS2001), S05-P003, pp 1-4.
- B12. Hillier, W., McConnell, I., Singh, S., **Debus, R. J.**, Boussac, A. and Wydrzynski, T. (2008) "Substrate Water Oxygen Exchange in Photosystem II: Insights from Mutants and Ca vs. Sr Substitution," in *Photosynthesis. Energy from the Sun: 14th International Congress on Photosynthesis* (J. F. Allen, E. Gantt, J. H. Golbeck, and B. Osmond, eds.) pp. 427-430, Springer, Dordrecht, The Netherlands.

Review Articles (numbering corresponds to that in UCR's eFile system)

- C1. Babcock, G. T., Barry, B. A., **Debus, R. J.**, Hoganson, C. W., Atamian, M. McIntosh, L., Sithole, I. and Yocum, C. F. (1989) "Water Oxidation in Photosystem II: From Free Radical Chemistry to Multielectron Chemistry," *Biochemistry* **28**, 9557-9565 (Invited, Peer Reviewed) (<http://pubs.acs.org/doi/abs/10.1021/bi00451a001>).
- C2. **Debus, R. J.** (1992) "The Manganese and Calcium Ions of Photosynthetic Oxygen Evolution," *Biochim. Biophys. Acta (Bioenergetics)*, **1102**, 269-352 (Invited, Peer Reviewed) (<http://www.sciencedirect.com/science/article/pii/000527289290133M>).
- C3. **Debus, R. J.** (2000) "The Polypeptides of Photosystem II and their Influence on Manganese-Tyrosyl-Based Oxygen Evolution." In *Metal Ions in Biological Systems* (Sigel, A. and Sigel, H., eds.) Vol. 37, pp. 657-710, Marcel Dekker, New York, NY (Invited)
- C4. **Debus, R. J.** (2001) "Amino Acid Residues that Modulate the Properties of Tyrosine Y_Z and the Manganese Cluster in the Water Oxidizing Complex of Photosystem II," *Biochimica et Biophysica Acta (Bioenergetics)* **1503**, 164-186 (Invited, Peer Reviewed) (<http://www.sciencedirect.com/science/article/pii/S0005272800002218>).
- C5. **Debus, R. J.** (2005) "The Catalytic Manganese Cluster – II. Protein Ligation," in *Photosystem II: The Light-Driven Water:Plastoquinone Oxidoreductase* (Wydrzynski T. and Satoh, Ki., Eds.) Springer, Dordrecht, The Netherlands pp. 261-284 (Invited, Peer Reviewed).
- C6. **Debus, R. J.** (2008) "Protein Ligation of the Photosynthetic Oxygen-Evolving Center," *Coordination Chemistry Reviews* **252**, 244-258 (invited, Peer Reviewed) (<http://www.sciencedirect.com/science/article/pii/S001085450700224X>).
- C7. Messenger, J., **Debus, R.**, Dismukes, G. C. (2014) "Warwick Hillier: A Tribute," *Photosynthesis Research* **122**, 1-11 (Invited) (<http://link.springer.com/article/10.1007/s11120-014-0025-5/fulltext.html>).

- C8. **Debus, R. J.** (2015) "FTIR Studies of Metal Ligands, Networks of Hydrogen Bonds, and Water Molecules near the Active Site Mn_4CaO_5 Cluster in Photosystem II, *Biochimica et Biophysica Acta* 1847, 19-34 (Invited, Peer Reviewed)
(<http://www.sciencedirect.com/science/article/pii/S0005272814005337>).

Edited Journal Articles (numbering corresponds to that in UCRs eFile system)

- D1. Ravnikar, P. D., **Debus, R. J.**, Sevrinck, J., Saetaert, P. and McIntosh, L. (1989) "Nucleotide Sequence of a Second *psbA* Gene from the Unicellular Cyanobacterium *Synechocystis* 6803," *Nucleic Acids Res.* **17**, 3991.

Abstracts (numbering corresponds to that in UCR's eFile system)

- E1. Okamura, M. Y., **Debus, R. J.**, Isaacson, R. A. and Feher, G. (1980) "ENDOR of Reduced Ubisemiquinone in Iron-Free Reaction Centers from *Rb. sphaeroides*," *Fed. Proc., Fed. Am. Soc. Exp. Biol.* **39**, 1802.
- E2. **Debus, R. J.**, Okamura, M. Y. and Feher, G. (1981) "Dissociation and Reconstitution of the H Subunit from Reaction Centers from *Rb. sphaeroides*," *Biophys. J.* **33**, 19a.
- E3. **Debus, R. J.**, Okamura, M. Y. and Feher, G. (1984) "The Electron Transfer Rate from Q_A^- to Q_B in Iron-Depleted Reaction Centers from *Rb. sphaeroides* R-26.1," *Biophys. J.* **47**, 3a.
- E4. **Debus, R. J.**, Okamura, M. Y. and Feher, G. (1985) "Reconstitution of Fe-Depleted Reaction Centers from *Rhodospseudomonas sphaeroides* R-26.1 with Fe, Mn, Cu, and Zn," *Biophys. J.* **47**, 3a.
- E5. Lubitz, W., **Debus, R. J.**, Okamura, M. Y. and Feher, G. (1985) "Electron Nuclear Double Resonance of Ubisemiquinone in Reaction Centers from *Rb. sphaeroides* in which Fe was Replaced by Zn," *Biophys. J.* **47**, 3a.
- E6. Okamura, M. Y., Abresch, E. C., **Debus, R. J.** and Feher, G. (1985) "Hybridization of RC Subunits from Native and Herbicide-Resistant Strains of *Rhodospseudomonas sphaeroides*: Localization of the Herbicide Binding Site," *Biophys. J.* **47**, 3a.
- E7. Feher, G., Isaacson, R. A., **Debus, R. J.** and Okamura, M. Y. (1986) "The Superhyperfine Structure of ^{14}N in Iron-Depleted RCs from *Rb. sphaeroides* R-26.1 Reconstituted with ^{65}Cu ," *Biophys. J.* **49**, 585a.
- E8. Holten, D., Kirmaier, C., **Debus, R. J.**, Okamura, M.Y. and Feher, G. (1986) "Photochemistry in Iron-Depleted Reaction Centers from *Rb. sphaeroides* R-26.1," *Biophys. J.* **49**, 585a.
- E9. Jansson, C., **Debus, R. J.**, Osiewacz, H., Gurevitz, M. and McIntosh, L. (1987) "In-vitro Mutagenesis of *psbA* Genes in *Synechocystis* 6803," *J. Cell. Biochem.* **11B**, 14.
- E10. **Debus, R. J.**, Barry, B. A., Babcock, G. T. and McIntosh, L. (1988) "Site-Directed Mutagenesis Identifies the Specific Tyrosine Residues Shown to be Redox Components of Photosystem II," *Biophys. J.* **53**, 270a.
- E11. Barry, B. A., **Debus, R. J.**, Rodriguez, I. D., McIntosh, L. and Babcock, G. T. (1988) "Tyrosyl Radical Involvement in the Photosynthetic Oxygen-Evolving System," *Biophys. J.* **53**, 414a.
- E12. **Debus, R. J.**, Barry, B. A., Sithole, I., Babcock, G. T. and McIntosh, L. (1989) "Site-directed Mutagenesis Indicates that the Donor to P_{680}^+ in Photosystem II is Tyr-161 of the D1 Polypeptide," *Biophys. J.* **55**, 220a.
- E13. **Debus, R. J.**, Barry, B. A., Sithole, I., Babcock, G. T. and McIntosh, L. (1989) "Site-directed Mutagenesis Identifies the Two Tyrosine Residues Shown to be Redox Components of Photosystem II," *Photochem. Photobiol.* **49**, 84S.
- E14. McIntosh, L., Sithole, I., Barry, B. A., **Debus, R. J.**, Kakefuda, M., Bowlby, N. and Babcock, G. T. (1989) "Creation of Altered Oxygen-Evolving Photosystems Through Protein Engineering," *J. Cell. Biochem.* **13D**, 242.
- E15. Sithole, I., **Debus, R. J.**, Kakefuda, M., Babcock, G. T. and McIntosh, L. (1989) "Putative Manganese Binding Ligands in the Photosystem II Reaction Center of the Cyanobacterium *Synechocystis* 6803," *Plant Physiol.* **89**, 36S.
- E16. McIntosh, L., Sithole, I., Barry, B. A., **Debus, R. J.**, Kakefuda, M., Bowlby, N. and Babcock, G. T. (1989) "Functional Alterations of the Photosystem II Core," *Physiologia Plantarum* **76**, A26.
- E17. Babcock, G. T., Barry, B. A., **Debus, R. J.**, Hoganson, C. W., Sithole, I., McIntosh, L., El-Deeb, M., Bender, C., Petersen, J., Dekker, J., Bowlby, N. R. and Yocum, C. F. (1989) "Redox Reactions Preceding Oxygen Evolution," *Physiologia Plantarum* **76**, A15.

- E18. **Debus, R. J.**, Nguyen, A. P. and Conway, A. B. (1989) "Site-directed Mutagenesis Employed to Identify the Protein Residues that Ligand Manganese and Calcium in Photosystem II," *Physiologia Plantarum* **76**, A141.
- E19. **Debus, R. J.**, Conway, A. B. and Nguyen, A. P. (1990) "Identification of Ligands to Manganese and Calcium in Photosystem II by Site-Directed Mutagenesis," *Biophys. J.* **57**, 566a.
- E20. **Debus, R. J.**, Nguyen, A. P., Conway, A. B. and Chu, H.-A. (1991) "Identification of Manganese or Calcium Ligands in Photosystem II by Site-Directed Mutagenesis," *Biophys. J.* **59**, 143a.
- E21. Boerner, R. J., Nguyen, A. P., Conway, A. B., Bixby, K. A., **Debus, R. J.** and Barry, B. A. (1991) "The Use of Site-Directed Mutagenesis in *Synechocystis* to Identify Manganese Ligands in Photosystem II," *Biophys. J.* **59**, 145a.
- E22. **Debus, R. J.** (1991) "The Manganese and Calcium Ions of Photosynthetic Oxygen Evolution," *Photochem. Photobiol.* **53**, 97s.
- E23. Boerner, R. J., Nguyen, A. P., Barry, B. A. and **Debus, R. J.** (1992) "Characterization of Two Site-Directed Mutations that were Created at a Potential Manganese Ligand Site in the Water Splitting Complex," *Biophys. J.* **61**, A102.
- E24. Boerner, R. J., Nguyen, A. P., Barry, B. A. and **Debus, R. J.** (1992) "Aspartate-170 of the D1 Polypeptide Influences the Assembly and/or Stability of the Manganese Cluster in Photosystem II," *Photosynth. Res.* **34**, 145.
- E25. Boerner, R. J., Bixby, K. A., Nguyen, A. P., Noren, G. H., **Debus, R. J.** and Barry, B. A. (1993) "Removal of the Tyrosine Radical, D⁺, Affects the Structure or Redox Properties of Tyrosine Z in Manganese Depleted Photosystem II Particles from *Synechocystis* sp. PCC 6803," *Biophys. J.* **64**, A18.
- E26. Chu, H.-A., Nguyen, A. P. and **Debus, R. J.** (1993) "Residues of the D1 Polypeptide that Influence the Assembly or Stability of the Manganese Cluster or the Binding of Calcium in Photosystem II," *Biophys. J.* **64**, A216.
- E27. Chu, H.-A., Nguyen, A. P. and **Debus, R. J.** (1994) "Directed Mutagenesis of the Photosynthetic Oxygen Evolving Complex," *Photochem. Photobiol.* **59**, 82S.
- E28. Bernard, M. T., MacDonald, G. M., Nguyen, A. P., **Debus, R. J.** and Barry, B. A. (1995) "A Difference Infrared Study of Hydrogen Bonding to the Z⁺ Radical of Photosystem II," *Biophys. J.* **68**, A92.
- E29. Chu, H.-A., Nguyen, A. P. and **Debus, R. J.** (1995) "Amino Acid Residues that Influence the Binding of Manganese or Calcium to Photosystem II," *Photosynth. Res.*, Supplement 1, 98.
- E30. Bernard, M. T., MacDonald, G. M., Nguyen, A. P., **Debus, R. J.**, and Barry, B. A. (1995) "A Difference Infrared Study of Hydrogen Bonding to the PSII Z Tyrosyl Radical," *Photosynth. Res.*, Supplement 1, 100.
- E31. Kim, S., **Debus, R. J.**, and Barry, B. A. (1997) "Chemical Complementation Identifies a Proton Acceptor of Redox-Active Y_D in Photosystem II," *Biophys. J.* **72**, A249.
- E32. Clausen, J., Winkler, S., Hays, A.-M. A., Hundelt, M., **Debus, R. J.**, and Junge, W. (2001) "Mutations D1-E189K, R and Q of *Synechocystis* sp. PCC6803 are Without Influence on ns-to- μ s Electron Transfer between OEC-YZ-P680 in Photosystem II," *Photosynth. Res.* **69**, 102-103.
- E33. Faller, P., **Debus, R. J.**, Brettel, K., Sugiura, M., Rutherford, A. W. and Boussac, A. (2001) "Rapid Electron Donation from TyrosineD to P680⁺ in Photosystem II," *Photosynth. Res.* **69**, 103.
- E34. **Debus, R. J.**, Chu, H.-A., Campbell, K. A., Gregor, W., Babcock, G. T., and Britt, R. D. (2001) "Ligation of the Mn Cluster in Photosystem II by Asp170 of the D1 Polypeptide: ESEEM and FTIR Studies of the D1-Asp170His Mutant," *Photosynth. Res.* **69**, 125.
- E35. Chu, H. A., Hillier, W., Law, N. A., Sackett, H., **Debus, R. J.** and Babcock, G. T. (2001) "Identification of a Mn-O-Mn Cluster Vibrational Mode of the Oxygen-Evolving Complex in Photosystem II by Low-Frequency FTIR Spectroscopy," *Photosynth. Res.* **69**, 125.
- E36. Chu, H.-A., Babcock, G. T. and **Debus, R. J.** (2002) "Possible Ligation of the Manganese Cluster in Photosystem II by the C-Terminus of the D1 Protein," *Biophys. J.* **82**, 518a.
- E37. **Debus, R. J.**, Walker, L. M., Strickler, M. A., and Hillier, W. (2004) "FTIR Studies of the Water Oxidizing Complex in Photosystem II," in *13th International Congress on Photosynthesis*, Allen Press, Inc., Lawrence, KS (published on the web: <http://abstracts.co.allenpress.com/pweb/pwc2004/document/?ID=43645>).
- E38. **Debus, R. J.**, Strickler, M. A., Walker, L. M., and Hillier, W. (2005) "FTIR Studies of the Water-Oxidizing Complex in Photosystem II," *Biophys. J.* **89**, B605.

- E39. **Debus, R. J.** (2007) "Oxygen Evolution," *Photosynth. Res.* **91**, 133.
- E40. Hiller, W., Singh, S., Boussac, A., **Debus, R. J.**, McConnell, I., and Wydrzynski, T. (2007) "Substrate Water Binding in the OEC: The Message is Clear from Flashes, Mutants, and Strontium Effects," *Photosynth. Res.* **91**, 177.

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National Institutes of Health, R01 GM43496; "Directed Mutagenesis of Photosynthetic Oxygen Evolution" (R. J. Debus, PI) \$598,386 Direct Costs, 12/01/1989 – 11/30/1994

National Institutes of Health, R01 GM43496; "Directed Mutagenesis of Photosynthetic Oxygen Evolution" (R. J. Debus, PI) \$565,074 Direct Costs, 07/1/1995 – 06/30/1999

National Science Foundation, MCB 0111065, "Mechanism of Photosynthetic Oxygen Evolution" (R. J. Debus, PI) \$360,000 Total Award, 08/01/2001 – 07/31/2004

National Institutes of Health, R01 GM66136; "EPR & Optical Studies of Photosynthetic Water Oxidation" (R. J. Debus, PI) \$746,467 Total Award, 08/02/2002 – 07/31/2006

National Institutes of Health, R01 GM76232; "FTIR Studies of Photosynthetic Oxygen Evolution" (R. J. Debus, PI) \$847,048 Total Award, 07/03/2006 – 05/31/2010

Department of Energy, Office of Energy Biosciences, DE-FG01-10ER16191; "FTIR Studies of Photosynthetic Oxygen Production (R. J. Debus, PI) \$499,725 Total Award, 09/01/2010 – 08/31/2013

Current Funding Support

Department of Energy, Office of Energy Biosciences, DE-SC0005291, "FTIR Studies of Photosynthetic Oxygen Production (R. J. Debus, PI) \$499,177 Total Award, 09/01/2014 – 08/31/2017

Synergistic Activities (since 2001)

Editorial Board, Photosynthesis Research, 1995-present.

Member, NSF Molecular Biophysics Grant Review Panel, 2001-2002.

Member, NSF Molecular Biochemistry Grant Review Panel, 2002

Vice Chair, Gordon Research Conference on Photosynthesis, 2011

Chair, Gordon Research Conference on Photosynthesis, 2012

Invited Presentations at International Meetings (since 2000)

1. "Directed Mutagenesis Studies of Photosynthetic Oxygen Evolution," Jacques Monod Conference on Structure and Function in Oxygenic Photosynthesis, November 18-22, 2000, Roscoff, France (*Invited Speaker*).
2. "Amino acid residues that modulate the properties of the Mn cluster in PSII," The 12th International Congress on Photosynthesis, Electron Transfer Satellite Meeting, August 15-18, 2001, Couran Cove, Australia (*Invited Speaker*).
3. "FTIR Studies of the Photosynthetic Water Oxidizing Complex: Possible Ligation of the Manganese Cluster by the C-Terminus of the D1 Polypeptide," 314th WE-Heraeus Seminar: Water Oxidation in Photosynthesis, November 22-25, 2003, Bad Honnef, Germany (*Invited Speaker*).
4. "FTIR Studies of the Water Oxidizing Complex," Satellite Conference on Photosynthesis and Post-Genomic Era," August 25-28, 2004, Trois-Rivières, Québec, Canada (*Invited Speaker*).
5. "FTIR Studies of the Water Oxidizing Complex in Photosystem II," 13th International Congress on Photosynthesis, August 29-September 3, 2004, Montréal, Québec, Canada (*Poster and Session Co-Chair of Session Entitled "Type II Reaction Centers: Structure"*).

6. “FTIR Studies of the Water Oxidizing Complex in Photosystem II,” Gordon Research Conference on Photosynthesis, Bryant University, Smithfield, Rhode Island, July 3-8, 2005 (*Co-Discussion Leader of Special Session Entitled “Reconciling Spectroscopy and PSII Structural Models”*).
7. “Protein Ligands of the PSII Manganese Complex: Mutagenesis and FTIR,” Sonder Forschungs Bereich 498 on Protein-Cofactor Interactions in Biological Processes: Workshop on Photosystem II, Freie University, Berlin, Germany, May 4-6, 2006 (*Invited Speaker*).
8. “FTIR Studies of the Oxygen-Evolving Complex in Photosystem II,” Gordon Research Conference on Metals in Biology, Four Points Sheraton: Harbortown, Ventura, California, January 28 – February 2, 2007 (*Invited Speaker*).
9. “FTIR Studies of the Protein Environment of the Oxygen-Evolving Complex,” Royal Society Discussion Meeting, “Revealing How Nature uses Sunlight to Split Water,” The Royal Society, London, United Kingdom, April 23-25, 2007 (*Invited Speaker*).
10. Novartis Foundation Discussion Meeting, “Revealing How Nature Uses Sunlight to Split Water,” The Royal Society of London, United Kingdom, April 25, 2007 (*Invited Participant and Discussion Co-Leader for the session, “Compatibility of Site Directed Mutagenesis with OEC Structure and S-state Cycling*).
11. “Oxygen Evolution,” The 14th International Congress on Photosynthesis in 2007, Glasgow, United Kingdom, July 22-27, 2007 (*Invited Plenary Lecturer*).
12. “Evidence from FTIR Difference Spectroscopy for a Network of Hydrogen Bonds Near the Oxygen Evolving Mn₄Ca cluster of Photosystem II,” The 70th Okazaki Conference: Molecular Mechanism of Photosynthetic Energy Conversion: The Present Research and Future Prospects, Okazaki, Japan, December 4-6, 2010 (*Invited Speaker*).
13. “A Network of Hydrogen Bonds Near the Mn₄Ca Cluster of Photosystem II,” Gordon Research Conference on Protons & Membrane Reactions, Four Points Sheraton: Harbortown, Ventura, California, February 19-24, 2012 (*Invited Speaker*).
14. “FTIR Studies of H-bond networks and water molecules near the Mn₄CaO₅ cluster of Photosystem II,” Umeå Renewable Energy Meeting 2014, March 17-19, 2014, Umeå University, Umeå, Sweden (*Invited Speaker*).
15. “Oxygen Evolution,” Gordon Research Conference on Photosynthesis, August 10-15, 2014, Mount Snow Resort, West (*Overview talk - Invited Session Chair*).
16. “FTIR studies of the substrate/water reactions of the Mn₄CaO₅ cluster of Photosystem II”, 79th Harden Conference: Oxygen Evolution and Reduction - Common Principles, April 16–20 2016, Grauer Bär, Innsbruck, Austria (*Invited Oral Presentation*).
17. “FTIR studies of Water Oxidation in Photosystem II,” The 17th International Congress on Photosynthesis Research: Photosynthesis in a Changing World, August 7-12, 2016, MECC, Maastricht, The Netherlands (*Invited Symposium Speaker*).

Li Fan

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Education:

Michigan State University, East Lansing, Michigan, *Ph. D. in Biochemistry*, 2000.
Bowling Green State University, Bowling Green, Ohio, *M. S. in Chemistry*, 1993.
Beijing University, Beijing, China, *B. S. in Chemistry*, 1987.

Professional Experience:

University of California at Riverside, Department of Biochemistry, Riverside, California	
Associate Professor	2016-Present
Assistant Professor	2009- 2016
Director of Macromolecular X-ray crystallography core facility	2009-present

The Scripps Research Institute, Department of Molecular Biology, La Jolla, California	
Senior Research Associate	2007- 2008
Research Associate	2000 – 2007

Manuscripts in Preparation (*corresponding author)

1. K. DuPrez, I. Wang, and **Li Fan*** "Crystal structure of archaeal XPB associated with an endonuclease complex".
2. Binyuan Zhai, K. Duprez, T. I. Doukov, Jinfeng Ni, Lichuan Gu, Yulong Shen*, **Li Fan*** "A novel P-loop ATPase conserved in archaea is associated with Holliday junction processing and essential for cell viability"

Manuscripts Submitted (*corresponding author)

1. K. DuPrez, I. Wang, E. Hilario, **Li Fan*** "ATP-Driven domain rotation in XPB helicase supports a unified DNA unwinding mechanism for transcription and DNA repair".

Publications (22 listed out of 25, H-index 11) (*corresponding author)**Review articles**

D3. **Li Fan*** and K. DuPrez (2015). "XPB: an unconventional SF2 DNA helicase" *Prog. Biophys. Mol. Biol.* 117(2-3):174-181. (Impact factor: 3.377). PMID: 25641424.

<http://www.sciencedirect.com/science/article/pii/S0079610714001904>

D2. **Li Fan*** (2013). "How two helicases work together within the TFIIH complex: a perspective from structural studies of XPB and XPD helicases". *Frontier in Biology* 8(4): 363-368.

<http://link.springer.com/article/10.1007/s11515-013-1259-x>

D1. J. J. Perry, **Li Fan**, and J. A. Tainer (2007). "Developing master keys to brain pathology, cancer and aging from the structural biology of proteins controlling reactive oxygen species and DNA repair." *Neuroscience* 145(4): 1289-1299.

<http://www.sciencedirect.com/science/article/pii/S0306452206013893>

Book chapters

C1. **Li Fan**, R. S. Williams, D. S. Shin, B. R. Chapados, and J. A. Tainer. (2007). "Master keys to DNA replication, repair, and recombination from the structural biology of enzymes from thermophiles". in **Thermophiles** edited by Frank Robb, Garo Antranikian, Arnold Driessen, and Dennis Grogan. CRC, Sept. 27, 2007.

Journal articles

18. K. DuPrez, M. Scranton, L. Walling*, and **Li Fan*** (2016). "Structure insights for the chaperone activity enhancement by mutation K354E in tomato acidic leucine aminopeptidase". *Acta Cryst. D* 72: 694-702. doi:10.1107/S205979831600509X. (impact factor: 2.512). PMID: 27139632
17. E. Hilario, B. G. Caulkins, Y.M.M. Huang, Chang, Chia-en; M. F. Dunn*; L. J. Mueller*; **Li Fan*** (2016). "Visualizing the tunnel in tryptophan synthase with crystallography: Insights into a selective filter for accommodating indole and rejecting water" *Biochimica et Biophysica Acta - Proteins and Proteomics* 1864 (3): 268-279. (Impact factor: 3.191). PMID: 26708480
<http://www.sciencedirect.com/science/article/pii/S1570963915003052>
16. B. G. Caulkins, C. Yang, E. Hilario, **Li Fan**, M. F. Dunn, and L. J. Mueller* (2015). "Catalytic Roles of β Lys87 in Tryptophan Synthase: ^{15}N Solid State NMR Studies" *BBA-Proteins and Proteomics*. (Impact factor: 3.191). PMID: 25688830
<http://www.sciencedirect.com/science/article/pii/S0079610714001904>
15. B. G. Caulkins, B. Bastin, C. Yang, T. J. Neubauer, R. P. Young, E. Hilario, Y. M. Huang, C. Chang, **Li Fan**, M. F. Dunn, M. J. Marsella, and L. J. Mueller* (2014). "Protonation States of the Tryptophan Synthase Internal Aldimine Active Site from Solid-State NMR Spectroscopy: Direct Observation of the Protonated Schiff Base Linkage to Pyridoxal-5'-Phosphate". *J. Am. Chem. Soc.* 136 (37): 12824-12827. (impact factor: 11.444). PMID: 25148001.
<http://pubs.acs.org/doi/pdf/10.1021/ja506267d>
14. K. DuPrez, M. Scranton, L. Walling, and **Li Fan*** (2014). "Crystal structure of tomato wound-induced leucine aminopeptidase sheds light on substrate specificities". *Acta Cryst. D. Biol Crystallogr* 70: 1649-1658. (impact factor: 2.680). PMID: 24914976
<http://journals.iucr.org/d/issues/2014/06/00/lv5057/lv5057.pdf>
13. D. Niks†, E. Hilario†, A. Dierkers, H. Ngo, D. Borchardt, T. J. Neubauer, **Li Fan***, L. J. Mueller*, and M. F. Dunn* (2013) "Allostery and substrate channeling in the tryptophan synthase bienzyme complex: evidence for two subunit conformations and four quaternary states. *Biochemistry*. 52(37): 6396-6411. †first authors. (impact factor: 3.377) PMID: 23952479
<http://pubs.acs.org/doi/pdf/10.1021/bi400795e>
12. E. Hilario, Y. Li, Y. Nobumori, X. Liu and **Li Fan*** (2013). "Structure of the C-terminal half of human XPB helicase and the impact of disease-causing mutation XP11BE". *Acta Cryst. D. Biol Crystallogr* 69: 237-246. (impact factor: 7.232). PMID: 23385459
<http://journals.iucr.org/d/issues/2013/02/00/mn5013/index.html>
11. Y. Nobumori, G. P. Shouse, **Li Fan** and X. Liu*. (2012). "HEAT-repeat 1 is required for B56 γ -PP2A holoenzyme assembly and tumor suppressive function". *J. Biol. Chem.* 287: 11030-11036. (impact factor: 5.382) PMID: 22315229.
<http://www.jbc.org/content/287/14/11030.full.pdf+html>
10. E. Hilario, Y. Li, D. Niks and **Li Fan*** (2012). "Structure of a *Xanthomonas* general stress protein involved in citrus canker reveals its flavin-binding property". *Acta Cryst. D. Biol Crystallogr* 68: 846-853. (impact factor: 14.103) PMID: 22751670
<http://journals.iucr.org/d/issues/2012/07/00/lv5018/lv5018.pdf>
9. E. Hilario, F. Martin, M.C. Bertolini, and **Li Fan*** (2011). "Crystal structures of *Xanthomonas* small heat shock protein provide a structural basis for active molecular chaperone oligomers." *J. Mol. Biol.* 408(1): 74-86. (impact factor: 4.001) PMID: 21315085

<http://journals.iucr.org/d/issues/2012/07/00/lv5018/lv5018.pdf>

8. Y. Matsushima, C.L. Farr, **Li Fan**, and L.S. Kaguni (2008). "Physiological and biochemical defects in carboxyl-terminal mutants of mitochondrial DNA helicase." *J. Biol. Chem.* 283: 23964-71. <http://www.jbc.org/content/283/35/23964.full.pdf+html>

7. **Li Fan**, J. O. Fuss, Q. J. Cheng, A. S. Arvai, M. Hammel, V. A. Roberts, P. K. Cooper and J. A. Tainer. (2008). "XPD Helicase Structures and Activities: Insights into the Cancer and Aging Phenotypes from XPD Mutations". *Cell* 133: 789-800.
<http://www.sciencedirect.com/science/article/pii/S0092867408005606>
"Must read" Recommended by Faculty of 1000 Biology
<http://www.f1000biology.com/article/id/1115102>
Highlighted by C&E News Enzyme Structure And Mutations Reveal Disease Roles
http://pubs.acs.org/subscribe/journals/cen/86/i23/toc/toc_i23.html#sci

6. **Li Fan** and V. A. Roberts (2006). "Complex of linker histone H5 with the nucleosome and its implications for chromatin packing." *Proc. Natl. Acad. Sci. USA* 103: 8384-8389.
<http://www.pnas.org/content/103/22/8384.full>

5. **Li Fan**, A. Arvai, P. K. Cooper, S. Iwai, F. Hanaoka, and J. A. Tainer (2006). "Conserved XPB core structure and motifs for DNA unwinding: implications for pathway selection of transcription or excision repair." *Mol. Cell* 22(1): 27-37.
<http://www.sciencedirect.com/science/article/pii/S1097276506001195>
Recommended by Faculty of 1000 Biology
<http://www.f1000biology.com/article/16600867/>.
Commentary review by Timmins J & McSweeney S. "XPB: An essential helicase involved in both transcription and repair of DNA." *Mol Cell.* 2006 Apr 21;22(2):149-50.

4. **Li Fan**, S. Kim, C. L. Farr, K. T. Schaefer, K. M. MacLauchlan, J. A. Tainer, and L. S. Kaguni (2006) "A novel processive mechanism for DNA synthesis revealed by structure, modeling and mutagenesis of the accessory subunit of human mitochondrial DNA polymerase". *J.Mol. Biol.* 358: 1229-1243. <http://www.sciencedirect.com/science/article/pii/S0022283606002889>
Ranked in the top 20 most downloaded JMB papers from April-June 2006
http://top25.sciencedirect.com/index.php?cat_id=8&subject_area_id=3&journal_id=00222836)

3. A. S. Hearn, **Li Fan**, J. R. Lepock, J. P. Luba, W. B. Greenleaf, D. E. Cabelli, J. A. Tainer., H. S. Nick, and D. N. Silverman. (2004) "Amino-acid substitution at the dimeric interface of human manganese superoxide dismutase". *J. Biol. Chem.* 279 (7): 5861-5866.
<http://www.jbc.org/content/279/7/5861.long>

2. **Li Fan** and L. S. Kaguni (2001). "Multiple regions of subunit interaction in Drosophila mitochondrial DNA polymerase: three functional domains in the accessory subunit." *Biochemistry.* 40(15):4780-4791. <http://pubs.acs.org/doi/pdf/10.1021/bi010102h>

1. **Li Fan**, P. S. Sanschagrin, L. S. Kaguni, and L. A. Kuhn (1999). "The accessory subunit of mitochondrial DNA polymerase shares structural homology with aminoacyl-tRNA synthetases: implications for a dual role as a primer recognition factor and processivity clamp." *Proc. Natl. Acad. Sci. USA.* 96: 9527-9532. <http://www.pnas.org/content/96/17/9527.full>

- E1. V. A. Roberts and **Li Fan** (2002). "Predicting DNA/Protein interactions with DOT". *Protein Science*, 11(suppl.1). (Abstract).

Grants, Honors and Awards

2015-2020 NIH grant 1R01GM108893-01A1 "Investigating the role of XPB helicase in DNA nucleotide excision repair" \$1,624,416. Sole-PI.

2015-2016 University of California Regents Faculty Development Award (\$9,000).

2011-2016 NIH grant R01GM097569 (PI: L. J. Mueller) "Chemically-Rich Structure and Dynamics in the Active Site of Tryptophan Synthase" \$1,872,803 total cost. Co-PI (\$225,000 direct cost)

2012-2016 US Department of Agriculture AES/RSAP award at UCR "Structural biology of citrus canker disease". \$45,000. Sole PI.

2012-2013 Hellman Scholar, Hellman Fellowship Foundation, USA. (\$30,000)

2012 Recent Alumni Award, College of Natural Sci. Alumni Association, Michigan State Univ.

2012, 2013, 2014, 2015 Academic Senate Omnibus Travel Award, UCR.

Honorable Guest Professor (May 09, 2011), Central South University, Changsha, China.

R. Gaurth Hansen Award (2011) for outstanding alumni at early academic career, 50th anniversary of Department of Biochemistry and Molecular Biology, Michigan State University

Outstanding Graduate Student Award for Excellence in Research, Scholarship and Teaching (2000), Department of Biochemistry, Michigan State University, Michigan.

Graduate travel award (1999), College of Natural Sciences, Michigan State University, Michigan.

Professional Association Memberships

American Crystallography Association, Advanced American Association of Science, Protein Society, American Pharmaceutical Scientists Society.

Structural coordinates (12) in PDB hold prior publication

1. Hilario, E. , Niks, D. , Dunn, M. F. , Mueller, L. J. , **Fan, L.** 2012. Tryptophan synthase in complex with alpha aminoacrylate E(A-A) form and the F9 inhibitor in the alpha site.
(<http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4hn4>)
2. Hilario, E. , Niks, D. , Dunn, M. F. , Mueller, L. J. , **Fan, L.** 2012. Crystal structure of Tryptophan Synthase at 1.45 Å resolution in complex with 2-aminophenol quinonoid in the beta site and the F9 inhibitor in the alpha site.
(<http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4hpi>)
3. Hilario, E. , Niks, D. , Dunn, M. F. , Mueller, L. J. , **Fan, L.** 2012. Crystal structure of Tryptophan Synthase at 1.65 Å resolution in complex with alpha aminoacrylate E(A-A) and benzimidazole in the beta site and the F9 inhibitor in the alpha site.
(<http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4hpx>.)
4. Hilario, E. , Niks, D. , Dunn, M. F. , Mueller, L. J. , **Fan, L.** 2012. The crystal structure of Salmonella typhimurium Tryptophan Synthase at 1.30 Å complexed with N-(4'-TRIFLUOROMETHOXYBENZENESULFONYL)-2-AMINO-1-ETHYLPHOSPHATE (F9) inhibitor in the alpha site, internal aldimine.
(<http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4ht3>)
5. Hilario, E. , Niks, D. , Dunn, M. F. , Mueller, L. J. , **Fan, L.** 2013. Crystal structure of Tryptophan Synthase from Salmonella typhimurium with 2-aminophenol quinonoid in the beta site and the F6 inhibitor in the alpha site.
(<http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4kkx>)

6. Hilario, E., Caulkins, B.G., Young, R.P., Dunn, M.F., Mueller, L.J., **Fan, L.** 2015. Crystal structure of Tryptophan Synthase from *Salmonella typhimurium* in complex with N-(4'-trifluoromethoxybenzoyl)-2-amino-1-ethylphosphate (F6F) inhibitor in the alpha-site and beta-site. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4y6g>
7. Hilario, E., Caulkins, B.G., Young, R.P., Niks, D., Dunn, M.F., Mueller, L.J., **Fan, L.** 2015. Crystal structure of Tryptophan Synthase from *Salmonella typhimurium* in complex with N-(4'-trifluoromethoxybenzoyl)-2-amino-1-ethylphosphate (F6) inhibitor in the alpha and beta-sites. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4wx2>
8. Hilario, E., Caulkins, B.G., Young, R.P., Niks, D., Dunn, M.F., Mueller, L.J., **Fan, L.** 2015. Crystal structure of Tryptophan Synthase from *Salmonella typhimurium* in complex with 2-([4-(Trifluoromethoxy)Phenyl]Sulfonyl)Amino)Ethyl Dihydrogen Phosphate (F9F) inhibitor in the alpha site and ammonium ion in the metal coordination site. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4xug>
9. Hilario, E., Caulkins, B.G., Young, R.P., Dunn, M.F., Mueller, L.J., **Fan, L.** 2015. Tryptophan Synthase from *Salmonella typhimurium* in complex with two molecules of N-(4'-trifluoromethoxybenzoyl)-2-amino-1-ethylphosphate (F6F) inhibitor in the alpha-site and a single F6F molecule in the beta-site at 1.54 Angstrom resolution. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=4zqc>
10. Hilario, E., Caulkins, B.G., Young, R.P., Niks, D., Dunn, M.F., Mueller, L.J., **Fan, L.** 2015. Tryptophan Synthase from *Salmonella typhimurium* in complex with a single molecule of 2-([4-(trifluoromethoxy)phenyl]carbonyl)amino)ethyl dihydrogen phosphate (F6) in the alpha-site. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=5bw6>
11. Hilario, E., Caulkins, B.G., Young, R.P., Dunn, M.F., Mueller, L.J., **Fan, L.** 2015. Crystal structure of Tryptophan Synthase from *Salmonella typhimurium* in complex with F9 ligand and the product L-Tryptophan in the beta-site. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=5cgg>
12. DuPrez, K.T., Hilario, E., Wang, I., Fan, L. 2015. S. tokodaii XPB II crystal structure at 3.0 Angstrom resolution. <http://www.rcsb.org/pdb/search/structidSearch.do?structureId=5cun>

Published structural coordinates (12) in PDB.

1. Duprez, K., Scranton, M., Walling, L., **Fan, L.** 2013. Crystal Structure Analysis of the Acidic Leucine Aminopeptidase of Tomato. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=4KSI>)
2. Hilario, E., Li, Y., **Fan, L.** 2012. Crystal structure of the general stress FMN/FAD binding protein from the phytopathogen *Xanthomonas citri*. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=3U34>)
3. Hilario, E., Li, Y., **Fan, L.** 2012. Crystal structure of the general stress FMN/FAD binding protein from the phytopathogen *Xanthomonas citri*. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=3U35>)
4. Hilario, E., Li, Y., **Fan, L.** 2013. Crystal structure of the C-terminal domain of human XPB/ERCC-3 excision repair protein at 1.80 Å. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=4ERN>)
5. **L. Fan** and J. A. Tainer. Crystal Structure of the N-terminal half of Archaeoglobus Fulgidus XPB. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=2FZ4>)
6. **L. Fan**, A.S. Arvai, J.A. Tainer. Structure of C-terminal domain of Archaeoglobus fulgidus XPB. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=2FZL>)

7. **L. Fan**, A.S. Arvai, J.A. Tainer. Structure of Archaeoglobus Fulgidis XPB. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=2FWR>).
8. **L. Fan**, A.S. Arvai, J.A. Tainer. "XPD_Helicase" (<http://www.rcsb.org/pdb/explore/explore.do?structureId=3CRV>)
9. **L. Fan**, A.S. Arvai, J.A. Tainer. "XPD_APO" (<http://www.rcsb.org/pdb/explore/explore.do?structureId=3CRW>)
10. **L. Fan**, C.L. Farr, L.S. Kaguni, J.A. Tainer. Crystal Structure of human DNA polymerase gamma accessory subunit. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=2G4C>).
11. **L. Fan**, A.S. Hearn, D.N. Silverman, J.A. Tainer. Crystal Structure of human MnSOD Y166F mutant. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=1PL4>).
12. **L. Fan**, A.S. Hearn, D.N. Silverman, J.A. Tainer. Crystal structure of human mnsod H30N, Y166F mutant. (<http://www.rcsb.org/pdb/explore/explore.do?structureId=1PM9>).

Conference and Seminar Presentations:

- 06/13-17/2016 Poster presentation at the 2016 Cold Spring Harbor Asia Conference on DNA metabolism, Genomic Stability and Disease at Suzhou, China. Title: "Structural and functional study of a novel ATPase associated with Holiday junction resolvase Hjc".
- 05/26-29/2016 Oral presentation at the 2016 International Conference on Nucleic Acid-Protein Chemical and Structural Biology for Novel Drug Discovery at Chengdu, China. Title: "Identification and characterization of a novel RuvB-like ATPase from *S. Islandicus*"
- 03/15/2015 Session Chair and Oral presentation at 22nd West Coast Protein Crystallography Workshop, Monterey, CA. Title: "Structural evidence supporting XPB helicase as a molecular wrench".
- 02/08/2015 Poster presentation at Gordon Research Conference of Mammalian DNA Repair, Ventura, California. Title: "Structural evidence supporting XPB helicase as a molecular wrench".
- 02/15/2014 Oral presentation at International Fusion conference of Dynamic Structures in DNA Damage Responses and Cancer, Cancun, Mexico. Title: "Structural study of XPB helicase: insight into molecular mechanism of DNA unwinding and impact of disease-causing mutations"
- 10/04/2013 Invited lecture at Molecular and Computational Biology program at University of Southern California (USC). Title: "Structural study of XPB helicase: insight into molecular mechanism of DNA unwinding and impact of disease-causing mutations".
- 03/25/2013 Invited lecture at School of Life Sciences, Shangdong University, Jinan, China. Title: "How two helicases work together within the TFIIH complex, a perspective from structural studies of XPB and XPD helicases".
- 03/25/2013 Invited lecture at State Key Laboratory of Microbial Technology, Shangdong University, Jinan, China. Title: "Structural biology of citrus canker: structural and functional studies on Xanthomonas proteins important for the disease".
- 03/22/2013 Oral presentation at BIT's 6th Annual World Protein and Peptide Conference 2013 at Suzhou, China. Title: "Crystal structures of Xanthomonas small heat shock protein provide a structural basis for active molecular chaperone oligomers".
- 03/17/2013 Poster presentation at the West Coast Protein Crystallography Workshop XXI in Monterey, CA. March 16 - 21, 2013. Title: "The crystal structure of C-terminal half of the human XPB helicase at 1.8 Angstroms and the impact of the genetic disease-causing mutation XP11BE".

11/30/2012 Invited lecture at Department of Botany and Plant Sciences and Center for Plant Cell Biology, University of California Riverside. Title: "Structural biology of citrus canker: structural and functional studies on *Xanthomonas* proteins important for the disease".

05/10/2011 Invited lecture at Institute of Cancer Research, Central South University, Changsha, China. Title: "Structural biology of XPB and XPD in nucleotide excision repair and insights into clinical mutations in cancer and aging".

05/09/2011 Distinguished lecture at Central South University, Changsha, China. Title: "Genome-wide structural and functional studies on *Xanthomonas axonopodis* pv *citri* (Xac)-citrus infections"

04/26/2011 Oral presentation at the 2nd International Symposium on Enzymes & Biocatalysis-2011 in Dalian, China. Title: "Structural Basis of Disease Causing Mutation G47R at the ATP Binding Site of DNA Repair Helicase XPD".

04/21/2011 Keynote speaker at 50th anniversary of Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, MI. Title: "Helicases are not built the same: crystal structures of archaeal XPB and XPD helicases reveal the "transmission" and "driving wheel" of TFIIH to open damaged DNA for DNA repair".

04/07/2011 Invited lecture at Department of Chemistry and Biochemistry, California State University, Fullerton, California. Title: "Genome-wide structural and functional studies on *Xanthomonas axonopodis* pv *citri* (Xac)-citrus infections"

11/17/2010 Invited Seminar for Environmental Toxicology Seminar Series 2010 Fall, UCR. Title: "Helicases are not built the same: crystal structures of archaeal XPB and XPD"

11/1&3/2010 Invited Guest speech for BCH095 2010 Fall, UCR. Title: "Application of X-ray crystallography to structural determination of biomolecules."

3/02/2010 Invited Seminar in Biochemistry of BMB graduate program, UCR. Title: "Genome-wide studies on *Xanthomonas axonopodis* pv *citri* (Xac)-citrus infections by protein X-ray crystallography"

11/02/2009 Invited Guest lecture at BCH095, UCR. Title: "Introduction to protein structure determination by X-ray crystallography"

July 18-22, 2008. *DNA Replication and Genome Integrity meeting*. Salk Institute for Biological Studies, La Jolla, California. (Selected for Oral presentation). Title: "Insights into the Cancer and Aging Phenotypes from XPD Mutations: structural and function studies on archaeal XPD helicase".

May 8-10, 2008. *The 7th Workshop of Structural Biology of DNA Repair*. Berkeley, California. (poster) Title: "Crystal structures of XPD helicase from *Sulfolobus acidocaldarius*."

July 22-27, 2006. *The 2006 Meeting of the American Crystallographic Association*. Honolulu, Hawaii (poster). Title: "Structural and Biochemical Characterization Of An Archaeal XPB: A Helicase Adapted For Damaged DNA Unwinding."

March 20-23, 2005. *XVII West Coast Protein Crystallography Workshop*. Asilomar, California. (poster). Title: "Crystal structure of *Archaeoglobus fulgidus* XPB protein: the structural basis for unwinding damaged DNA."

May 20-25, 2004. *The 3rd Workshop of Structural Biology of DNA Repair*. Berkeley, California. (poster). Title: "XPB crystal structure reveals a damage verification domain flexibly linked to a helicase core."

August 17-21, 2002. *The 16th Protein Society Meeting*. San Diego, California. (poster). Title: "A 1.47 Å resolution crystal structure of human manganese superoxide dismutase Y166F mutant".

Sept., 1990. *The 1999 Keystone Symposia on "Molecular Mechanisms in DNA Replication and Recombination."* Taos, New Mexico. (poster and selected for oral presentation). Title: "Subunit Assembly of Drosophila Mitochondrial DNA Polymerase."

Nov. 1999. *The 1999 Cold Spring Harbor Laboratory International Conference on " Eukaryotic DNA Replication."* Cold Spring Harbor, New York. (selected for oral presentation). Title: "Structure-function Studies of Drosophila Mitochondrial DNA Polymerase Reveal A Critical Role For The Accessory Subunit".

Regular Class-room Teaching

BCH101: Fundamental Biochemical Laboratory (3 units, Winter)

BCH184: Topics in Physical Biochemistry (4 units, 1/3 Winter)

BCH210: Biochemistry of Macromolecules (4 units, 1/4 Spring)

BCH252: BMB graduate seminar series (2 units, 1/3 Fall)

NASC093: Freshman Advising Seminars in Natural and Agricultural Sciences (2 units, fall)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Theodore Garland, Jr.

eRA COMMONS USER NAME (credential, e.g., agency login): tgarland

POSITION TITLE: Professor of Biology

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Nevada, Las Vegas, Highest Honors	B.S.	05/1978	Zoology
University of Nevada, Las Vegas	M.S.	08/1980	Biology
University of California, Irvine	Ph.D.	08/1985	Biological Sciences
University of Washington	Postdoctoral	08/1987	Zoology

A. Personal Statement

As a faculty member of the University of Wisconsin-Madison, I began study of the quantitative genetics of exercise behavior and physiology in outbred mice, and then implemented a long-term selective breeding experiment, beginning in 1993. Using our High Runner and Control mouse lines, my collaborators and I have successfully utilized all of the proposed methods, including administration of Western diet; manipulation of access to running wheels; characterization of voluntary exercise, spontaneous physical activity, and additional behavioral parameters; measurement of basal metabolic rate; and non-invasive assessment of body composition. In addition, we have extensive experience employing the mixed-model statistical techniques required for appropriate analysis of data derived from this selection experiment.

I have the experience, resources, and collaborators necessary to advise graduate students in the proposed graduate program. I have served as PI on multiple federally funded grants to support the selection experiment and to study the physiological, biochemical, anatomical, and experiential influences on differences in voluntary activity and spontaneous physical activity in High Runner vs. Control lines of mice. I have administered the budgets, made recruitment and hiring decisions, and supervised all personnel for these projects since the selection experiment was begun in 1993. I have developed leadership skills and demonstrated the ability to carry out a long-term selection experiment extending for 75 generations and over 23 years. I have also served as the sponsor for NIH NRSA awards at both the predoctoral and postdoctoral levels for additional studies on these lines of mice, as well as an existing R21.

Most of my research, and especially that involving the selection experiment, has involved numerous collaborators, including internationally. Hence, I understand the importance of clear and effective communication among participants, as well as developing a realistic budget, research plan, and timeline for graduate students. I know what it takes to advise graduate research projects on time and within budget.

B. Positions and Honors**Positions**

1986-87	Lecturer, Department of Zoology, University of Washington
1987	Lecturer, Department of Ecology and Evolutionary Biology, Univ. of Calif., Irvine
1987-01	Assistant/Associate/Full Professor, Department of Zoology, University of Wisconsin-Madison
1991-92	Assistant/Associate Program Director, National Science Foundation, Population Biology and Physiological Ecology Program

- 2001-2016 Professor, Department of Biology, University of California, Riverside (also member of graduate programs in Evolution, Ecology, and Organismal Biology; Biomedical Sciences; Genetics, Genomics, and Bioinformatics; Neuroscience)
- 2001-2016 Distinguished Professor, Department of Biology, University of California, Riverside (also member of graduate programs in Evolution, Ecology, and Organismal Biology; Biomedical Sciences; Genetics, Genomics, and Bioinformatics; Neuroscience)
- 2006- Associate Director, University of California Multicampus Research Program: Network for Experimental Research on Evolution (NERE) (<http://nere.bio.uci.edu/>)
- 2014- Founding Director, Institute for the Development of Educational Applications (IDEA), University of California, Riverside (<http://idea.ucr.edu/>)

Other Experience and Professional Memberships

- 2007 NIH CADO Study Section, ad hoc phone reviewer
- 2008 NIH CADO Study Section, ad hoc phone reviewer
- 2010 NIH Peer Review Committee: Genetics of Longevity P01 consortium, ad hoc phone reviewer
- 2011 NIH Aging Consortium, ad hoc phone reviewer
- 2012 NIH Comparative Physiology of Aging, Special Emphasis Panel via phone
- 2013 NIH Comparative Physiology of Aging, Special Emphasis Panel Chair via phone
- 2015 NIH Comparative Physiology of Aging, Special Emphasis Panel Chair via phone

Honors

- 1974 Rotary Club Scholarship, U.N.L.V.
- 1974-78 Dean's Honor List, U.N.L.V.
- 1975 East African Natural History Safari Scholarship, U.N.L.V.
- 1976 Charter Member, Alpha Epsilon Delta, U.N.L.V.
- 1977 Elected Phi Kappa Phi, U.N.L.V.
- 1980 Regent's Fellowship, U.C., Irvine
- 1981 Honorable Mention, Edward A. Steinhaus Teaching Award, U.C., Irvine
- 1983-84 Fulbright Predoctoral Grant, Australia
- 1985 Regent's Dissertation Fellowship, U.C., Irvine
- 1985 Edward A. Steinhaus Teaching Award, U.C., Irvine
- 1985 Outstanding Graduate Student Scholar Award, U.C., Irvine
- 1986 Alternate Fellow (no funding), National Science Foundation Fellowship in Environmental Biology
- 1991-96 Presidential Young Investigator Award, National Science Foundation
- 1994 H. I. Romnes Faculty Fellowship, Wisconsin Alumni Research Foundation
- 1998 Vilas Associates Program, Wisconsin Alumni Research Foundation

Editorial Experience

- 1993-2000 Associate Editor, *The American Naturalist*
- 1997-2005 Editorial Board, *Physiological and Biochemical Zoology*
- 1999- Editorial and Advisory Board, *Zoology*
- 1999-02 Editorial Board, Academic Press Physiological Ecology book series
- 2000-2010 Editorial Board, *Journal of Morphology*
- 2000-2002 Associate Editor, *Evolution*
- 2003- Advisory Board, *Ecological and Environmental Physiology* book series, Oxford University Press
- 2005-2014 Associate Editor, *Physiological and Biochemical Zoology*
- 2009- Editor of the Evolutionary Physiology section of *Comprehensive Physiology*
- 2014- Editor in Chief, *Physiological and Biochemical Zoology*

Professional Memberships (current)

- American Physiological Society
- Society for Integrative and Comparative Biology
- Society for the Study of Evolution

Teaching Experience at UCR

- 2002-present Ecological and Evolutionary Physiology (BIOL 174, 3 credits)
- 2003-present Evolution (BIOL 105, 4 credits)

2003-present Seminar in Genetics & Evolution or Organismal Physiology & Physiological Ecology (BIOL 282, 1 credit)

2008-present Evolutionary Physiology (BIOL 220, 4 credits)

C. Contribution to Science

1. Individual Variation in the Exercise Physiology of Natural Populations

Beginning with my Ph.D. dissertation research, I have explored the nature of individual variation in exercise physiology and activity metabolism in wild populations of vertebrates. I developed techniques for obtaining valid, reproducible, and physiologically based measures of locomotor endurance in lizards and snakes. I pioneered the use of residuals from regression equations as a way to remove statistically the confounding effects of such variables as body size, age, sex, and season. My studies were successful in demonstrating that individual differences in locomotor performance abilities are indeed repeatable on a day-to-day basis and represent variation in lower level traits expected to affect performance (e.g., heart size). They set the stage for subsequent quantitative genetic analyses by myself and many other workers.

- a) Garland, Jr. T. 1984. Physiological correlates of locomotor performance in a lizard: an allometric approach. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* 247:R806–R815.
- b) Garland, Jr. T. 1985. Ontogenetic and individual variation in size, shape and speed in the Australian agamid lizard *Amphibolurus nuchalis*. *Journal of Zoology* 207:425–439.
- c) Garland, Jr. T. and P.L. Else. 1987. Seasonal, sexual, and individual variation in endurance and activity metabolism in lizards. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* 252:R439–R449.
- d) Garland, Jr. T., P.L. Else, A.J. Hulbert, and P. Tap. 1987. Effects of endurance training and captivity on activity metabolism of lizards. *American Journal of Physiology (Regulatory, Integrative and Comparative Physiology)* 252:R450–R456.

2. Quantitative Genetics of Exercise Physiology in Squamates and Laboratory Rodents

Having demonstrated the physiological solidity of individual differences in squamate exercise performance abilities, the next logical question was the extent to which they were genetically based as opposed to the consequence of "natural training" that might occur as individuals moved about home ranges of different sizes, etc. By use of newborn snakes, we were able to demonstrate that a substantial fraction of the individual variation did, in fact, seem to be based in the additive effects of polygenes. I then applied a similar approach with laboratory mice, except that breeding designs could be much more sophisticated including cross-fostering, hence allowing much cleaner estimates of narrow-sense heritability and genetic correlations. These studies helped set the stage both for selection experiments with laboratory rodents and also subsequent genetic mapping efforts.

- a) Garland, Jr. T. 1988. Genetic basis of activity metabolism. I. Inheritance of speed, stamina, and antipredator displays in the garter snake *Thamnophis sirtalis*. *Evolution* 42:335–350.
- b) Garland, Jr. T. and A.F. Bennett. 1990. Quantitative genetics of maximal oxygen consumption in a garter snake. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* 259:R986–R992.
- c) Dohm M.R., J.P. Hayes, and T. Garland, Jr. 1996. Quantitative genetics of sprint running speed and swimming endurance in laboratory house mice (*Mus domesticus*). *Evolution* 1688–1701.
- d) Dohm, M. R., J. P. Hayes, and T. Garland, Jr. 2001. The quantitative genetics of maximal and basal rates of oxygen consumption in mice. *Genetics* 159:267–277.

3. Selection Experiments as a Tool to Understand the Genetics and Evolution of Complex Behavior/Physiological Traits

Following from my quantitative genetic analyses of squamates and rodents, I turned to replicated artificial selection as an approach to elucidate the genetics, physiology, neurobiology, and evolution of activity levels.

Initially, this was motivated by interests in the evolution of exercise physiology, but in recent years we have turned towards studies with more direct biomedical relevance. This is a fairly easy transition because activity levels are intimately related to energy balance and health effects on numerous metabolic processes, organ systems, and disease processes. Most of our current research with the High Runner lines of mice involves (1) genetic mapping studies via SNP chips and whole-genome sequencing in the context of a fully defined pedigree for all eight lines across the entire experiment (76 generations) and (2) elucidation of the role of early-life effects in the high-activity phenotype of the HR mice.

- a) Swallow J.G., P.A. Carter, and T. Garland, Jr. 1998. Artificial selection for increased wheel-running behavior in house mice. *Behavior Genetics* 28:227–237.
- b) Belke T.W. and T. Garland, Jr. 2007. A brief opportunity to run does not function as a reinforcer for mice selected for high daily wheel-running rates. *Journal of the Experimental Analysis of Behavior* 88:199–213.
- c) Kelly S.A., D.L. Nehrenberg, K. Hua, T. Garland, Jr., and D. Pomp. 2012. Functional genomic architecture of predisposition to voluntary exercise in mice: expression QTL in the brain. *Genetics* 191:643–654.
- d) Careau V., M.E. Wolak, P.A. Carter, and T. Garland, Jr. 2013. Limits to behavioral evolution: the quantitative genetics of a complex trait under directional selection. *Evolution* 67:3102–3119.

4. Phylogenetic Analyses of Physiological Diversity

My training as a comparative physiologist led me to explore interspecific variation in exercise physiology, locomotor behavior, and related traits, primarily in small mammals and lizards. In the mid-1980s it became apparent from seminal studies in evolutionary biology that the standard way of analyzing variation among species was statistically inappropriate and often highly misleading. Therefore, as an Assistant Professor I initiated a research program to develop and test phylogenetically based statistical methods and associate computer software, which we have made freely available.

- a) Garland Jr. T., P.H. Harvey, and A.R. Ives. 1992. Procedures for the analysis of comparative data using phylogenetically independent contrasts. *Systematic Biology* 41:18–32.
- b) Garland, Jr. T. A.W. Dickerman, C.M. Janis, and J.A. Jones. 1993. Phylogenetic analysis of covariance by computer simulation. *Systematic Biology* 42:265–292.
- c) Garland, Jr. T. and A.R. Ives. 2000. Using the past to predict the present: confidence intervals for regression equations in phylogenetic comparative methods. *American Naturalist* 155:346–364.
- d) Garland, Jr. T., A.F. Bennett, and E.L. Rezende. 2005. Phylogenetic approaches in comparative physiology. *Journal of Experimental Biology* 208:3015–3035.

5. Development of the Field of Evolutionary Physiology

At the time I began my dissertation studies in 1980, the term "evolutionary physiology" did not exist. My work on individual variation, quantitative genetics, and phylogenetic analyses helped lay the groundwork for a burgeoning field that crystallized in the later 1980s and early 1990s. Review and perspective pieces brought the field into sharp relief. Presently, I serve as Editor-in-Chief of *Physiological and Biochemical Zoology*, one of the top journals in the field, and am enforcing a strict policy of ecological/evolutionary relevance for all manuscripts. In addition, I am the founding editor of the Evolutionary Physiology section of *Comprehensive Physiology*, in charge of commissioning review articles in this area.

- a) Garland, Jr. T. and S.C. Adolph. 1991. Physiological differentiation of vertebrate populations. *Annual Review of Ecology and Systematics* 22:193–228.
- b) Garland, Jr. T. and S.C. Adolph. 1994. Why not to do two-species comparative studies: limitations on inferring adaptation. *Physiological Zoology* 67:797–828.
- c) Garland, Jr. T. and P.A. Carter. 1994. Evolutionary physiology. *Annual Review of Physiology* 56:579–621.
- d) Hayes J.P. and T. Garland, Jr. 1995. The evolution of endothermy: testing the aerobic capacity model. *Evolution* 49:836–847.

<http://www.ncbi.nlm.nih.gov/myncbi/browse/collection/48678414/?sort=date&direction=descending>

<http://www.biology.ucr.edu/people/faculty/Garland/GarlandPublications.html>

As of 2 Feb. 2016, my publications have been cited a total of ~20,943 times, with an H-index of 72 (Web of Science) or 25,740 times, with an H-Index of 83 (Google Scholar: <https://scholar.google.com/citations?user=iSSbrhwAAAAJ&hl=en>).

Current Research Support

Role: PI

Role: Co-PI

Role: PI

Role: PI

Joseph C. Genereux

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University of California at Riverside Riverside, CA 2015-present
Assistant Professor, Department of Chemistry
CFM in Biochemistry, Environmental Toxicology, and Microbiology
Molecular characterization of protein homeostasis in health and disease

EDUCATION and TRAINING

The Scripps Research Institute La Jolla, CA 2010-2015
Research Associate with Profs. Jeffery Kelly and R. Luke Wiseman
Protection of the Extracellular Space by Unfolded Protein Response Signaling
California Institute of Technology Pasadena, CA 2003-2009
Ph.D. in Chemistry from Prof. Jacqueline K. Barton
Exploring DNA-mediated Charge Transport with Fast Radical Traps
University of California Irvine, CA 2001-2002
B.S. Physics, minor in Mathematics
Swarthmore College Swarthmore, PA 1997-2001
B.A. Chemistry, minor in Economics, with High Honors

PUBLICATIONS

26) Hulleman*, J.D.; **Genereux*, J.C.**; Nguyen, A. "Mapping wild-type and R345W fibulin-3 intracellular interactomes", in review. * indicates co-first author

25) Chen*, J.J.; **Genereux*, J.C.**; Suh, E.H.; Vartabedian, V.F.; Rius, B.; Qu, Q.; Dendle, M.T.A.; Kelly, J.W.; Wiseman, R.L. "Endoplasmic Reticulum Proteostasis Influences the Oligomeric State of an Amyloidogenic Protein Secreted from Mammalian Cells", *Cell Chem. Biol.* (2016), in press. * indicates co-first author

24) Plate, L.; Cooley, C.B.; Chen, J.J.; Paxman, R.J.; Gallagher, C.M.; Madoux, F.; **Genereux, J.C.**; Dobbs, W.; Garza, D.; Spicer, T.P.; Scampavia, L.; Brown, S.J.; Rosen, H.; Powers, E.T.; Walter, P.; Hodder, P.; Wiseman, R.L.; Kelly, J.W. "Small Molecule ER Proteostasis Regulators that Reprogram the ER to Reduce Extracellular Protein Aggregation", *eLife* (2016), in press.

23) Baranczak, A.; Liu, Y.; Connelly, S.; Du, W.-G.H.; Greiner, E.R.; **Genereux, J.C.**; Wiseman, R.L.; Eisele, Y.S.; Bradbury, N.C.; Dong, J.; Sharpless, K.B.; Noodelman, L.; Wilson, I.A.; Encalada, S.E.; Kelly, J.W. "Fluorogenic Aryl Fluorosulfate for Intraorganellar Transthyretin Imaging in Living Cells and in *C. elegans*", *J. Am. Chem. Soc.* (2015), 137, 7404.

22) Chen, J.J.; **Genereux, J.C.**; Wiseman, R.L. "Endoplasmic Reticulum Quality Control and Systemic Amyloid Disease: Impacting Protein Stability from the Inside Out", *IUBMB* (2015), 67, 404. Review.

21) **Genereux, J.C.**; Wiseman, R.L. "Regulating Extracellular Proteostasis Capacity Through the Unfolded Protein Response", *Prion* (2015), 9, 10. Perspective.

20) **Genereux, J.C.***; Qu, S.*; Zhou, M.; Ryno, L.M.; Wang, S.; Shoulders, M.S.; Kaufman, R.J.; Kelly, J.W.; Lasmezas, C.I.; Wiseman, R.L. "ERdj3 is an Unfolded Protein Response-Induced Secreted Chaperone that Increases Extracellular Proteostasis Capacity", *EMBO J.* (2015), 34, 4. * indicates co-first author

- 19) Chen, J.J.*; **Genereux, J.C.***; Qu, S.; Hulleman, J.D.; Shoulders, M.D.; Wiseman, R.L. "ATF6 Activation Reduces the Secretion and Extracellular Aggregation of Destabilized Variants of an Amyloidogenic Protein", *Chem. Biol.* (2014), 21, 1564. * indicates co-first author.
- 18) Zhang, X.; Liu, Y.; **Genereux, J.C.**; Nolan, C.; Singh, M.; Kelly, J.W. "Heat-Shock Response Transcriptional Program Enables High-Yield and High-Quality Recombinant Protein Production in *Escherichia coli*", *ACS Chem. Biol.* (2014), 9, 1945.
- 17) Tan, Y.-L.; **Genereux, J.C.**; Pankow, S.; Aerts, J.M.F.G.; Yates III, J.R.; Kelly, J.W. "ERdj3 is an Endoplasmic Reticulum Degradation versus Folding Partitioning Factor for Mutant Glucocerebrosidases Linked to Gaucher's Disease", *Chem. Biol.* (2014), 21, 967.
- 16) Ryno, L.M.; **Genereux, J.C.**; Naito, T.; Morimoto, R.I.; Powers, E.T.; Shoulders, M.D.; Wiseman, R.L. "Characterizing the Altered Cellular Proteome Induced by the Stress-Independent Activation of Heat Shock Factor 1", *ACS Chem. Biol.* (2014), 9, 1273.
- 15) Liu, Y.; Tan, Y.-L.; Zhang, X.; Bhabha, G.; Ekiert, D.C.; **Genereux, J.C.**; Cho, Y.-H.; Kipnis, Y.; Baker, D.; Kelly, J.W. "Small Molecule Probes to Quantify the Functional Fraction of a Specific Protein in a Cell with Minimal Folding Equilibrium Shifts", *Proc. Natl. Acad. Sci.* (2014), 111, 4449.
- 14) Suh, E.H.; Liu, Y.; Connelly, S.; **Genereux, J.C.**; Wilson, I.A.; Kelly, J.W. "Stilbene Vinyl Sulfonamides as Fluorogenic Sensors of and Traceless Covalent Kinetic Stabilizers of Transthyretin that Prevent Amyloidogenesis", *J. Am. Chem. Soc.* (2013), 135, 17869.
- 13) Rainbolt, T.K.; Atanassova, N.; **Genereux, J.C.**; Wiseman, R.L. "Stress-Regulated Translational Attenuation Adapts Mitochondrial Protein Import Through Tim17A Degradation", *Cell Metabolism* (2013), 18, 908.
- 12) Leung, A.; Nah, S.K.; Reid, W.; Ebata, A.; Koch, C.M.; Monti, S.; **Genereux, J.C.**; Wiseman, R.L.; Wolozin, B.; Connors, L.H.; Berk, J.L.; Seldin, D.C.; Mostoslavsky, G.; Kotton, D.N.; Murphy, G.J. "Induced Pluripotent Stem Cell Modeling of Multisystemic, Hereditary Transthyretin Amyloidosis" *Stem Cell Rep.* (2013), 1, 451.
- 11) Shoulders, M.D.; Ryno, L.M.; **Genereux, J.C.**; Moresco, J.J.; Tu, P.G.; Wu, C.; Yates, J.R.; Su, A.I.; Kelly, J.W.; Wiseman, R.L. "Stress-Independent Activation of XBP1s and/or ATF6 Reveals Three Functionally Diverse ER Proteostasis Environments" *Cell Rep.* (2013), 3, 1279.
- 10) **Genereux, J.C.**; Wiseman, R.L. "Chemically Targeting the Emergent Properties of a Chaperone Complex", *Chem. Biol.* (2011) 18, 144. Commentary.
- 9) **Genereux, J.C.**; Wuerth, S.M.; Barton, J.K. "Single-Step Charge Transport through DNA over Long Distances" *J. Am. Chem. Soc.* (2011) 133, 3863.
- 8) **Genereux, J.C.**; Boal, A.K.; Barton, J.K. "DNA-mediated Charge Transport in Redox Sensing and Signaling", *J. Am. Chem. Soc.* (2010) 132, 891. Perspective.
- 7) **Genereux, J.C.**; Barton, J.K. "Mechanisms of Long-range DNA-mediated Charge Transport", *Chem. Rev.* (2010) 110, 1642. Review.
- 6) Boal, A.K.; **Genereux, J.C.**; Sontz, P.A.; Gralnick, J.A.; Newman, D.K.; Barton, J.K. "Redox Signaling between DNA Repair Proteins for Efficient Lesion Detection", *Proc. Natl. Acad. Sci. USA* (2009) 106, 15237.
- 5) **Genereux, J.C.**; Barton, J.K. "Molecular Electronics: DNA Charges Ahead", *Nat. Chem.* (2009) 1, 106. Commentary.

- 4) Elias, B.; **Genereux, J.C.**; Barton, J.K. "Ping-Pong Electron Transfer Through DNA", *Angew. Chem. Int. Ed.* (2008) 47, 9067.
- 3) **Genereux, J.C.**; Augustyn, K.E.; Davis, M.L.; Shao, F.; Barton, J.K. "Back Electron Transfer Suppresses the Periodic Length Dependence of DNA-mediated Charge Transport Across Adenine Tracts", *J. Am. Chem. Soc.* (2008) 130, 15150.
- 2) Augustyn, K.E.; **Genereux, J.C.**; Barton, J.K. "Distant-independent DNA-mediated Charge Transport over an Adenine Tract" *Angew. Chem. Int. Ed.* (2007) 46, 5731.
- 1) Pasternack, R.F.; Gibbs, E.J.; Sibley, S.; Woodard, L.; Hutchinson, P.; **Genereux J.**; Kristian, K. "Formation Kinetics of Insulin-Based Amyloid Gels and the Effect of Added Metalloporphyrins" *Biophys. J.* (2006) 90, 1033.

AWARDS AND HONORS

The Scripps Research Institute

American Heart Association Postdoctoral Fellowship 2014-2015

Ruth Kirchstein National Research Service Award (NHLBI F32) 2010-2013

California Institute of Technology

Outstanding Graduate Teaching Assistant Service Award 2008

TEACHING AND MENTORING EXPERIENCE

University of California, Riverside

2015-present

Instructor for Chem 221E, *Bioanalytical Chemistry* and Chem 1B, *Introduction to Chemistry*

Advisor to 3 Graduate students, 2 Postdoctoral scholars, 5 UCR Undergraduate students

The Scripps Research Institute

Protein Folding in the Cell, Teaching Assistant 2013

SURF Program Undergraduate Research Mentor 2012

California Institute of Technology

SURF Program Undergraduate Research Mentor 2008

Introduction to Chemistry, Recitation Teaching Assistant 2005-2008

Biophysics of Macromolecules, Teaching Assistant 2004

Frontiers in Chemistry, Teaching Assistant 2003-2004

University of California - Irvine

LARC Tutor: Biochemistry and Physics courses 2002

Swarthmore College

Laboratory Teaching Assistant: General and Organic Chemistry 2001

PROFESSIONAL SERVICE

Peer reviewer for *J. Phys. Chem. B*, *J. Am. Chem. Soc.*, *Anal. Chem.*, *Chem. Res. Tox.*, *Open Biology*, *Nat. Comm.*, *ACS Sus. Chem. Eng.*

Ad hoc reviewer for the Medical Research Council

**ROHLFS CURRICULUM VITAE
CHARLES RUSSELL HILLE**

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BIRTHDATE November 15, 1951

CITIZENSHIP U.S.

MARITAL STATUS Married, four children

EDUCATION B.S. with Honors (Chemistry) Texas Tech University, Lubbock, TX, 1974
Ph.D. (Biochemistry) Rice University, Houston, TX, 1979

PROFESSIONAL EXPERIENCE

Graduate Study (with Dr. John S. Olson, Rice University, Houston, TX), 9/74 – 8/78
Post-doctoral Study (with Dr. Vincent Massey, University of Michigan, Ann Arbor, MI), 9/78 – 8/81
Lecturer, Department of Biological Chemistry, University of Michigan, Ann Arbor, MI, 9/81 – 10/82
Assistant Professor, Dept. of Biological Chemistry, University of Michigan, Ann Arbor, MI, 11/82 – 8/85
Assistant Professor, Dept. Mol. Cell. Biochemistry, The Ohio State University, Columbus, OH, 8/85 – 8/90
Associate Professor, Dept. Mol. Cell. Biochemistry, The Ohio State University, Columbus, OH, 9/90 – 6/95
Professor, Dept. Mol. Cell. Biochemistry, The Ohio State University, Columbus, OH, 7/95 – 9/07
Professor, Department of Chemistry, The Ohio State University, Columbus, OH, 10/95 – 9/07
Professor, Dept. of Biochemistry, University of California, Riverside, 9/07 – 6/14
Distinguished Professor of Biochemistry, University of California, Riverside, 7/14 - present

HONORS AND AWARDS

Phi Kappa Phi Honors Fraternity, Texas Tech University, Lubbock, TX, April 1974
Rice University Fellowship, Rice University, Houston, TX, Academic Year, 1974 - 1975
Michigan Society of Fellows, University of Michigan, Ann Arbor, MI, August 1978 - August 1981
Simson Faculty Research Award, College of Medicine and Public Health, The Ohio State University, 1997
Humboldt Senior Research Prize, Alexander von Humboldt Foundation, Germany, 2003-2004
Fellow of the American Association for the Advancement of Science, October, 2004
Wenner-Gren Fellow, University of Lund, Sweden, 2007
Chancellor's Chair, University of California, 2007-2010
Humboldt Senior Research Prize, Alexander von Humboldt Foundation, Germany, 2011-2012
Distinguished Professor of Biochemistry, University of California, Riverside, 2014

PROFESSIONAL SOCIETIES

American Association for the Advancement of Science
American Society of Biochemistry and Molecular Biology
American Chemical Society

RECENT PROFESSIONAL SERVICE

Editorial Board, *The Journal of Biological Chemistry*, July 1996 – June 2001; July 2002 – June, 2007
Co-Founder, Molybdenum and Tungsten Enzymes Gordon Conference, Plymouth, NH (July 1999)
Chair, Molybdenum and Tungsten Enzymes Nomenclature Committee (advisory to the IUBMB/Enzyme Commission); July 2001 – August 2003
Scientific Advisory Committee, International Symposia on Flavins and Flavoproteins, April 2003 – present
Chair, Computational Biophysics Study Section, National Institutes of Health – November, 2005
Contributing Member, Faculty of 1000 – August 2006-present
Member, Biophysical and Biochemical Sciences Fellowship Study Section – March, 2010
Local Organizing Committee, 14th International Symposium on Flavins and Flavoproteins – July 24-29, 2011
Member, National Institutes of Health MSFE study section – February 2013
Member, Life Sciences Review Panel for the National Research Council – March 2013 - present

RECENT UNIVERSITY SERVICE/ADMINISTRATION

Search Committee for Chair of the Department of Neuroscience (OSU), January 2001 - June 2002
Promotion and Tenure Committee, College of Medicine and Public Health (OSU), July 2002 – October 2003
Chair, Structural Biology I Search Committee, Dept. Mol. Cell. Biochemistry (OSU), 2001/02 Academic Year
Chair, Structural Biology II Search Committee, Dept. Mol. Cell. Biochemistry (OSU), 2002/03 Academic Year
Interim Chair, Department of Molecular and Cellular Biochemistry (OSU), October 1, 2004 – January, 2007
Research Committee, College of Medicine and Public Health (OSU), October 2004 – September, 2005
Steering Committee, Medical Scientist Program, College of Medicine (OSU), Oct 2004 – January, 2007
Organizer, “Mathematical Modeling of Enzyme Dynamics and Reactivity”, Mathematical Biosciences Institute, (OSU), May, 2005
Chair, Department of Biochemistry, University of California, Riverside, August, 2007 – November, 2010
Member, Search Committee for CNAS Dean, UC Riverside, 2008
Member, Search Committee for Dean of the Medical School, UC Riverside, 2009
Chair, Structural Biology Search Committee, Department of Biochemistry – 2010/2011 Academic Year
Graduate Advisor, Biochemistry and Molecular Biology graduate program – July 2012 - present
UCR Senate Committee on Academic Personnel – July 2013 - present

RESEARCH INTERESTS

Structure/function relationships in redox-active enzymes; Inorganic biochemistry, particularly involving molybdenum; Spectroscopy of redox-active proteins; Biological electron transfer

15-YEAR GRANT HISTORY

National Science Foundation MCB 9420185; “Physical Studies of Xanthine Oxidase and Trimethylamine Dehydrogenase” (R. Hille, PI) \$305,000 TDC, 1/95 - 12/97
National Science Foundation INT 9513747; “Pulse radiolysis studies of xanthine oxidase and trimethylamine dehydrogenase” (R. Hille, PI) \$18,000 TDC, 12/1/95 – 11/30/99
National Institutes of Health R01 GM52322; “Mechanistic Studies of Oxomolybdenum enzymes” (R. Hille, PI) \$565,074 TDC, 3/1/96 – 2/29/00
Monbyuso (Japanese Ministry of Science) “Structure/function studies of xanthine oxidoreductase” (T. Nishino, PI; R. Hille and E.F. Pai, additional PI's) \$18,000 TDC, 4/01 – 3/04
National Institutes of Health R01 GM59953 "Studies of Molybdenum-containing Enzymes" (R. Hille, PI) 9/1/99-12/31/04, \$756,500 TDC
National Institutes of Health R01 GM58481 "Studies of Trimethylamine Dehydrogenase" (R. Hille, PI) \$453,350 TDC, 1 2/1/99-12/31/04
National Institutes of Health R01 GM075036 “Structure/activity studies of two molybdenum enzymes” (R. Hille, PI) \$650,000 TDC, 7/12/05 – 6/30/11
National Institutes of Health R01 ES012658 “Studies of environmentally important molybdenum enzymes” (R. Hille, PI)) \$1,092,500 TDC, 9/1/05 – 8/31/12
Department of Energy DE FG02-13ER16411 “Structure, Function and Reactivity of CO Dehydrogenase from *Oligotropha carboxidovorans*” (R. Hille, PI) \$480,000 TDC, 8/1/13 – 7/31/16

ACTIVE GRANT SUPPORT

Department of Energy DE FG02-13ER16411 “Structure, Function and Reactivity of Energy-Relevant Molybdenum Enzymes” (R. Hille, PI) \$725,000 TDC, 8/1/16 – 7/31/19

PEER-REVIEWED JOURNAL ARTICLES (CORRESPONDING AUTHOR IN BOLD -)

1. Hille, R., Palmer, G., & Olson, J.S. (1977) Chain equivalence in the reaction of nitric oxide with hemoglobin. *J. Biol. Chem.* **252**, 403-405.
2. Hille, R., Olson, J.S., & Palmer, G. (1979) Spectral transitions of nitrosyl hemes during ligand binding to hemoglobin. *J. Biol. Chem.* **254**, 12110-12120.
3. Hille, R., Fee, J.A., & Massey, V. (1981) Equilibrium properties of xanthine oxidase containing chemically modified flavins. *J. Biol. Chem.* **257**, 8933-8940.
4. Hille, R., & Massey, V. (1981) Studies on the oxidative half-reaction of xanthine oxidase. *J. Biol. Chem.* **257**, 9090-9095.
5. Nishino, T., Tsushima, K., Hille, R., & Massey, V. (1982) Inhibition of milk xanthine oxidase by fluorodinitrobenzene. *J. Biol. Chem.* **257**, 7348-7353.
6. Hille, R., & Massey, V. (1982) The presence of a reducible disulfide bond in xanthine oxidase. *J. Biol. Chem.* **257**, 8898-8901.
7. Hille, R., Stewart, R.C., Fee, J.A., & Massey, V. (1983) The interaction of arsenite with xanthine oxidase. *J. Biol. Chem.* **258**, 4849-4856.
8. Hille, R., Yoshida, T., Williams, C.H., Jr., Ludwig, M.L., Fee, J.A., Kent, T.A., Hyunh, B., Day, T., & Münck, E. (1983) Studies of the ferredoxin from *Thermus thermophilus*, *J. Biol. Chem.* **258**, 13008-13013.
9. Fee, J.A., Findling, K.L., Choc, M.G., Yoshida, T., Hille, R., Hearshen, D., Dunham, W.R., Kent, T.A., & Münck, E. (1984) Purification and initial characterization of a Rieske-type protein from *Thermus thermophilus*. *J. Biol. Chem.* **259**, 124-133.
10. Hille, R., & Stewart, R.C. (1984) The interaction of xanthine oxidase with 8-bromoxanthine. *J. Biol. Chem.* **259**, 1570-1576.
11. Stewart, R.C., Hille, R., & Massey, V. (1984) Characterization of arsenite-complexed xanthine oxidase at room temperature - spectral properties and pH-dependent redox behavior of the molybdenum-arsenite Center. *J. Biol. Chem.* **259**, 14426-14436.
12. Stewart, R.C., Hille, R., & Massey, V. (1985) The reaction of arsenite-complexed xanthine oxidase with oxygen - evidence for an oxygen-reactive molybdenum center. *J. Biol. Chem.* **260**, 8892-8904.
13. Cramer, S.P., & Hille, R. (1985) Arsenite-inhibited xanthine oxidase - determination of the Mo-S-As geometry by EXAFS. *J. Am. Chem. Soc.* **107**, 8164-8169.
14. Hille, R., Hagen, W.R., & Dunham, W.R. (1985) Spectroscopic studies of the iron-sulfur centers in xanthine oxidase. *J. Biol. Chem.* **260**, 10569-10575.
15. Hille, R. & Massey, V. (1986) The equilibration of reducing equivalents within milk xanthine oxidase. *J. Biol. Chem.* **261**, 1241-1247.
16. Anderson, R.F., Hille, R., & Massey, V. (1986) The radical chemistry of milk xanthine oxidase as studied by radiation chemistry techniques. *J. Biol. Chem.* **261**, 15870-15876.
17. Hille, R., & Sprecher, H. (1987) On the mechanism of action of xanthine oxidase. *J. Biol. Chem.* **262**, 10914-10917.
18. Hille, R., George, G.N., Eidsness, M.K., & Cramer, S.P. (1989) EXAFS of xanthine oxidase complexes with alloxanthine, violapterin, and 6-pteridylaldehyde. *Inorg. Chem.* **28**, 4018-4022.
19. H.-D. Zeller, Hille, R., & Jorns, M.S. (1989) Bacterial sarcosine oxidase: identification of novel substrates and a biradical reaction intermediate. *Biochemistry* **28**, 5145-5154.
20. Oertling, W.A., & Hille, R. (1990) Resonance Raman spectroscopy of the molybdenum center of xanthine oxidase. *J. Biol. Chem.* **265**, 17446-17450.
21. Hille, R., & Anderson, R.F. (1991) Electron transfer in milk xanthine oxidase as studied by pulse radiolysis. *J. Biol. Chem.* **266**, 5608-5615.
22. Rohlf, R.J., & Hille, R. (1991) Intramolecular electron transfer in trimethylamine dehydrogenase from bacterium W₃A₁. *J. Biol. Chem.* **266**, 15244-15252.
23. Hille, R. (1991) Electron transfer within xanthine oxidase: a solvent kinetic isotope effect study. *Biochemistry* **30**, 8522-8529.
24. Hille, R., & Massey, V. (1991) The kinetic behavior of xanthine oxidase containing chemically modified flavins. *J. Biol. Chem.* **266**, 17401-17408.
25. McWhirter, R.B., & Hille, R. (1991) The reductive half-reaction of xanthine oxidase. Spectral intermediates in the hydroxylation of 2-hydroxy-6-methylpurine. *J. Biol. Chem.* **266**, 23724-23731.
26. Roffey, R., Golbeck, J., Hille, R., & Sayre, R. (1991) Photosynthetic electron transport in genetically altered photosystem II reaction centers of chloroplasts. *Proc. Natl. Acad. Sci.* **88**, 9122-9126.
27. Anderson, G.L., Williams, J. & Hille, R. (1992) The purification and characterization of arsenite oxidase from *Alcaligenes faecalis*: a molybdenum-containing hydroxylase. *J. Biol. Chem.* **267**, 23674-23682.

28. Kim, J.H., & Hille, R. (1993) The reductive half-reaction of xanthine oxidase with xanthine. Observation of a spectral intermediate attributable to the molybdenum center in the reaction of enzyme with xanthine. *J. Biol. Chem.* **268**, 44-51.
29. Hille, R., Kim, J.H., & Hemann, C. (1993) Reductive half-reaction of xanthine oxidase. Mechanistic role of the species giving rise to the "rapid" Mo(V) EPR signal. *Biochemistry* **32**, 3973-3980.
30. Ratnam, K., & Hille, R. (1993) Paradoxical stabilization of the neutral flavin semiquinone of xanthine dehydrogenase at high pH. *Biochem. Biophys. Res. Commun.* **194**, 1097-1102.
31. Kim, J.H., & Hille, R. (1994) Studies of substrate binding to xanthine oxidase by using a spin-labeled analog. *J. Inorg. Biochem.* **55**, 295-303.
32. Lorigan, G.A., Britt, R.D., Kim, J.H., & Hille, R. (1994) Electron spin echo envelope modulation spectroscopy of the molybdenum center of xanthine oxidase. *Biochim. Biophys. Acta* **1185**, 284-294.
33. Scrutton, N.S., Packman, L.C., Mathews, F.S., Rohlfs, & Hille, R. (1994) Assembly of redox centers in the trimethylamine dehydrogenase from bacterium W₃A₁: properties of the wild-type enzyme and a C30A mutant expressed from a cloned gene in *Escherichia coli*. *J. Biol. Chem.* **269**, 13942-13950.
34. DuPlessis, E.R., Rohlfs, R.J., Hille, R., & Thorpe, C. (1994) Electron-transferring flavoprotein from pig and the methylotrophic bacterium W₃A₁ contains AMP as well as FAD. *Biochem. Mol. Biol. Intl.*, **32**, 195-199.
35. White, S.A., Mathews, F.S., Rohlfs, R., & Hille, R. (1994) Crystallization and preliminary crystallographic investigation of electron-transferring flavoprotein from the bacterium *Methylophilus* W₃A₁. *J. Mol. Biol.* **240**, 265-266.
36. Rohlfs, R.J., & Hille, R. (1994) The reaction of trimethylamine dehydrogenase with diethylmethylamine. *J. Biol. Chem.* **269**, 30869-30879.
37. Schultz, B.E., Hille, R., & Holm, R.H. (1995) Direct oxygen atom transfer in the mechanism of action of *Rhodobacter sphaeroides* dimethylsulfoxide reductase. *J. Am. Chem. Soc.* **117**, 827-828.
38. Vitale, M., Le, K.K., Hemann, C.F., Hille, R., Gustafson, T.L., & Bursten, B.E. (1995) Resonance Raman studies of [CpFe(CO)₂]₂ and [Cp*Fe(CO)₂]₂: a probe of photoreactive states and intermediates. *J. Am. Chem. Soc.* **117**, 2286-2296.
39. Rohlfs, R.J., Huang, L. & Hille, R. (1995) Prototropic control of intramolecular electron transfer in trimethylamine dehydrogenase. *J. Biol. Chem.* **270**, 22196-22207.
40. Ryan, M.G., Ratnam, K., & Hille, R. (1995) The molybdenum centers of xanthine oxidase and xanthine dehydrogenase. Determination of the spectral change associated with reduction from the Mo^{VI} to the Mo^{IV} state. *J. Biol. Chem.* **270**, 19209-19212.
41. Anderson, R.F., Hille, R., & Patel, K. (1996) Inactivation of xanthine oxidase by oxidative radical attack. *Intl. J. Rad. Biol.* **68**, 535-541.
42. Ratnam, K., Shiraishi, N., Campbell, W.H., & Hille, R. (1995) Spectroscopic and kinetic characterization of the recombinant wild-type and C242S mutant of the cytochrome *b* reductase fragment of nitrate reductase. *J. Biol. Chem.* **270**, 24067-24072.
43. Brody, M.S., & Hille, R. (1995) The reaction of chicken liver sulfite oxidase with dimethylsulfite. *Biochim. Biophys. Acta.* **1253**, 133-135.
44. Huang, L., Rohlfs, R.J., & Hille, R. (1995) The reaction of trimethylamine dehydrogenase with electron transferring flavoprotein. *J. Biol. Chem.* **270**, 23958-23965.
45. Kim, J.H., Ryan, M.G., Knaut, H., & Hille, R. (1996) The reductive half-reaction of xanthine oxidase: a pH dependence and solvent kinetic isotope effect study. *J. Biol. Chem.* **271**, 6771-6780.
46. Sun, J., Kahlow, M.A., Kaysser, T.M., Osborne, J.P., Hill, J.J., Rohlfs, R.J., Hille, R., Gennis, R.B., & Loehr, T.M. (1996) Resonance Raman spectroscopic identification of a histidine ligand of *b*₅₉₅ and the nature of the ligation of chlorin *d* in the fully reduced *Escherichia coli* cytochrome *bd* oxidase. *Biochemistry* **35**, 2403-2412.
47. Ratnam, K., Brody, M. S., & Hille, R. (1996) Purification of xanthine dehydrogenase and sulfite oxidase from chicken liver. *Prep. Biochem. Biotech.* **26**, 143-154.
48. Huang, L., Scrutton, N.S., & Hille, R. (1996) The reaction of the C30A mutant of trimethylamine dehydrogenase with diethylmethylamine. *J. Biol. Chem.* **271**, 13401-13406.
49. Huber, R., Hof, P., Duarte, R.O., Moura, J.J.G., Moura, I., LeGall, J., Hille, R., Archer, M., & Romão, M. (1996) A structure-based catalytic mechanism for the xanthine oxidase family of molybdenum enzymes. *Proc. Natl. Acad. Sci. USA* **93**, 8846-8851.
50. Bian, S., Hemann, C.F., Hille, R., & Cowan, J.A. (1996) Mutagenesis studies to probe the role of phenylalanine 66 in defining the stability of the [Fe₄S₄] center provides evidence for oxidative degradation via a [Fe₃S₄] cluster. *Biochemistry* **35**, 14544-14552.
51. Xue Y., Traina S J., & Hille R. (1996) Stability of metal-organic complexes in acetone- and methanol-water mixtures. *Environmental Science & Technology* **30**, 3177-3183.

52. Winkler, W., Gonzalez, G., Wittenberg, J.B., Hille, R., Dakappagari, N., Jacob, A., Gonzalez, L.A., & Gilles-Gonzalez, M.-A. (1996) Non-steric factors dominate binding of nitric oxide, azide, imidazole, cyanide and fluoride to the rhizobial heme-based oxygen sensor FixL. *Chem. Biol.* **3**, 841-850.
53. Wilson, E.K., Huang, L., Sutcliffe, M.J., Mathews, F.S., Hille, R., & Scrutton, N.S. (1997) An exposed tyrosine on the surface of trimethylamine dehydrogenase facilitates electron transfer to electron transferring flavoprotein: kinetics of transfer in wild-type and mutant complexes. *Biochemistry* **36**, 41-48.
54. Ratnam, K., Shiraishi, N., Campbell, W.H., & Hille, R. (1997) Spectroscopic and kinetic characterization of the heme- and flavin-containing cytochrome *c* reductase fragment of nitrate reductase. *J. Biol. Chem.* **272**, 2122-2128.
55. Mewies, M., Basran, J., Packman, L.C., Hille, R., & Scrutton, N.S. (1997) Involvement of a flavin iminoquinone methide in the formation of 6-hydroxy FMN in trimethylamine dehydrogenase: a rationale for the existence of 8a-methyl- and C₆-linked covalent flavoproteins. *Biochemistry* **36**, 7162-7168.
56. Babu, C.R., Arudchandran, A., Hille, R., Gross, E.L., & Bullerjahn, G.S. (1997) Reconstitution and characterization of a divergent plastocyanin from the photosynthetic prokaryote *Prochlorothrix hollandica*, expressed in *Escherichia coli*. *Biochem. Biophys. Res. Commun.* **235**, 631-635.
57. Ilich, P., & Hille, R. (1997) Tautomerization of the heterocycle nucleus in the course of the reaction of xanthine oxidase with purines and pteridines. *Inorg. Chim. Acta* **263**, 87-94.
58. Ilich, P., Hemann, C.F., & Hille, R. (1997) Molecular vibrations of solvated uracils. *Ab initio* reaction field calculations and experiment. *J. Phys. Chem. B* **101**, 10923-10932.
59. Michaud, A.L., Herrick, J.A., Duplain, J.E., Manson, J.L., Hemann, C.F., Donohoe, R.J., Hille, R., & Oertling, W.A. (1998) FTIR characterization of heterocycles lumazine and violapterin in solution: Effects of solvent on anionic forms. *Biospectroscopy* **4**, 235-256.
60. Conrads, T., Hemann, C.F. & Hille, R. (1998) A tyrosyl radical generated in xanthine oxidase by reaction with ferricenium ion. *Biochemistry* **37**, 7787-7791.
61. Fournel, A., Gambarelli, S., Guigliarelli, B., More, C., Asso, M., Chouteau, G., Hille, R., & Bertrand, P. (1998) Magnetic interactions between a [4Fe-4S]¹⁺ cluster and an FMN radical in the enzyme trimethylamine dehydrogenase: a high-field EPR study. *J. Chem. Phys.* **109**, 10905-10913.
62. Xia, M., Dempsey, R., & Hille, R. (1999) The reaction of xanthine oxidase with aldehyde substrates. *J. Biol. Chem.* **274**, 3323-3330.
63. Huang, L., Abu-Soud, H.M., Hille, R., & Stuehr, D. (1999) Nitric oxide-generated P420 nitric oxide synthase: characterization and roles for tetrahydrobiopterin and substrate in protecting against or reversing the P420 conversion. *Biochemistry* **38**, 1912-1920.
64. Jang, M.-H., Basran, J., Scrutton, N.S. & Hille, R. (1999) The reaction of trimethylamine dehydrogenase with trimethylamine. *J. Biol. Chem.* **274**, 13147-13154.
65. Basran, J., Jang, M.-H., Sutcliffe, M.J., Hille, R., & Scrutton, N.S. (1999) The role of Tyr 169 of trimethylamine dehydrogenase in substrate oxidation and mediation of the magnetic interaction between the FMN and 4Fe/4S center. *J. Biol. Chem.* **274**, 13155-13161.
66. Brody, M.S., & Hille, R. (1999) The kinetic behavior of chicken liver sulfite oxidase. *Biochemistry* **38**, 6668-6677.
67. Basran, J., Sutcliffe, M.J., Hille, R., & Scrutton, N.S. (1999) The reductive half-reaction of the H172Q mutant of trimethylamine dehydrogenase: evidence against a carbanion mechanism and assignment of kinetically influential ionizations in the enzyme-substrate complex. *Biochem. J.* **341**, 307-314.
68. Ilich, P., & Hille, R. (1999) The mechanism of formamide hydroxylation catalyzed by a molybdenum-dithiolene complex: a model for xanthine oxidase reactivity. *J. Phys. Chem.(B)* **103**, 5406-5412.
69. Jones, R.M., Inscore, F.E., Hille, R., & Kirk, M.L. (1999) Freeze-quench difference magnetic circular dichroism study of a xanthine oxidase intermediate. *Inorg. Chem.* **38**, 4963-4970.
70. Yoon, K.-S., Hemann, C., Hille, R., & Tabita, F.R. (1999) Rubredoxin from the green sulfur bacterium *Chlorobium tepidum* functions as an electron acceptor for pyruvate:ferredoxin oxidoreductase. *J. Biol. Chem.* **274**, 29772-29778.
71. Roberts, P., Basran, J., Wilson, E.K., Hille, R., & Scrutton, N.S. (1999) Redox cycles in trimethylamine dehydrogenase and the mechanism of substrate inhibition. *Biochemistry* **38**, 14927-14940.
72. Jang, M.-H., Scrutton, N.S., & Hille, R. (2000) Formation of the hydroquinone of electron-transferring flavoprotein within the physiological complex with trimethylamine dehydrogenase. *J. Biol. Chem.* **275**, 12546-12552.
73. Anderson, R.F., Jang, M.-H., & Hille, R. (2000) Radiolytic studies of trimethylamine dehydrogenase. Spectral deconvolution of the neutral and anionic semiquinone forms and determination of electron transfer rate constants in the one-electron reduced enzyme. *J. Biol. Chem.* **275**, 30781-30786.

74. Wei, C.-C., Wang, Z.-Q., Wang, Q., Meade, A., Hemann, C., Hille, R., & Stuehr, D.J. (2001) Rapid kinetic studies link tetrahydrobiopterin oxidation, heme-dioxy reduction and arginine hydroxylation in inducible nitric oxide synthase. *J. Biol. Chem.* **276**, 315-319.
75. Ellis, P., Conrads, T., Hille, R., & Kuhn, P. (2001) Crystal structure of the 100 kDa arsenite oxidase from *Alcaligenes faecalis* in two crystal forms at 1.64 and 2.03 Å. *Structure* **9**, 125-132.
76. Manikandan, P., Choi, E.-Y., Hille, R., & Hoffman, B.M. (2001) 35-GHz ENDOR investigation of the "very rapid" signal of xanthine oxidase reacted with 8-[¹³C]-2-hydroxy-6-methylpurine. *J. Am. Chem. Soc.* **123**, 2658-2663.
77. Huhta, M.S., Chen, H.-P., Hemann, C., Hille, R. & Marsh, E.N.G. (2001) Protein-coenzyme interactions in adenosylcobalamin-dependent glutamate mutase. *Biochem. J.* **355**, 131-137.
78. Hille, R., & Anderson, R.F. (2001) Coupled electron transfer and protonation/deprotonation in complex flavoproteins. Solvent kinetic isotope effect studies of electron transfer in xanthine oxidase and trimethylamine dehydrogenase. *J. Biol. Chem.* **276**, 31193-31201.
79. Mitchell, D.J., Nikolic, D., Jang, M.-H., van Breemen, R.V., Hille, R., & Silverman, R.B. (2001) Isolation and Mass Spectral Analysis of Flavin Adducts Produced by the Inactivation of Trimethylamine Dehydrogenase. *Biochemistry* **40**, 8523-8530.
80. Wang, Z.-Q., Wei, C.-C., Ghosh, S., Meade, A., Hemann, C., Hille, R., & Stuehr, D.J. (2001) A conserved tryptophan in nitric oxide synthase regulates heme-dioxy reduction by tetrahydrobiopterin. *Biochemistry* **40**, 12819-12825.
81. Yoon, K.-S., Bobst, C., Hemann, C.F., Hille, R., & Tabita, F.R. (2001) Spectroscopic and functional properties of novel 2[4Fe-4S] cluster-containing ferredoxins from the green sulfur bacterium *Chlorobium tepidum*. *J. Biol. Chem.*, **276**, 44027-44036.
82. Eilers, T., Schwarz, G., Brinkmann, H., Witt, C., Richter, T., Nieder, J., Koch, B., Hille, R., Hänsch & Mendel, R.R. (2001) Identification and biochemical characterization of *Arabidopsis thaliana* sulfite oxidase. A new player in plant sulfur metabolism. *J. Biol. Chem.* **276**, 46989-46994.
83. Wei, C.-C., Wang, Z.-Q., Wang, Q., Meade, A., Hemann, C., Hille, R., & Stuehr, D.J. (2001) Rapid kinetic studies link tetrahydrobiopterin oxidation, heme-dioxy reduction and arginine hydroxylation in inducible nitric oxide synthase. *J. Biol. Chem.* **276**, 315-319.
84. Mansy, S., Xiong, Y., Hemann, C.F., Hille, R., Sundaralingam, M., & Cowan, J.A. (2002) Crystal structure of C77S HiPIP: a serine ligated [4Fe-4S] cluster. *Biochemistry* **41**, 1195-1201.
85. Wang, J., Gosztola, D., Ruffle, S.V., Hemann, C., Seibert, M., Wasielewski, M.R., Hille, R., Gustafson, T.L., & Sayre, R.T. (2002) Functional asymmetry of photosystem II D1 and D2 peripheral chlorophyll mutants of *Chlamydomonas reinhardtii*. *Proc. Natl. Acad. Sci. USA* **99**, 4091-4096.
86. Wu, G., Mansy, S.S., Hemann, C., Hille, R., Surerus, K.K., & Cowan, J.A. (2002) Iron-sulfur cluster biosynthesis: characterization of *Schizosaccharomyces pombe* Isa1. *J. Biol. Inorg. Chem.* **7**, 526-532.
87. Ilich, P., & Hille, R. (2002) Reactivity of oxo, sulfido and tellurido Mo-dithiolene: understanding the reactivity of xanthine oxidase. *J. Am. Chem. Soc.* **124**, 6796-6797.
88. Conrads, T., Hemann, C.F., George, G.N., Pickering, I.J., Prince, R.C., & Hille, R. (2002) XAS and resonance Raman studies of the molybdenum center of arsenite oxidase. *J. Am. Chem. Soc.* **124**, 11276-11277.
89. Stockert, A.L., Shinde, S., Anderson, R.F., & Hille, R. (2002) The reaction mechanism of xanthine oxidase. Evidence for two-electron chemistry rather than sequential one-electron steps. *J. Am. Chem. Soc.* **124**, 14554-14555.
90. Hemann, C.F., Ilich, P., & Hille, R. (2003) Molecular vibrations of solvated lumazines. *Ab initio* reaction field calculations and experiment. *J. Phys. Chem.* **107**, 2139-2155.
91. Wei, C.-C., Wang, Z.-Q., Arvai, A.S., Hemann, C., Hille, R., Getzoff, E.D., & Stuehr, D.J. (2003) Structure of tetrahydrobiopterin tunes its electron transfer to the heme-dioxy intermediate in nitric oxide synthase. *Biochemistry* **42**, 1969-1977.
92. Lu, X., Nikolic, D., Mitchell, D.J., van Breemen, R.B., Mersfelder, J.A., Hille, R., & Silverman, R.B. (2003) A Mechanism for Substrate-Induced Formation of 6-Hydroxyflavin Mononucleotide Catalyzed by C30A Trimethylamine Dehydrogenase. *Bioorg. Med. Chem. Lett.* **13**, 4129-4132.
93. Wei, C.-C., Wang, Z.Q., Hemann, C.F., Hille, R., & Stuehr, D.J. (2003) A tetrahydrobiopterin radical forms and then becomes reduced during N-omega-hydroxyarginine oxidation by nitric oxide synthase. *J. Biol. Chem.* **278**, 46668-46673.
94. Hoke, K., Cobb, N., Armstrong, F.A., & Hille, R. (2004) Electrochemical studies of arsenite oxidase: an example of a highly cooperative two-electron molybdenum center. *Biochemistry* **43**, 1667-1674.
95. Choi, E.-Y., Stockert, A.L., Leimkühler, S., and Hille, R. (2004) Studies on the mechanism of action of xanthine oxidase. *J. Inorg. Biochem.* **98**, 841-848.

96. Okamoto, K., Matsumoto, K., Hille, R., Eger, B.T., Pai, E.F., & Nishino, T. (2004) The crystal structure of xanthine oxidoreductase during catalysis: implications for reaction mechanism and enzyme inhibition. (2004) *Proc. Natl. Acad. Sci. USA*. **101**, 7931-7936.
97. Leimkühler, S., Stockert, A.L., Igarashi, K., Nishino, T., & Hille, R. (2004) The role of active site glutamate residues in catalysis of *Rhodobacter capsulatus* xanthine dehydrogenase. *J. Biol. Chem.* **279**, 40437-40444.
98. Xiong, L., Seibert, M., Gusev, A.V., Wasielewski, M.R., Hemann, C., Hille, R., & Sayre, R.T. (2004) Substitution of a chlorophyll into the inactive branch pheophytin-binding site impairs charge separation in photosystem II. *J. Phys. Chem. B*. **108**, 16904-16911.
99. Hemann, C.F., Ilich, I., Stockert, A.L., Choi, E.-Y., & Hille, R. (2005) Resonance Raman studies of xanthine oxidase: the reduced enzyme•product complex with violapterin. *J. Phys. Chem. B*. **109**, 3023-3031.
100. Wei, C.C., Wang, Z.Q., Durra, D., Hemann, C., Hille, R., Garcin, E.D., Getzoff, E.D., and Stuehr, D.J. (2005) The three nitric-oxide synthases differ in their kinetics of tetrahydrobiopterin radical formation, heme-dioxy reduction and arginine hydroxylation. *J. Biol. Chem.* **280**, 8929-8935.
101. Cobb, N., Conrads, T., & Hille, R. (2005) The reaction of reduced dimethylsulfoxide reductase with dimethylsulfoxide. *J. Biol. Chem.* **280**, 11007-11017.
102. Doonan, C.J., Stockert, A.L., Hille, R., & George, G.N. (2005) Nature of the catalytically labile oxygen in the active site of xanthine oxidase. *J. Am. Chem. Soc.* **127**, 4518-4522.
103. Shi, W., Mersfelder, J., & Hille, R. (2005) The interaction of trimethylamine dehydrogenase with electron-transferring flavoprotein. *J. Biol. Chem.* **280**, 20239-20246.
104. Anderson, R.F., Hille, R., Shinde, S. and Cecchini, G. (2005) Electron transfer with succinate:ubiquinone oxidoreductase (SQR) of *Escherichia coli*. *J. Biol. Chem.* **280**, 33331-33337.
105. Astashkin, A.V., Hood, B.L., Feng, C., Hille, R., Mendel, R.R., Raitsimring, A.M., & Enemark, J.H. (2005) Studies of the Mo(V) forms of sulfite oxidase from *Arabidopsis thaliana* by pulsed EPR. *Biochemistry* **44**, 13274-13281.
106. Stuehr, D.J., Wei, C.C., Wang, Z.Q., and Hille, R. (2005) Exploring the redox reactions between heme and tetrahydrobiopterin in the nitric oxide synthases. *Dalton Trans.* **21**, 3427-3435.
107. Hemann, C.F., Hood, B.L., Fulton, M., Hänsch, R., Mendel, R.R., Kirk, M.L., & Hille, R. (2005) Spectroscopic and kinetic properties of sulfite oxidase from *Arabidopsis thaliana*: nature of the redox-active orbital and electronic structure contributions to catalysis *J. Am. Chem. Soc.* **127**, 16567-16577.
108. Pei, P., Horan, M.P., Hille, R., Hemann, C.F., Schwendoeman, S.P., & Mallery, S.R. (2006) Reduced nonprotein thiols inhibit activation and function of MMP-9. Implications for chemoprevention. *Free Rad. Biol. Med.* **41**, 1315-1324.
109. Kundu, T.K., Hille, R., Velayutham, M., & Zweier, J.L. (2007) Characterization of superoxide production from aldehyde oxidase: an important source of oxidants in biological tissues. *Arch. Biochem. Biophys.* **460**, 113-121.
110. Paufl, J.M., Hemann, C.F., Leimkühler, S., and Hille, R. (2007) The role of arginine 310 in catalysis and substrate specificity in xanthine dehydrogenase from *Rhodobacter capsulatus*. *J. Biol. Chem.* **282**, 12785-12790.
111. Astashkin, A.V., Johnson-Winters, K., Klein, E.L., Byrne, R.S., Hille, R., Raitsimring, A.M. & Enemark, J.H. (2007) Direct demonstration of the presence of coordinated sulfate in the reaction of *Arabidopsis thaliana* sulfite oxidase using ³³S-labeling and ESEEM spectroscopy. *J. Am. Chem. Soc.* **129**, 14800-14810.
112. Erzurum, S.C., Ghosh, S., Janocha, A.J., Xu, W., Bauer, S., Bryan, N.S., Tejero, J., Hemann, C., Hille, R., Stuehr, D.J., Geelisch, M., & Beall, C.M. (2007) Higher blood flow and circulating nitric oxide products offset high-altitude hypoxia among Tibetans. *Proc. Natl. Acad. Sci. USA* **104**, 17593-17598.
113. Cobb, N., Hemann, C.F., Polsinelli, G., Ridge, J.P., McEwan, A.G., & Hille, R. (2007) Spectroscopic and kinetic studies of Y114F and W116F mutants of DMSO reductase from *Rhodobacter capsulatus*. *J. Biol. Chem.*, **282**, 35519-35529.
114. Paufl, J.M., Zhang, J., Bell, C.E., & Hille, R. (2008) Substrate orientation in xanthine oxidase. The crystal structure of an intermediate in reaction with 2-hydroxy-6-methylpurine. *J. Biol. Chem.* **283**, 4818-4824.
115. Wei, C.-C., Wang, Z.-Q., Tejero, J., Yang, Y.-P., Hemann, C., Hille, R., & Stuehr, D.J. (2008) Catalytic Reduction of a Tetrahydrobiopterin Radical Within Nitric Oxide Synthase. *J. Biol. Chem.* **283**, 11734-11742.
116. Ilagan, R.P., Tiso, M., Konas, D.W., Hemann, C., Hille, R., & Stuehr, D.J. (2008) Differences in a conformational equilibrium distinguish catalysis by the endothelial and neuronal nitric-oxide synthase flavoproteins. *J. Biol. Chem.* **283**, 19603-19615.

117. Pauff, J.M., Cao, H., & Hille, R. (2009) Substrate orientation at the molybdenum center of xanthine oxidase: crystal structures of complexes with xanthine and lumazine, *J. Biol. Chem.* **284**, 8751 - 8758.
118. Pauff, J.M. & Hille R. (2009) Inhibition studies of xanthine oxidase by luteolin, silibinin, quercetin and curcumin. *J. Med. Chem.* **72**, 725-731.
119. Wagener, N., Pierik, A., Ibdah, A., Hille, R. & Dobbek, H. (2009) The Mo-Se active site of nicotinate dehydrogenase. *Proc. Natl. Acad. Sci. USA*, **106**, 11055-11060.
120. Alzate, O., Hemann, C., Hille, R., & Dean, D.H. (2009) Ser 170 in the *Bacillus thuringiensis* Cry1Ab δ -endotoxin becomes anchored in the hydrophobic moiety upon protein insertion into *Manduca sexta* brush border membrane vesicles. *BMC Biochemistry* **10**, #25. DOI 10.1186/1471-2091-10-25
121. Spiegelhauer, O., Dickert, F., Mende, S., Niks, D., Hille, R., Ullmann, G.M., & Dobbek, H. (2009) Kinetic characterization of xenobiotic reductase A from *Pseudomonas putida* 86, *Biochemistry* **48**, 11412-11420.
122. Byrne, R.S., Hänsch, R., Mendel, R.R. & Hille, R. (2009) Demonstration of superoxide production by *Arabidopsis thaliana* sulfite oxidase. Insights into the oxidative half-reaction. *J. Biol. Chem.* **284**, 35479-35484.
123. Zhang, B., Hemann, C.F., & Hille, R. (2010) Kinetic and spectroscopic studies of the molybdenum-copper CO dehydrogenase from *Oligotropha carboxidovorans*. *J. Biol. Chem.*, **285**, 12571-12578.
124. Duval, S., Santini, J.M., Nitschke, W., Hille, R., & Schoepp-Cothenet, B. (2010) The small AroB subunit of arsenite oxidase: Lessons on the [2Fe-2S] Rieske protein superfamily. *J. Biol. Chem.* **285**, 20442-20451.
125. Cao, H., Pauff, J.M., & Hille, R. (2010) Substrate orientation and catalytic specificity of xanthine oxidase: strictly ordered hydroxylation steps from hypoxanthine to uric acid., *J. Biol. Chem.* **285**, 28044-28053.
126. Wahl, B., Reichmann, D., Niks, D., Biester, H., Krompholz, N., Havemeyer, A., Clement, B., Meßerschmidt, T., Rothkegel, M., Hille, R., Mendel, R.R., & Bittner, F. (2010) Biochemical and spectroscopic characterization of the human mitochondrial amidoxime-reducing components hmARC-1 and hmARC-2 suggests the existence of a new molybdenum enzyme family in eukaryotes. *J. Biol. Chem.* **285**, 37847-37859.
127. Shanmugam, M., Zhang, B., McNaughton, R.L., Kinney, A., Hille, R. & Hoffman, B.M. (2010) The structure of formaldehyde-inhibited xanthine oxidase determined by 35 GHz ^2H ENDOR spectroscopy. *J. Am. Chem. Soc.* **132**, 14015-14017.
128. Tejero, J., Biswas, A., Haque, M.M., Wang, Z.-Q., Hemann, C., Varnado, C.L., Novince, Z., Hille, R., Goodwin, D.C. & Stuehr, D.J. (2011) Mesoheme-substitution reveals how heme electronic properties can influence the kinetic and catalytic parameters of neuronal NO synthase. *Biochem. J.* **433**, 163-174.
129. Service, R.J., Yano, J., McConnell, I., Hwang, H.J., Niks, D., Hille, R., Wydrzynski, T., Burnap, R.L., Hillier, W., & Debus, R.J. (2011) Participation of glutamate-354 of the CP43 in the ligation of Mn and the binding of substrate water in photosystem II. *Biochemistry* **50**, 63-81.
130. Havelius, K.G.V., Reschke, S., Horn, S., Döring, A., Niks, D., Hille, R., Schulzke, C., Leimkühler, S., & Haumann, M. (2011) The structure of the molybdenum site of YedY, a sulfite oxidase homologue from *Escherichia coli*. *Inorg. Chem.* **50**, 741-748.
131. Wilcoxon, J., Zhang, B. & Hille, R. (2011) The oxidative half-reaction of the molybdenum-copper CO dehydrogenase from *Oligotropha carboxidovorans*. *Biochemistry* **50**, 1910-1916.
132. Mtei, R., Lyashenko, G., Stein, B., Rubie, N., Hille, R. and Kirk, M.L. (2011) Spectroscopic and electronic structure studies of a DMSO reductase catalytic intermediate: implications for electron and atom transfer reactivity. *J. Am. Chem. Soc.* **133**, 9762-9774.
133. Cao, H., Hall, J. & Hille, R. (2011) X-ray crystal structure of arsenite-inhibited xanthine oxidase: μ -sulfido μ -oxo double bridge between molybdenum and arsenic in the active site. *J. Am. Chem. Soc.* **133**, 12414-12417.
134. Wilcoxon, J., Snider, S., & Hille, R. (2011) Substitution of silver for copper in the binuclear Mo/Cu cluster of CO dehydrogenase leads to partial retention of catalytic power. *J. Am. Chem. Soc.*, **133**, 12934-12936.
135. Lambeck, I.C., Fischer-Schrader, K., Niks, D., Roeper, J., Chi, J.-C., Hille, R. & Schwarz, G. (2012) The mechanism of inhibition of *Arabidopsis thaliana* nitrate reductase by 14-3-3 protein. *J. Biol. Chem.* **287**, 4562-4571.
136. Pushie, M.J., Cotelesage, J.J.H., Lyashenko, G., Hille, R. & George, G.N. (2013) X-ray absorption spectroscopy of a quantitatively Mo(V) dimethyl sulfoxide reductase species. *Inorg. Chem.* **52**, 2830-2837.
137. Shanmugam, M., Wilcoxon, J., Habel-Rodriguez, D., Kirk, M.L., Hoffman, B.M. & Hille, R. (2013) ^{13}C and $^{63,65}\text{Cu}$ ENDOR studies of CO dehydrogenase from *Oligotropha carboxidovorans*. Experimental evidence in support of a copper-carbonyl intermediate. *J. Am. Chem. Soc.* **135**, 17775-17782.

138. Reschke, S., Niks, D., Wilson, H., Sigfridsson, K.G.V., Haumann, M., Rajagopalan, K.V., Hille, R. & Leimkühler, S. (2013) Impact of the cysteine molybdenum ligand by selenocysteine on structure and function of the active site in human sulfite oxidase. *Biochemistry* **52**, 8295-8303.
139. Wilcoxon, J., & Hille, R. (2013) The hydrogenase activity of CO dehydrogenase from *Oligotropha carboxidovorans*. *J. Biol. Chem.* **288**, 36052-36060.
140. Cao, H., Hall, J., & Hille, R. (2014) Crystal structures of xanthine oxidoreductase complexed with guanine and indole-3-aldehyde. *Biochemistry* **53**, 533-541.
141. Anderson, R.F., Shinde, S.S, Hille, R, Rothery, R.A., Weiner, J.H., Rajagukguk, S., Maklashina, E. & Cecchini, G. (2014) Efficient Electron Transfer to the Heme in Complex II Involves the [3Fe-4S] and Quinone Sites of the Enzyme. *Biochemistry* **53**, 1637-1646.
142. Cao, H., Pauff, J.M., & Hille, R. (2014) X-ray crystal structure of xanthine oxidase in complex with flavonoid inhibitor quercetin. *J. Nat. Prod.* **77**, 1693-1699.
143. Hall, J., Reschke, S., Cao, H., Leimkühler, S. & Hille, R. (2014) The reaction mechanism of xanthine dehydrogenase from *R. capsulatus*. *J. Biol. Chem.* **289**, 32121-32130.
144. Lee, M.-C., Velayutham, M., Shoji, H., Yoshino, F., Hille, R., & Zweier, J.L. (2014) Measurement and characterization of superoxide generation from xanthine dehydrogenase: A redox regulated pathway of radical generation in ischemic tissues. *Biochemistry* **53**, 6615-6623.
145. Wang, J., Krizowski, S., Fischer, K, Niks, D., Tejero, J., Wang, L., Sparacino-Watkins, C., Ragireddy, P., Frizzell, S., Kelley, E., Shiva, S., Zhang, Y., Hille, R., Basu, P., Schwarz, G., Gladwin, M.T. (2015) Sulfite oxidase catalyzes single electron transfer reaction at its molybdenum domain to reduce nitrite to NO. *Antiox. Redox. Sign.* **23**, 283-294.
146. Niks, D, Duvvuru, J., Escalona, M. & Hille, R. (2016) Spectroscopic and kinetic characterization of the soluble, NAD⁺-dependent formate dehydrogenase from *Ralstonia eutropha*, *J. Biol. Chem.* **291**, 1162-1174.

Manuscripts submitted or in preparation

- Dingwall, S., Wilcoxon, J., Niks, D., and Hille, R. Studies of CO dehydrogenase from *Oligotropha carboxidovorans*. *J. Mol. Catal. B: Enzymatic*, submitted
- Reichmann, D., Niks, D., Hille, R., Krompholz, N.K., Havemeyer, A., Clement, B., Caezan, A., Biester, H. Mendel, R.R., and Bittner, F., Characterization of the MOSC domain family enzymes YcbX and YiiM from *Escherichia coli*. To be submitted to *J. Biol. Chem.*

REVIEW ARTICLES

1. Hille, R. & Massey, V. (1981) Tight binding inhibitors of xanthine oxidase, *Pharmacol. Ther.*, **14**, 249-263.
2. Hille, R. & Massey, V. (1985) Molybdenum-containing hydroxylases: xanthine oxidase, aldehyde oxidase and sulfite oxidase, in *Molybdenum Enzymes* (Spiro, T.G., ed.) John Wiley, New York, pp. 443- 518.
3. Hille, R. (1989) Xanthine oxidase, xanthine dehydrogenase and aldehyde oxidase in *The Chemistry and Biochemistry of Flavoproteins* vol. III (F. Müller, ed.) CRC Press, New York, pp. 21-68.
4. Hille, R. (1994) The reaction mechanism of oxomolybdenum enzymes, *Biochim. Biophys. Acta* **1184**, 143-169.
5. Hille, R., & Nishino, T. (1995) Xanthine oxidase and xanthine dehydrogenase, *FASEB J.* **9**, 995-1003.
6. Hille, R. (1996) Structure/function of mononuclear molybdenum enzymes. *J. Biol. Inorg. Chem.* **1**, 397-406.
7. Hille, R. (1996) The mononuclear molybdenum enzymes, *Chem. Rev.* **96**, 2757-2816.
8. Hille, R. (1998) "Xanthine oxidoreductase" in *Human Protein Data* (A. Haeblerli, ed.) VCH Press, Zurich.
9. Hille, R. (1998) "Aldehyde oxidase", in *Human Protein Data* (A. Haeblerli, ed.) VCH Press, Zurich.
10. Hille, R. (1998) Mechanistic aspects of the mononuclear molybdenum enzymes, *J. Biol. Inorg. Chem.* **2**, 804-809.
11. Hille, R., Rétey, J., Bartlewski-Hof, U., Kroneck, P.M.H., Reichenbecher, W. & Schink, B. (1999) Mechanistic aspects of molybdenum-containing enzymes. *FEMS Microbiol. Rev.* **22**, 489-501.
12. Hille, R. (1999) "Sulfite Oxidase", in *Human Protein Data* (A. Haeblerli, ed.) VCH Press, Zurich.
13. Hille, R. (1999) Molybdenum-containing enzymes. *Essays in Biochemistry*, v. 34 Metalloproteins (D.P. Ballou, Ed.), Portland Press, Edinburgh, pp. 125-143.
14. Hille, R. (2000) Molybdenum enzymes. in *Subcellular Biochemistry*, v. 36, "Enzymes Catalyzing Electron and Radical Transfer" (A. Holzenberg & N.S. Scrutton, eds.) Plenum Publishing Co., London, pp. 445-485.

15. Hille, R. (2002) Molybdenum Enzymes Containing the Pyranopterin Cofactor. An Overview. in *Metals in Biological Systems* v. 39. Molybdenum and tungsten: their roles in biological processes (A. Sigel & H. Sigel, eds.), Marcel Dekker, New York, pp. 187-226.
16. Manikandan, P., Hoffman, B., Ellis, P., Kuhn, P., Choi, E.-Y., Hemann, C.F., & Hille, R. (2002) Structure and Function in the Molybdenum Enzymes Xanthine Oxidase and Arsenite Oxidoreductase. *Indian J. Chem., Sec. A* **41**, 22-31.
17. Hille, R. (2002) Molybdenum and Tungsten in Biology. *Trends Biochem. Sci.* **27**, 360-367.
18. Anderson, G.L., Ellis, P.J., Kuhn, P., and Hille R. (2002) Oxidation of arsenite by *Alcaligenes faecalis* in *Environmental Chemistry of Arsenic* (Frankenberger, W.T., ed.) Marcell Dekker, New York, pp. 343-361.
19. Hille, R. (2003) Plants have SOX – the structure of sulfite oxidase from *Arabidopsis thaliana*. *Structure*, **11**, 1189-1190.
20. Hille, R. (2005) Molybdenum-containing hydroxylases. *Arch. Biochem. Biophys.* **433**, 107-116.
21. Hille R. (2006) Structure and function of xanthine oxidoreductase. *Eur. J. Inorg. Chem.* **10**, 1913-1926.
22. Hille, R. (2009) Are Metal-Carbon Bonds Formed in Molybdenum-Containing Enzymes? in *Metal Ions in the Life Sciences*, vol 6. (A. Sigel, H. Sigel and R.K.O. Sigel, eds.) RSC Publishing, Cambridge, UK, pp. 395-416.
23. Hille, R. (2010) EPR studies of xanthine oxidoreductase and other molybdenum-containing hydroxylases Ch. 5. in *Biological Magnetic Resonance* vol. 29, Metals in Biology: Applications of High-Resolution EPR to Metalloenzymes. (G. Hanson and L. Berliner, Jr., eds.) Springer, Berlin, pp. 91-121.
24. Hille, R. (2011) Arsenite oxidase: molecular, biological and environmental aspects. in *Handbook of Metalloproteins* Vols 4&5 (A. Messerschmidt, ed.), John Wiley & Sons, Ltd, Chichester, UK, pp. 533-540.
25. R. Hille & R.R. Mendel (2011) An overview of molybdenum in biology. *Coord. Chem. Rev.* **255**, 991-992.
26. Hille, R., Nishino, T., and Bittner, F. (2011) Eukaryotic molybdenum enzymes. *Coord. Chem. Rev.* **255**, 1179-1205.
27. Hille, R. (2012) The molybdenum-containing hydroxylases and related enzymes. In *Molybdenum: Its Biological and Coordination Chemistry* (A. Holder and W.E. Newton, eds.) Nova Science Publishers, Hapauge, New York.
28. Hille, R. (2013) The molybdenum oxotransferases and related enzymes. *Dalton Trans.* **42**, 3029-3042.

29. Appel, A.M., Bercaw, J.E., Bocarsly, A.B., Dobbek, H., Dubuis, M., Dubois, D., Ferry, J.G., Fujita, E., Hille, R., Kenis, P.J.A., Kerfeld, C.A., Morris, R.H., Peden, C.H.F., Portis, A.R., Ragsdale, S.J., Rauchfuss, T.B., Reek, J.N.H., Seefeldt, L., Thauer, R.K., & Waldrop, G.L. (2013) Frontiers, Opportunities, and Challenges in Biochemical and Chemical Catalysis of CO₂ Fixation. *Chem. Rev.* **113**, 6621-6658.
30. Hille, R., Hall, J., & Basu, P. The mononuclear molybdenum enzymes. (2014) *Chem. Rev.* **114**, 3963-4038.
31. Hille, R., Dingwall, S., & Wilcoxon, J. (2015) The aerobic CO dehydrogenase from *Oligotropha carboxidovorans*. *J. Biol. Inorg. Chem.* **20**, 243-251145.

PEER-REVIEWED BOOK CHAPTERS AND SYMPOSIUM PROCEEDINGS

1. Hille, R. (1979) The kinetic and equilibrium properties of xanthine oxidase containing chemically modified flavins, in *The Chemistry and Uses of Molybdenum* (H.F. Barry & P.C.H. Mitchell, eds.), Climax Molybdenum Company, Ann Arbor, Michigan, pp. 310-315.
2. Hille, R., Stewart, R.C., Fee, J.A. & Massey, V. (1982) The binding of arsenite to the molybdenum center of xanthine oxidase, in *The Chemistry and Uses of Molybdenum* (Barry, H.F. & Mitchell, P.C.H., eds.), Climax Molybdenum Company, Ann Arbor, pp. 169-172.
3. Hille, R., & Massey, V. (1982) The oxidative half-reaction of xanthine oxidase, in *Flavins and Flavoproteins* (Massey, V., & Williams, C.H., eds.) Elsevier Biomedical, New York, 786-791.
4. Hille, R. (1985) The equilibration of reducing equivalents within milk xanthine oxidase, in *Flavins and Flavoproteins*, (R.C. Bray, P.C. Engel, S.G. Mayhew, eds.) Walter de Gruyter, Berlin, pp. 683-686.
5. Hille, R. (1987) Redox interactions of the FAD in xanthine oxidase with other centers of the protein, in *Flavins and Flavoproteins* (D.M. McCormick & D.E. Edmondson, eds.) Walter de Gruyter, New York, pp. 391-401.
6. Hille, R. & Anderson, R.F. (1990) Studies of electron transfer in xanthine oxidase, in *Flavins and Flavoproteins* (Curti, B., Zanetti, G., Ronchi, S., eds.) Walter de Gruyter, New York, pp. 681-684.
7. Shardy, D., & Hille, R. (1990) Electron transfer in xanthine oxidase containing chemically modified flavins, in *Flavins and Flavoproteins* (Curti, B., Zanetti, G., Ronchi, S., eds.) Walter de Gruyter, New York, pp. 670-680.

8. Rohlfs, R.J. & Hille, R. (1990) Intramolecular electron transfer in trimethylamine dehydrogenase from *W₃A₁*, in *Flavins and Flavoproteins* (Curti, B., Zanetti, G., Ronchi, S., eds.) Walter de Gruyter, New York, pp. 739-742.
9. Hille, R. (1993) "The reductive half-reaction of xanthine oxidase", in *Molybdenum Enzymes, Cofactors and Model Systems* (E.I. Stiefel, W.E. Newton & D. Coucouvanis, eds.) ACS Symposium Series, New York, pp. 22-37.
10. Hille, R. & Rohlfs, R.J. (1993) Electron transfer and prototropic equilibria in two complex flavoproteins, in *Flavins and Flavoproteins* (Yagi, K., ed.) Walter de Gruyter, New York, pp. 751-754.
11. Wilson, E.K., Hille, R., Huang, L., Mathews, F.S. & Scrutton, N.S. (1997) Electron transfer in trimethylamine dehydrogenase: site-directed mutagenesis of a potential tunneling pathway. *Biochem. Soc. Trans.* **24**, 456-461.
12. Hille, R. (1997) The reaction mechanism of xanthine oxidase. in *Flavins and Flavoproteins* (K.J. Stevenson, V. Massey, & C.H. Williams, Jr., eds.) University of Calgary Press, 821-830.
13. Ratnam, K., Shiraishi, N., Campbell, W.H., & Hille, R. (1997) Spectroscopic and kinetic characterization of the recombinant cytochrome c reductase fragment of nitrate reductase. in *Flavins and Flavoproteins* (K.J. Stevenson, V. Massey, & C.H. Williams, Jr., eds.) University of Calgary Press, 921-925.
14. Anderson, R.F. & Hille, R. (1997) Electron transfer within trimethylamine dehydrogenase. in *Flavins and Flavoproteins* (K.J. Stevenson, V. Massey, & C.H. Williams, Jr., eds.) University of Calgary Press, 865-868.
15. Wilson, E.K., Scrutton, N.S., Huang, L., Hille, R., & Mathews, F.S. (1997) Electron transfer complex assembly: the association of trimethylamine dehydrogenase with electron transferring flavoprotein. in *Flavins and Flavoproteins* (K.J. Stevenson, V. Massey, & C.H. Williams, Jr., eds.) University of Calgary Press, pp. 957-960.
16. Scrutton, N.S., Wilson, E., Mewies, M., Packman, L.C., Mathews, F.S., Huang, L., & Hille, R. (1997) Trimethylamine dehydrogenase: mechanism and assembly of a complex iron-sulfur flavoprotein. in *Flavins and Flavoproteins* (K.J. Stevenson, V. Massey, & C.H. Williams, Jr., eds.) University of Calgary Press, pp. 857-864.
17. Xia, M., Ilich, P., Dempski, R. & Hille, R. (1997) Recent studies of the reductive half-reaction of xanthine oxidase, *Biochem. Soc. Trans.* **25**, 768-773.
18. Scrutton, N.S., Basran, J., Wilson, E.K., Chohan, K.K., Jang, M.-H., Sutcliffe, M.J. & Hille, R. (1999), Electron transfer in trimethylamine dehydrogenase and electron transferring flavoprotein, *Biochem. Soc. Trans.* **28**, 196-201.
19. Hille, R., & Anderson, R.F. (1999) Solvent isotope effects on electron transfer in xanthine oxidase. in *Flavins and Flavoproteins* (S. Ghisla, P. Kroneck, P. Macheroux, and H. Sund, eds.) Rudolph Weber, Berlin, 215-218.
20. Jang, M.-H., Scrutton, N.S., & Hille, R. (1999) Formation of the ETF hydroquinone in the TMADH/ETF protein complex. in *Flavins and Flavoproteins* (S. Ghisla, P. Kroneck, P. Macheroux, and H. Sund, eds.) Rudolph Weber, Berlin, 223-226.
21. Roberts, P., Basran, J., Wilson, E.K., Hille, R., & Scrutton, N.S. (1999) Substrate inhibition in trimethylamine dehydrogenase. in *Flavins and Flavoproteins* (S. Ghisla, P. Kroneck, P. Macheroux, and H. Sund, eds.) Rudolph Weber, Berlin, 423-426.
22. Jang, M.-H., Basran, J., Scrutton, N.S., & Hille, R. (1999) The reductive half-reaction of trimethylamine dehydrogenase with trimethylamine. in *Flavins and Flavoproteins* (S. Ghisla, P. Kroneck, P. Macheroux, and H. Sund, eds.) Rudolph Weber, Berlin, 451-454.
23. Mewies, M., & Hille, R. (1999) Studies of the bile-acid inducible NADH:flavin oxidoreductase. in *Flavins and Flavoproteins* (S. Ghisla, P. Kroneck, P. Macheroux, and H. Sund, eds.) Rudolph Weber, Berlin, 795-797.
24. Shi, W., Mersfelder, J., and Hille, R. (2002) Studies of the interaction of trimethylamine dehydrogenase with electron-transferring flavoprotein. in *Flavins and Flavoproteins* (R.N. Perham, S.K. Chapman, and N.S. Scrutton, eds.) Rudolph Weber, Berlin, pp. 647-652.
25. Mersfelder, J., Shi, W. and Hille, R. (2005) A linear free energy study of trimethylamine dehydrogenase. in *Flavins and Flavoproteins* (T. Nishino, R. Miura, M. Tanokura, K. Fukui eds.) ArchiText, Inc., Tokyo, pp. 287-292.
26. Anderson, R.F., Hille, R., Shinde, S., and Cecchini, G. (2005) Electron transfer in succinate dehydrogenase. in *Flavins and Flavoproteins* (T. Nishino, R. Miura, M. Tanokura, K. Fukui eds.) ArchiText, Inc., Tokyo, pp. 401-406.
27. Cao, H., Pauff, J.M., & Hille, R. (2010) Substrate Binding and Orientation in Xanthine Oxidase. *Indian J. Chem.* **50A**, 355-362.
28. Hille, R. (2012) Xanthine oxidase and related enzymes. In *Encyclopedia of Metalloproteins* (R.R. Kretsinger, V.N. Uversky and E.A. Permyakov, eds.), Springer Press.

29. Hille R. (2012) Pyranopterins. In *Encyclopedia of Biophysics* (V. Davidson, ed.), Springer Press.
30. Anderson, R.F., Shinde, S.S., Maklashina, E., Rajagukguk, S., Hille, R., & Cecchini, G. (2012) Single electron transfers within the flavoprotein succinate:ubiquinone oxidoreductase (Complex II). In *Flavins and Flavoproteins* (S. Miller, R. Hille, and B. Palfey, eds.) Lulu Press, Raleigh, NC, pp. 209-216.
31. Hille, R., Wilcoxon, J., Zhang, B., and Snider, S. (2012) Kinetic and EPR studies of CO dehydrogenase from *Oligotropha carboxidovorans*. In *Flavins and Flavoproteins* (S. Miller, R. Hille, and B. Palfey, eds.) Lulu Press, Raleigh, NC, pp. 217-226.
32. Wilcoxon, J., Zhang, B., & Hille, R. (2012) The oxidative half-reaction of CO dehydrogenase from *Oligotropha carboxidovorans*. In *Flavins and Flavoproteins* (S. Miller, R. Hille, and B. Palfey, eds.) Lulu Press, Raleigh, NC, pp. 227-232.
33. Hall, J., Cao, H. & Hille, R. (2012) Cofactor insertion into members of the xanthine oxidase family of molybdenum- and flavin-containing enzymes. In *Flavins and Flavoproteins* (S. Miller, R. Hille, and B. Palfey, eds.) Lulu Press, Raleigh, NC, pp. 233-238.
34. Niks, D., Spiegelhauer, O., Dobbek, H. & Hille, R. (2012) Characterization of the 2-oxoquinoline monooxygenase reductase component from *P. putida* 86. In *Flavins and Flavoproteins* (S. Miller, R. Hille, and B. Palfey, eds.) Lulu Press, Raleigh, NC, pp. 595-600.
35. Hille, R. (2013) The assimilatory nitrate reductases. In *Handbook of Flavoproteins*, vol 2 (R. Hille, S.M. Miller and B. Palfey, eds), Walter de Gruyter, Berlin, pp. 125-140.
36. Hille, R. Molybdenum-containing iron-sulfur proteins. (2014) In *Iron-Sulfur Clusters in Chemistry and Biology* (T.A. Roualt, ed.) Walter de Gruyter, Berlin, pp. 133-210.

Editorships

- “Molybdenum in Living Systems” *Coord. Chem. Rev.* **255** (R.R. Mendel and R. Hille, Guest Editors for Vol. 255), ACS Press, New York, 2011.
- Flavins and Flavoproteins: Proceedings of the 17th International Symposium on Flavins and Flavoproteins* (S.M. Miller, R. Hille and B. Palfey, eds.). ISBN 978-1-300-78640-5. 2013.
- Handbook of Flavoproteins*, Vols. I and II (R. Hille, S.M. Miller and B. Palfey, eds.) Walter de Gruyter, Berlin. ISBN 978-3-11-026842-3 and 978-3-11-029828-4. 2014
- Molybdenum and Tungsten Enzymes* (R. Hille, C. Schulzke and M.L. Kirk, eds.) Royal Society of Chemistry (Metallobiochemistry Series), London (3-volume set). In press.

Invited Talks at National and International Meetings (since 2000)

- Iron-Sulfur Proteins Meeting, King's College London, UK – May, 2000
- Inorganic Biochemistry Summer Workshop, University of Georgia, Athens, GA – August, 2000
- International Symposium on Bioinorganic Chemistry, Mumbai, India – November, 2000
- Molybdenum and Tungsten Enzymes Gordon Conference, Oxford, UK – July, 2001
- Robert C. Bray Memorial Symposium, University of Sussex, UK – September, 2002
- Japanese Biochemical Society Meeting, Kyoto, Japan – October, 2002
- Midwest Metals Meeting, Washington University, St. Louis – May, 2003
- Molybdenum and Tungsten Enzymes Gordon Conference, Meriden, NH – July, 2003
- 11th International Conference on Bioinorganic Chemistry, Cairns, Australia – July, 2003
- 7th European Symposium on Bioinorganic Chemistry, Garmisch-Partenkirchen, Germany – August, 2004
- Molybdenum and Tungsten Enzymes Gordon Conference, Oxford, UK – July, 2005
- Metals in Biology Gordon Conference, Ventura, CA – January, 2006
- Curti Symposium on Flavins and Flavoproteins, University of Milan, Italy – October, 2006
- FLAK Symposium, Brosarp, Sweden – June, 2007
- Molybdenum and Tungsten Enzymes Gordon Conference, New London, NH – July, 2007
- 2nd Intl Conference on Vitamins, Coenzymes and Biofactors, University of Georgia – October, 2008
- Molybdenum and Tungsten Enzyme Gordon Conference, Il Ciocco, Italy – July, 2009
- Symposium on Advances in Biological Inorganic Chemistry, TIFR, Mumbai, India – November, 2009

Second International Symposium on Enzymes and Biocatalysis, Dalian, China – April, 2011 (Keynote Lecture)
 Second International Symposium on Enzymes and Biocatalysis, Dalian, China – April, 2011 (Session Lecture)
 17th International Symposium on Flavins and Flavoproteins, Berkeley, CA – July, 2011
 Molybdenum and Tungsten Enzyme Conference, Edmonton, Alberta – August, 2011
 DFG “Prosthetic Groups: Transport and Insertion” Meeting, Burg Warberg, Germany – September, 2011
 US Department of Energy CO₂ Reduction Workshop, Annapolis, MD – October, 2011
 Metal Hydrides in Biology Workshop, University of Oxford, UK – March, 2012
 Trends in Enzymology 2012, Göttingen, Germany – June, 2012
 Iron-Sulfur Enzymes Gordon Conference, Mount Holyoke College, MA – June, 2012
 C1 Metabolism Gordon Conference, Bates College, NH – August, 2012
 16th International Conference on Bioinorganic Chemistry, Grenoble, France – July, 2013

DoE Physical Biosciences Meeting, Annapolis, MD – October, 2014
 Molybdenum and Tungsten Enzymes Meeting, Balatonfüred, Hungary – September, 2015
 38th Solar Photochemistry Meeting, Gaithersburg, MD – January, 2016
 6th Symposium on Bioinorganic Chemistry, Kolkata, India – January, 2017
 11th Molybdenum and Tungsten Enzymes Meeting, Santa Fe, NM – June, 2017
 19th International Symposium on Flavins and Flavoproteins, Groningen, Netherlands – July, 2017

Invited Seminars (since 2000)

Department of Biochemistry, Pennsylvania State University – January, 2000
 Department of Biochemistry, The John Innis Center, Norwich, UK – May, 2000
 Department of Chemistry, The University of Edinburgh, UK – May, 2000
 Departments of Biochemistry and Chemistry, The University of Leicester, UK – May, 2000
 Central Research Division, Pfizer Inc., Groton, CT – July, 2000
 Department of Chemistry, University of New Mexico – October, 2000
 Department of Biochemistry, Wright State University – January, 2001
 Department of Chemistry and Biochemistry, Utah State University – January, 2001
 Department of Chemistry, Duquesne University – March, 2001
 Chemical Biology and Biophysics Programs, The University of Michigan, Ann Arbor – October, 2001
 Biochemistry and Molecular Biology Program, University of Texas Health Sci Ctr, Houston – October, 2001
 Department of Microbiology, University of Brisbane – January, 2002
 Department of Chemistry, University of Wisconsin (Milwaukee) – February, 2002
 Department of Chemistry, University of Osaka (Japan) – October, 2002
 Department of Microbiology and Immunology, University of Illinois, Chicago – November, 2002
 Department of Biochemistry and Molecular Biophysics, University of Arizona – November, 2002
 Department of Chemistry, University of Auckland, New Zealand – February, 2003
 Department of Biochemistry, University of Texas Health Science Center, San Antonio – April, 2003
 Department of Plant Biology, Technical University of Braunschweig, Germany – September, 2003
(Humboldt Lectures on Enzymology and Spectroscopy of Metalloenzymes)
 Department of Microbiology, Technical University of Braunschweig, Germany – September, 2003
 Department of Biophysics, Medical College of Wisconsin – February, 2004
 Department of Biochemistry, Medical College of Wisconsin – May, 2004
 Department of Microbiology, University of Halle, Germany – June, 2004
 Department of Microbiology, University of Bayreuth, Germany – June, 2004
 Departments of Biochemistry and Microbiology, Michigan State University – March, 2005

Department of Biochemistry, University of British Columbia – April, 2005
 Department of Chemistry, University of New Mexico – September, 2005
 Department of Biochemistry, University of California, Riverside – May, 2006
 Department of Biochemistry, Temple University, Philadelphia – August, 2006
 Instituto Mario Negri, Milan, Italy – October, 2006
 Department of Biochemistry, University of California, Riverside – December, 2006
 Center for Chemistry and Chemical Engineering, University of Lund, Sweden – June, 2007
 Cellular, Molecular and Developmental Biology Program, University of California, Riverside – October, 2007
 Department of Chemistry and Biochemistry, Cal State, San Bernardino – January, 2008
 Department of Chemistry, University of California, Davis – March, 2008
 Department of Chemistry, University of California, Riverside – April, 2008
 Department of Chemistry, University of Washington – April 2008
 Institute of Biochemistry, University of Köln – July, 2008
 Institute of Inorganic Chemistry, University of Göttingen – July, 2008
 Center for Molecular Biosciences, University of Bayreuth – July, 2008
 Department of Chemistry, San Diego State University – March, 2009
 Institute of Biochemistry, University of Potsdam – June, 2009
 Department of Chemistry and Biochemistry, University of Potsdam – June, 2009
 Department of Chemistry, Indian Institute of Technology, Kanpur – November, 2009
 Department of Biochemistry and Cell Biology, Rice University – April, 2010
 Institute of Biochemistry, University of Potsdam, Germany – September, 2010
 Institute of Biochemistry, University of Potsdam, Germany – September, 2011
Humboldt Lecture in Biochemistry
 Institute of Biochemistry, University of Cologne, Germany – September ,2011
Humboldt Lecture in Biochemistry
 Department of Biochemistry, University of Wisconsin, Madison – October, 2011
 Mathematical Biosciences Institute, The Ohio State University – November, 2011
 Department of Chemistry and Biochemistry, Cal State Fullerton – December, 2011
 Department of Molecular Biology and Biochemistry, University of California, Irvine – April, 2012
 Department of Chemistry, Trinity College, Dublin – May, 2012
 Institute of Structural and Molecular Biology, University College, London – May, 2012
 Max Planck Institute for Terrestrial Microbiology, Marburg, Germany – June, 2012
 Department of Structural Biology, University of Freiburg, Germany – June, 2012
 Laboratory for Bacterial Biochemistry, CNRS Marseilles – July, 2012
 New University of Lisbon, Lisbon, Portugal – July, 2013

Department of Biochemistry, University of Alberta, CA – December 2015
 Cologne
 Greifswald
 Leipzig, Braunschweig, Max Planck Photochemistry???

The subject of these presentations was one of the following: (1) the mechanism of xanthine oxidase and other molybdenum enzymes; (2) the mechanism of trimethylamine dehydrogenase; (3) electron transfer in biological systems; (4) structure and function of arsenite oxidase; or (5) the reaction mechanism of CO dehydrogenase.

Research Program

My research program focuses the reaction mechanisms of oxidoreductase enzymes - particularly those possessing molybdenum or flavin in their active sites - and biological electron transfer. The molybdenum-containing enzymes catalyze the incorporation of oxygen into a variety of organic and inorganic compounds, and constitute an important enzyme class within the oxidoreductases. These enzymes have been only poorly understood in comparison to other biological systems that contain heme, flavin, non-heme iron or copper. Working with representative members of each of the three major families of molybdenum enzymes, we have successfully identified the fundamental aspects of the catalytic sequences of these enzymes, and in each case established the overall chemical course of the reaction. Particularly in the case of the molybdenum hydroxylase family (as represented by xanthine oxidase), work in our laboratory has elucidated the overall reaction mechanism, characterizing each of the principal intermediates in the course of the reaction both spectroscopically and crystallographically. This work has demonstrated that molybdenum-based hydroxylation of carbon centers is carried out without the generation of a highly reactive oxygenated intermediate (e.g., the perferryl oxide and 4a-peroxide "oxygen guns" of heme and flavin containing enzymes, respectively). These studies have provided an increasingly clear picture of the chemical sequence of events that lead to oxygen atom transfer in the absence of a high-energy intermediate, and our reaction mechanism is generally accepted in the literature. Other enzymes under active investigation in the laboratory include: sulfite oxidase and nitrate reductase from plants (such as *Arabidopsis thaliana*), the latter of which catalysis the first and rate-limiting step in nitrogen assimilation in higher plants; carbon monoxide dehydrogenase and DMSO reductase from *Rhodobacter capsulatus*, which play major roles in environmental CO remediation and the global sulfur cycle, respectively; and newly discovered molybdenum-containing enzymes that play as yet undefined physiological roles in humans and bacteria (mARC, YedY, YcbX, YiiM).

Enzymes possessing multiple redox-active centers in a single polypeptide are useful systems in which to examine the factors governing rates of biological electron transfer without the complication of protein-protein interactions. We are utilizing pH-jump stopped-flow, flash photolysis and pulse radiolysis methodologies to examine the rates of electron transfer within several such enzymes, including xanthine oxidase (possessing a molybdenum center, two [2Fe-2S] clusters and FAD), trimethylamine dehydrogenase (with FMN and a [4Fe-4S] cluster) and succinate:quinone oxidoreductase (with FAD, three different iron-sulfur centers, a b-type cytochrome and a tightly bound equivalent of ubiquinone). Our work with xanthine oxidase has shown, for example, that protonation/deprotonation of the enzyme flavin occurs concomitantly with electron transfer. By contrast, in trimethylamine dehydrogenase, protonation and electron transfer occur as discrete steps, rather than concomitantly. We have recently extended this work to studies of succinate:quinone oxidoreductase, demonstrating, for example, that electron equilibration involving the enzyme's heme is extremely rapid, despite the rather low reduction potential of the center. In each of these systems, electron transfer is generally extremely rapid and is typically not rate-limiting for turnover.

Laboratory Facilities

The above research program utilizes a wide range of spectroscopic techniques, including: x-ray absorption, electron paramagnetic resonance and resonance Raman. A variety of kinetic methods are also employed, including stopped-flow, freeze-quench, flash photolysis and pulse radiolysis. The principal instrumentation in the laboratory, most of which has been funded by two Shared Instrumentation Grants from NIH and one from NSF, is described below.

EPR facility. This facility consists of a computer-controlled Brüker ER300 EPR spectrometer capable of operating at 3, 9 and 34 GHz microwave frequency. The instrument is equipped with NMR gaussmeter and microwave frequency counter for the accurate determination of g-values. A variety of microwave cavities are available (including cylindrical and double-rectangular), as is cryogenic equipment for operation at both liquid nitrogen and liquid helium temperatures.

Resonance Raman facility. This instrument has been designed for optimal efficiency in the vis/NIR region. Kr⁺ and Ar⁺ lasers (Coherent, Inc.) provide a number of specific excitation lines and may also be used to pump either a titanium/sapphire or dye laser to provide excitation throughout the visible/NIR. The detector is a charge-coupled device whose active element is a 1024 x 1024 back-thinned element. Low-temperature capabilities are provided by an APD Cryogenics closed cycle liquid helium refrigerator. The

instrument is located in a specially designed room of the laboratory that is dedicated to spectroscopic instrumentation, including an Aviv Associates CD spectrophotopolarimeter (280 - 2,000 nm spectral range) and a recently upgraded Mattson Sirius 100+ FT-IR interferometer.

Laboratory: two large chromatography refrigerators, Millipore water purification system, and centrifuges (Beckman L7-65 and J2-21 ultra- and high-speed centrifuges, Tomy MTX-150 tabletop refrigerated centrifuge). New Brunswick BioFlow 415 fermentor; two Äkta FPLC protein purification systems; Millipore cell harvester; anaerobic trains, anaerobic glassware, *etc.* for manipulation of protein samples; two Applied Photophysics computer-controlled absorbance/fluorescence stopped-flow apparatuses; three Hewlett-Packard 8452A diode-array spectrophotometers; renovated Cary 14 spectrophotometer (including computer) with a 280-3000 nm scan range; Aviv Associates spectrophotometer (280 - 2,000 nm spectral range); Beckman HPLC apparatus; EG&G 363 potentiostat and associated electrodes; Coy glove box.

Computer: SGI Octane2/V10 molecular graphics workstation; two eight-processor Linux boxes; several desktop computers; software for the simulation of rapid kinetic transients and EPR spectra, analysis of x-ray absorption spectroscopic data, X-ray crystallography (COOT,) and computational chemistry (MOPAC, GAUSSIAN '08).

Existing Scientific Collaborations

Nationally

Gary Cecchini (Department of Biochemistry and Biophysics, University of California, San Francisco) – Kinetic studies of succinate dehydrogenase

John Enemark (Department of Chemistry, University of Arizona) – ESEEM and NMR studies of molybdenum enzymes

Brian Hoffman (Northwestern University) – ENDOR studies of paramagnetic intermediates of metalloenzymes

Richard Holm (Department of Chemistry, Harvard University) – Isotopic labeling studies of molybdenum-containing enzymes

Martin Kirk (Department of Chemistry, University of New Mexico) – Spectroscopic characterization and modeling of intermediates for molybdenum enzymes

Internationally

Robert Anderson (Department of Chemistry, University of Auckland, New Zealand) – Pulse radiolysis studies of complex redox-active enzymes

Fraser Armstrong (Department of Chemistry, University of Oxford, UK) – electrochemical studies of complex redox-active enzymes

Holger Dobbek (Department of Biochemistry Humboldt University, Berlin) – mechanistic studies of 2-oxoquinoline oxygenase and nicotinate dehydrogenase

Graham George (University of Saskatchewan, Canada) – X-ray absorption studies of molybdenum-containing enzymes

Silke Leimkühler (Department of Biochemistry, University of Potsdam, Germany) – Spectroscopic and kinetic studies of xanthine dehydrogenase from *Rhodobacter capsulatus*; molybdenum cofactor insertion

Ralf Mendel (Institute of Plant Biology, Technical University of Braunschweig, Germany) – Mechanistic studies of molybdenum enzymes from plants

Takeshi Nishino (Department of Biochemistry and Molecular Biology, Nippon Medical School, Tokyo, Japan) and Emil Pai (Department of Biochemistry, University of Toronto, Toronto, Canada) – Structure/function studies of xanthine oxidase and related enzymes

Günter Schwarz (Department of Biochemistry, University of Cologne) – Structure/function studies of nitrate reductase from plants

Matthias Ullmann (Department of Chemistry, University of Bayreuth) – computational studies of molybdenum-containing enzymes

Richard J. Hooley, Ph.D.

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Professional Preparation

2004-2008: The Scripps Research Institute, Department of Chemistry and the Skaggs Institute for Chemical Biology, La Jolla, CA, Skaggs Postdoctoral Fellow, Mentor: Prof. Julius Rebek, Jr.

1999-2004: Princeton University, Department of Chemistry, Princeton, NJ. Degree: Ph.D (Aug 2004) Mentor: Prof Martin F. Semmelhack.

1999: Emmanuel College, Cambridge University, Department of Chemistry, Cambridge, UK. Degree: M.Sci (Natural Sciences, 1999) Mentor: Dr. Stuart Warren.

1995-1999: Emmanuel College, Cambridge University, Department of Chemistry, Cambridge, UK. Degree: B.A. (Natural Sciences, 1999).

Appointments

Associate Professor, University of California, Riverside	2014-current
Assistant Professor, University of California, Riverside	2008-2014
Skaggs Postdoctoral Fellow, The Scripps Research Institute, La Jolla	2004-2008
Graduate Teaching/Research Assistant, Princeton University, NJ	1999-2004

Awards and Honors

University of California, Riverside Faculty Development Award, 2013.

2013 Chancellor's Award for Fostering Excellence in Undergraduate Research and Creative Achievement.

2012 NSF CAREER Award

2011-2012 Hellman Fellowship, University of California, Riverside, July 2011.

University of California, Riverside Regents' Faculty Fellowship, 2009.

Association of Princeton Graduate Alumni University Teaching Award, June 2002.

Pickering Teaching Award, Princeton University, June 2001.

Peer-Reviewed Publications (Bold = Undergraduate Coauthor)

Independent Career

55) Mettry, M.; Hooley, R.J. "Receptors Based on Van der Waals' Forces" in *Comprehensive Supramolecular Chemistry II*, Atwood, J.L., Gokel, G.W., ed., Elsevier, 2016. <http://dx.doi.org/10.1016/B978-0-12-409547-2.12479-5>

54) Johnson, A. M.; Hooley, R.J. "Endohedral Functionalization of Coordination Cages" in *Self-Assembled Rings and Cages*, Clever, G.H. ed., Wiley, 2016.

53) Mettry, M.; Moehlig, M.P.; **Gill, A.D.**; Hooley, R.J. "Alkane Oxidation Catalyzed by a Self-Folded Multi-Iron Complex" *Supramol. Chem.* **2016**, 28, DOI: 10.1080/10610278.2016.1177184

52) Holloway, L.R.; **McGarraugh, H.H.**; Young, M.C.; Sontising, W.; Beran, G.J.O.; Hooley, R.J. "Structural Switching in Self-Assembled Metal-Ligand Helicate Complexes via Ligand-Centered Reactions" *Chem. Sci.* **2016**, 7, 4423-4427.

51) Hooley, R.J. "Taking on the Turnover Challenge" *Nat. Chem.* **2016**, 8, 202-204.

- 50) Zhang, C.; Brown, M.Q.; van de Ven, W.; Zhang, Z.-M.; Wu, B.; Young, M.C.; Synek, L.; Borchardt, D.; Harrison, R.; Pan, S.; Luo, N.; Huang, Y.M.; Ghang, Y.-J.; Ung, N.; Li, R.; Isley, J.; Morikis, D.; Song, J.; Guo, W.; Hooley, R.J.; Chang, C.A.; Yang, Z.; Zarsky, V.; Muday, G.K.; Hicks, G.R.; Raikhel, N.V. "Endosidin2 targets conserved EXO70 to inhibit exocytosis" *Proc. Natl. Acad. Sci., U.S.A.* **2016**, *113*, E41-E50.
- 49) Perez, L.; Ghang, Y.-J.; Williams, P.B.; Wang, Y.; Cheng, Q.; Hooley, R. J. "Cell and Protein Recognition at a Supported Bilayer Interface via In Situ Cavitand-Mediated Functional Polymer Growth" *Langmuir* **2015**, *31*, 11152–11157.
- 48) Holloway, L.R.; Young, M.C.; Beran, G.J.O.; Hooley, R.J. "High Fidelity Sorting of Remarkably Similar Components via Metal-Mediated Assembly" *Chem. Sci.* **2015**, *6*, 4801-4806.
- 47) Mettry, M.; Moehlig, M.P.; Hooley, R.J. "Synthesis, Guest Binding and Metal Coordination of Functionalized Self-folding Deep Cavitands" *Org. Lett.* **2015**, *17*, 1497-1500.
- 46) Johnson, A.M.; Wiley, C.A.; Young, M.C.; Zhang, X.; Lyon, Y.; Julian, R.R.; Hooley, R.J. "Narcissistic Self-Sorting in Self-Assembled Rare Earth Metal-Ligand Cages" *Angew. Chem. Int. Ed.* **2015**, *54*, 5641-5645.
- 45) Ghang, Y.-J.; Perez, L.; Morgan, M. A.; Si, F.; Hamdy, O. M.; Beecher, C. N.; Larive, C. K.; Julian, R. R.; Zhong, W.; Cheng, Q.; Hooley, R. J. "Anionic Deep Cavitands Enable the Adhesion of Unmodified Proteins at a Membrane Bilayer" *Soft Matter* **2014**, *10*, 9651-9656.
- 44) Ghang, Y.-J.; **Lloyd, J.J.**; Moehlig, M.P.; **Arguelles, J.K.**; Mettry, M.; Zhang, X.; Julian, R.R.; Cheng, Q.; Hooley, R.J. "Labeled Protein Recognition at a Membrane Bilayer Interface by Embedded Synthetic Receptors" *Langmuir*, **2014**, *30*, 10161-10166.
- 43) Young, M.C.; Holloway, L.R.; Johnson, A.M.; Hooley, R.J. "A Supramolecular Sorting Hat: Stereocontrol in Metal-Ligand Self-Assembly by Complementary Hydrogen Bonding" *Angew. Chem. Int. Ed.* **2014**, *53*, 9832-9836.
- 42) Hooley, R.J.; Gavette, J.V.; Mettry M.; Ajami, D.; Rebek, J., Jr. "Unusual Orientation And Reactivity of Alkyl Halides in Water-Soluble Cavitands" *Chem. Sci.* **2014**, *5*, 4382-4387.
- 41) Young, M.C.; **Liew, E.**; Hooley, R.J. "Colorimetric Barbiturate Sensing with Hybrid Spin Crossover Assemblies" *Chem. Commun.* **2014**, *50*, 5043 - 5045.
- 40) Young, M.C.; Johnson, A.M.; Hooley, R.J. "Self-Promoted Post-Synthetic Modification of Metal-Ligand M_2L_3 Mesocates" *Chem. Commun.* **2014**, *50*, 1378 - 1380.
- 39) Li, V.; Ghang, Y.-J.; Hooley, R.J.; Williams T.J. "Non-Covalent Self Assembly Controls the Relaxivity of Magnetically Active Guests" *Chem. Commun.* **2014**, *50*, 1375 - 1377.
- 38) Johnson, A.M.; Young, M.C.; Zhang, X.; Julian, R.R.; Hooley, R.J. "Cooperative Thermodynamic Control of Selectivity in the Self-Assembly of Rare Earth Metal-Ligand Helices" *J. Am. Chem. Soc.* **2013**, *135*, 17723–17726.
- 37) Hong, J.; Djernes, K.E.; Lee, I.; Hooley, R.J.; Zaera, F. "Heterogeneous Catalyst for the Selective Oxidation of Unactivated Hydrocarbons Based on a Tethered Metal-Coordinated Cavitand" *ACS Catal.* **2013**, *3*, 2154–2157.
- 36) Young, M.C.; **Liew, E.**; Ashby, J.; **McCoy, K.M.**; Hooley, R.J. "Spin State Modulation of Iron Spin Crossover Complexes Via Hydrogen-Bonding Self-Assembly" *Chem. Commun.* **2013**, *49*, 6331-6333.

- 35) Ghang, Y.-J.; Schramm, M.P.; Zhang, F.; Acey, R.A.; David, C.N.; Wilson, E.H.; Wang, Y.; Cheng, Q.; Hooley, R.J. "Selective Cavitand-Mediated Endocytosis of Targeted Imaging Agents into Live Cells" *J. Am. Chem. Soc.* **2013**, *135*, 7090-7093.
- 34) Johnson, A.M.; Young, M.C.; Hooley, R.J. "Reversible Multicomponent Self-Assembly Mediated By Bismuth Ions" *Dalton Trans.* **2013**, *42*, 8394-8401.
- 33) Young, M.C.; Johnson, A.M.; Gamboa, A.S.; Hooley, R.J. "Achiral Endohedral Functionality Provides Stereochemical Control in Fe(II)-Based Self-Assemblies" *Chem. Commun.* **2013**, *49*, 1627-1629.
- 32) Djernes, K.E.; Padilla, M.; **Mettry, M.**; Young, M.C.; Hooley, R.J. "Hydrocarbon Oxidation Catalyzed by Self-folded Metal-coordinated Cavitands" *Chem. Commun.* **2012**, *48*, 11576 - 11578.
- 31) Liu, Y.; Young, M.C.; **Moshe, O.**; Cheng, Q.; Hooley, R.J. "A Membrane-Bound Synthetic Receptor Promotes Growth of a Polymeric Coating at the Bilayer-Water Interface" *Angew. Chem. Int. Ed.* **2012**, *51*, 7748.
- 30) Moehlig, A.R.; Djernes, K.E.; Krishnan, V.M.; Hooley, R.J. "Cytosine Derivatives Form Hemiprotonated Dimers in Solution and the Gas Phase" *Org. Lett.* **2012**, *14*, 2560.
- 29) Djernes, K.E.; **Moshe, O.**; **Mettry, M.**; **Richards, D.D.**; Hooley, R.J. "Metal-coordinated Water Soluble Cavitands act as C-H Oxidation Catalysts" *Org. Lett.* **2012**, *14*, 788.
- 28) Liu, Y.; Taira, T.; Young, M.C.; Ajami, D.; Rebek, J., Jr.; Cheng, Q.; Hooley, R.J. "Protein Recognition by a Self-Assembled Deep Cavitand Monolayer on a Gold Substrate" *Langmuir*, **2012**, *28*, 1391-1398.
- 27) Johnson, A.M.; **Moshe, O.**; Gamboa, A.S.; **Langloss, B.W.**; Limtiaco, J.F.K.; Larive, C.K.; Hooley, R.J. "Synthesis and Properties of Metal-Ligand Complexes with Endohedral Amine Functionality" *Inorg. Chem.*, **2011**, *50*, 9430.
- 26) Johnson, A.M.; Hooley, R.J. "Steric Effects Control Self-Sorting in Self-Assembled Clusters" *Inorg. Chem.*, **2011**, *50*, 4671.
- 24) Liu, R.; Liao, P.; Zheng, Z.; Hooley, R.J.; Feng, P. "A Water-soluble Deep Cavitand Acts as a Release Trigger for a Supramolecular Nanocap" *Chem. Mater.* **2010**, *22*, 5797.
- 23) Liao, P. **Langloss, B.W.**; Johnson, A.M.; Knudsen, E.R.; Tham, F.S.; Julian, R.R.; Hooley, R.J. "Two-Component Control of Guest Binding in a Self-Assembled Cage Molecule" *Chem. Commun.* **2010**, *46*, 4932.
- 22) Liu, Y.; Liao, P.; Cheng, Q.; Hooley, R.J. "Protein and Small Molecule Recognition Properties of Deep Cavitands in a Supported Lipid Membrane Determined by Calcination-Enhanced SPR Spectroscopy" *J. Am. Chem. Soc.* **2010**, *132*, 10383.

Postdoctoral Work

- 25) Ajami, D.; Kamioka, S.; Sather, A.C.; Hooley, R.J.; Rebek, J., Jr. "Autocatalysis and Organocatalysis with Kemp's Triacid Compounds" *Heterocycles* **2011**, *82*, 1203.
- 21) Hooley, R.J.; Rebek, J., Jr.; "Chemistry and Catalysis in Functional Cavitands" *Chem. Biol.*, **2009**, *16*, 255.
- 20) Tran, C.D.; Mejac, I.; Rebek, J., Jr; Hooley, R.J. "Gas Chromatographic Separation of Isotopic Molecules Using a Novel Cavitand-impregnated Stationary Phase" *Anal. Chem.*, **2009**, *81*, 1244.
- 19) Hooley, R.J.; Shenoy, S.R.; Rebek, J., Jr. "Electronic and Steric Effects in Binding of Deep Cavitands" *Org. Lett.*, **2008**, *10*, 5397.

- 18) Hooley, R.J.; Restorp, P.; Rebek, J., Jr. "A Cavitand with a Fluorous Rim acts as an Amine Receptor" *Chem. Commun.*, **2008**, 6291.
- 17) Lledó, A.; Hooley, R.J.; Rebek, J., Jr. "Recognition of Guests by Water-stabilized Cavitand Hosts" *Org. Lett.*, **2008**, 10, 3669.
- 16) Podkoscielny, D.; Hooley, R.J.; Rebek, J., Jr.; Kaifer, A.E. "Ferrocene Derivatives Included in a Water-Soluble Cavitand: Are They Electroinactive?" *Org. Lett.*, **2008**, 10, 2865.
- 15) Hooley, R.J.; Iwasawa, T.; Rebek, J., Jr. "Detection of Reactive Tetrahedral Intermediates in a Deep Cavitand with an Introverted Functionality" *J. Am. Chem. Soc.*, **2007**, 129, 15330.
- 14) Hooley, R.J.; Rebek, J., Jr. "A Deep Cavitand Catalyzes the Diels-Alder Reaction of Bound Maleimides" *Org. Biomol Chem.*, **2007**, 5, 3631 (Highlighted as a Hot Article, *Org. Biomol Chem.*, **2007**, 5, issue 22; highlighted in *Chem. Sci.*, **2007**, 4, C90).
- 13) Hooley, R.J.; Restorp, P.; Iwasawa, T.; Rebek, J., Jr. "Cavitands With Introverted Functionality Stabilize Tetrahedral Intermediates" *J. Am. Chem. Soc.*, **2007**, 129, 15369.
- 12) Hooley, R.J.; Van Anda, H. J.; Rebek, J., Jr. "Extraction of Hydrophobic Species into a Water-Soluble Synthetic Receptor" *J. Am. Chem. Soc.*, **2007**, 129, 13464.
- 11) Schramm, M.P.; Hooley, R.J.; Rebek, J., Jr. "Guest Recognition with Micelle-Bound Cavitands" *J. Am. Chem. Soc.*, **2007**, 129, 9773.
- 10) Iwasawa, T.; Hooley, R.J.; Rebek, J., Jr. "Stabilization of Labile Carbonyl Addition Intermediates by a Synthetic Receptor" *Science*, **2007**, 317, 493. (Highlighted in **Chemical & Engineering News**, 85 (32), August 1, 2007)
- 9) Hooley, R.J.; Rebek, J., Jr. "Self-Complexed Deep Cavitands – Alkyl Chains Coil Into A Nearby Cavity" *Org. Lett.*, **2007**, 9, 1179.
- 8) Hooley, R.J.; Biros, S.M.; Rebek, J., Jr. "A Deep, Water-Soluble Cavitand Acts as a Phase-Transfer Catalyst for Hydrophobic Species" *Angew. Chem. Int. Ed. Engl.*, **2006**, 45, 3517.
- 7) Hooley, R.J.; Van Anda, H.J.; Rebek, J., Jr. "Cavitands With Revolving Doors Regulate Binding Selectivities and Rates in Water." *J. Am. Chem. Soc.*, **2006**, 128, 3894.
- 6) Hooley, R.J.; Biros, S.M.; Rebek, J., Jr. "Normal Hydrocarbons Writhe and Tumble in a Water-Soluble Cavitand" *Chem. Commun.*, **2006**, 509.
- 5) Hooley, R.J.; Rebek, J., Jr. "Deep Cavitands Provide Organized Solvation of Reactions" *J. Am. Chem. Soc.*, **2005**, 127, 11904.

Graduate Work

- 4) Semmelhack, M.F.; Hooley, R.J.; Kraml, C.M. "Synthesis of Plakortone B and Analogs" *Org. Lett.*, **2006**, 8, 5203.
- 3) Semmelhack, M.F.; Hooley, R.J. "Palladium-Catalyzed Hydrostannylations of Highly Hindered Acetylenes in Hexane" *Tetrahedron Lett.*, **2003**, 44, 5737.
- 2) Hooley, R.J.; Lee, C.B. Commentary on "Iron-Catalyzed Cross-Coupling Reactions of Alkyl-Grignard Reagents with Aryl Chlorides, Tosylates and Triflates" *Chemtracts – Organic Chemistry*, **2003**, 518.

Undergraduate Work

- 1) Christlieb, M.; Davies, J.E.; Eames, J.; Hooley, R.; Warren, S.W. "The Stereoselective Synthesis of Oxetanes; Exploration of a New, Mitsunobu-Style Procedure for the Cyclisation of 1,3-Diols." *J. Chem. Soc. Perkin Trans. 1*, **2001**, 2983.

Research Funding, Last 48 Months

Hellman Faculty Foundation Grant, \$30,000 <i>"Molecular Motion and Molecular Recognition at the Nanoscale"</i>	07/01/2011 - 06/30/2013
NSF CAREER Award, \$600,000 <i>"Functional Metal-Ligand Assemblies: Self-Sorting, Supramolecular Catalysis and Molecular Dynamics"</i>	02/01/2012 - 01/31/2017
NSF TUES (Co-PI, 33%), \$199,350 <i>"Developing Pedagogies of Engagement in Foundation Chemistry Courses: Enhancing Minority Retention in STEM Majors"</i>	07/01/2012 - 06/30/2015
UC Riverside IGF Program (PI, 80%) <i>"Synthetic Receptors as Selective Hosts and Transfection Agents in Living Cells"</i>	08/01/2013 - 06/30/2014
UC Cancer Research Coordinating Committee, \$50,000 <i>"Synthetic Receptors As New Methods Of Drug Delivery For Cancer Therapy"</i>	07/01/2014 - 06/30/2015
NSF IUES (Co-PI, 40%), \$249,630 <i>"A NIMBLE Approach to Active Learning in Large Enrollment Introductory Chemistry Courses (NIMBLE = New Implementations of Massive Blended Learning)"</i>	07/15/2015 - 06/30/2017

Invited Talks

Syracuse University, Apr 2010
California State University, Long Beach, Sep 2010
American Chemical Society Western Regional Meeting, Mar 2011
Princeton University, Nov 2011
University of Southern California, Apr 2012
University of Texas - El Paso, September 2012
University of California, San Diego, October 2012
University of California, Santa Barbara, November 2012
University of California, Irvine, November 2012
Oregon State University, December 2012
University of Oregon, December 2012
Duke University, February 2013
University of North Carolina, February 2013
University of South Carolina, February 2013
Princeton University, February 2013
Georgetown University, February 2013
University of Maryland, February 2013
University of California, Davis, February 2013
University of Massachusetts, Amherst, March 2013
Dartmouth University, March 2013
University of San Diego, March 2013
University of Texas, Austin, April 2013
Denver University, May 2013 (Invited as the Marsico Lecturer)
University of California, Los Angeles, May 2013
University of Tennessee, Jan 2014
San Diego State University, Feb 2014
American Chemical Society National Meeting, Aug 2014 (Self-Assembled Coordination Architectures Symposium)

University of South Dakota, March 2015

NSF workshop "Accelerating our Understanding of Supramolecular Chemistry in Aqueous Solutions", June 2015

PacifiChem, December 2015

University of Sheffield, Feb 2017

University of Southampton, Feb 2017

University of Cambridge, Feb 2017

SUNY Buffalo, March 2017

Synergistic Activities

Reviewer: Nature Chemistry, Angewandte Chemie, Journal of the American Chemical Society, Chemical Science, Journal of Organic Chemistry, Chemical Communications, Inorganic Chemistry, Organic Letters, Analytical Chemistry, Bioconjugate Chemistry, Dalton Transactions, RSC Advances, Organic and Biomolecular Chemistry, CrystEngComm, Chemical Society Reviews, Tetrahedron, Bioorganic & Medicinal Chemistry, Supramolecular Chemistry.

Panelist: NSF CHE MSN CAREER Panel, 2012, 2013, NSF CHE MSN Panel 2015, 2016; NSF CBET Panel 2016; NIH SBCA panel (Ad Hoc member) 2016.

Reviewer: American Chemical Society PRF 2011, 2012, 2014, 2015, 2016; NSF CHE Division, 2013, 2014.

Advising mentor: Maximizing Access To Research Careers (MARC U*), California Alliance for Minority Participation (CAMP), UC Leadership Excellence through Advanced Degrees (UC-LEADS), Mentoring Summer Research Internship Program (MSRIP) programs, UC Riverside.

Current Collaborators: Prof. Christopher Bardeen, University of California, Riverside; Prof. Quan Cheng, University of California, Riverside; Prof. Ryan R. Julian, University of California, Riverside; Prof. Leonard Mueller, University of California, Riverside; Prof. Natasha Raikhel, University of California, Riverside; Prof. Yinsheng Wang, University of California, Riverside; Prof. Francisco Zaera, University of California, Riverside; Prof. Wenwan Zhong, University of California, Riverside, Prof. Yadong Yin, University of California, Riverside,.

Previous Collaborators (Last 48 months): Prof. Roger Acey, California State University - Long Beach; Prof. Pingyun Feng, University of California, Riverside; Prof. Cynthia Larive, University of California, Riverside; Prof. Michael Schramm, California State University - Long Beach; Prof. Travis Williams, University of Southern California; Prof. Emma Wilson, University of California, Riverside.

Graduate and Postdoctoral advisors

M.Sci. Mentor: Dr. Stuart Warren, Dept. of Chemistry, Cambridge University.

Ph.D. Mentor: Prof. Martin F. Semmelhack, Dept. of Chemistry, Princeton University.

Postdoctoral Mentor: Prof. Julius Rebek, Jr., Dept. of Chemistry, The Scripps Research Institute.

Graduate Students and Postdoctoral Scholars Advised (B: Black, F: Female, H: Hispanic)

Current Graduate Students: Calvin Wiley, Magi Mettry^{B,F}, Lauren Holloway^F, Lizeth Perez^{F,H}, Paul Bogie, Tabitha Miller^F, Guy Quanrud.

Previous Graduate Students (attained Ph.D.): Katherine Djernes^F, Ana Gamboa^{F,H}, Amber Johnson^F, Michael Young, Melissa Padilla Moehlig^{F,H}, Yoo-Jin Ghang^F.

Previous Postdoctoral Scholars: Puhong Liao.

Current Undergraduate Researchers: Phoebe Nye^F, Samantha Byers^F, Manolia Ghoul^{F,B}.

Previous Undergraduate Researchers: Kelsi McCoy^F, Hannah Hughes^F, Brian Langloss, Orly Moshe^F, Cindy Tawfik^{B,F} (MARC U* Scholar), Donald Richards^B (MARC U* Scholar), Magi Mettry^{B,F}, Kristianna Wi,^F Adam Gill, Erica Liew^F, Noora Siddiqui^{F,B}, Mi La^F, Jessica Arguelles (MARC U* Scholar),^{F,H} Linhui Li^F (MARC U* Scholar), Wendy Carabajal^{F,H}, Hannah McGarraugh^F.

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Research Interests

Landscape ecology • Ecosystem ecology • Ecohydrology • Global change • Sustainability

Academic Appointments

Associate Professor 2013 – Present

Assistant Professor 2008 – 2013

Department of Botany and Plant Sciences, University of California Riverside

Education and Training

Postdoctoral Fellow. Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ. 2005 – 2007

Postdoctoral Researcher. Carbon Management and Sequestration Center, School of Natural Resources, The Ohio State University, Columbus, OH. 2004 – 2005

Ph.D. Department of Plant Biology, Arizona State University, Tempe, AZ. 2004

B.S. Virginia Polytechnic Institute and State University, Blacksburg, VA. 1995

Awards

Visiting Fellowship for Young International Scientists, Chinese Academy of Sciences. 2011-2012

Early Career Fellowship, Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) 2007

Biological Informatics Postdoctoral Fellowship, National Science Foundation. 2005-2007

Graduate Fellowship, Urban Ecology Integrative Graduate Education and Research Traineeship (IGERT), National Science Foundation. 2001-2004

Tony Gonzales Excellence in GIS Scholarship. Arizona Geographic Information Council. 2004

Outstanding Poster. Central Arizona Phoenix Long Term Ecological Research Poster Symposium. 2000

Publications (*Lab members in **bold***)

ISI H Index = 22

Total Refereed Publications 88; Technical 69; Review 5; Other 14

Technical Journal Articles

2016

(69) **Jenerette GD, LW Clarke**, ML Avolio, DE Pataki, TW Gillespie, S Pincetl, J McFadden, D Nowak, L Hutrya, M McHale, and M Alonzo. *In Press*. Climate tolerances and trait choices shape continental patterns of urban tree biodiversity. *Global Ecology and Biogeography*

(68) Shen W, **GD Jenerette**, RL Scott, and D Hui. 2016. Precipitation legacy effects on dryland ecosystem carbon fluxes: direction, magnitude and biogeochemical carryovers. *Biogeosciences* 13:425-439

(67) **Tayyebi A** and **GD Jenerette**. 2016. Increases in the climate change adaption effectiveness and availability of vegetation across a coastal to desert climate gradient in metropolitan Los Angeles, CA, USA. *Science of the Total Environment* 548-549:60-71

- (66) **Feyisa GL**, H Meilby, **GD Jenerette**, and S Pauliet. 2016. Separability-optimized indices for accurate land cover mapping and surface heat assessment: Environmental consequences of rapid urbanization in Addis Ababa, Ethiopia. *Remote Sensing of the Environment* 175:14-31
- (65) **Liang LL**, DA Grantz, and **GD Jenerette**. 2016. Multivariate regulation of CO₂ and N₂O pulse emissions from agricultural soils. *Global Change Biology* 22:1286-1298
- (64) **Jenerette GD**, SL Harlan, **A Buyantuev**, WL Stefanov, J Declet-Barreto, BL Ruddell, S Myint, S Kaplan, and X Li. 2016. Micro scale urban surface temperatures are related to land cover features and heat related health impacts in Phoenix, AZ USA. *Landscape Ecology* 31:745-760

2015

- (63) **Oikawa PY**, C Ge, J Wang, **JR Eberwein**, **LL Liang**, **L Allsman**, DA Grantz, and **GD Jenerette**. 2015. Unusually high soil nitrogen oxide emissions influence air quality in high temperature agricultural region. *Nature Communications* 6:8753 DOI: 10.1038/NCOMMS9753
- (62) **Chatterjee A** and **GD Jenerette**. 2015. Variation in soil organic matter accumulation and metabolic activity along an elevation gradient in the Santa Rosa Mountains of Southern California, USA. *Journal of Arid Land* 7:814-819
- (61) Xie JB, GQ Xu, **GD Jenerette**, YF Bai, ZY Wang, and Y Li. 2015. Apparent plasticity in functional traits determining competitive ability and spatial distribution: a case from the desert. *Scientific Reports* 5:12174
- (60) Avolio ML, DE Pataki, TW Gillespie, **Jenerette GD**, HR McCarthy, S Pincetl, and **LW Clarke**. 2015. Tree diversity in southern California's urban forest: the interacting roles of social and environmental variables. *Frontiers in Ecology and Evolution* <http://dx.doi.org/10.3389/fevo.2015.00073>
- (59) **Eberwein JR**, **PY Oikawa**, **LA Allsman**, and **GD Jenerette**. 2015. Carbon availability regulates soil respiration response to nitrogen and temperature. *Soil Biology and Biochemistry* 88:158-164
- (58) Bytnerowicz A, R Johnson, L Zhang, **GD Jenerette**, S Schilling, M Fenn, and I Gonzalez-Fernandez. 2015. An empirical inferential method of estimating nitrogen deposition to Mediterranean-type ecosystems: the San Bernardino Mountains case study. *Environmental Pollution* 203:69-88
- (57) **Liang LL**, **JR Eberwein**, **L Allsman**, DA Grantz, and **GD Jenerette**. 2015. Regulation of CO₂ and N₂O fluxes by coupled carbon and nitrogen availability. *Environmental Research Letters* 034008
- (56) Zhichun L, **GD Jenerette**, SX Zhan, WH Li, SX Zheng, and YF Bai. 2015. Testing the scaling effects and mechanisms of N-induced biodiversity loss: Evidence from a decade-long grassland experiment. *Journal of Ecology* 103:750-760
- (55) Rossi RJ, DJ Bain, **GD Jenerette**, **LW Clarke**, and K Wilson. 2015. Responses of roadside soil cation pools to vehicular emission deposition in southern California. *Biogeochemistry* 131:44
- (54) Shaffer SR, WTL Chow, M Georgescu, P Hyde, **GD Jenerette**, A Mahalov, M Moustauoui, and BL Ruddell. 2015. Multi-scale modeling and evaluation of urban surface energy balance in the Phoenix metropolitan region. *Journal of Applied Meteorology and Climatology* 54:322-338
- (53) Avolio ML, DE Pataki, S Pincetl, T Gillespie, **GD Jenerette**, and HR McCarthy. 2015. Understanding preferences for tree attributes: the relative effects of socio-economic and

local environmental factors. *Urban Ecosystems* 18:73-86

(52) **Clarke LW** and **GD Jenerette**. 2015. Biodiversity and direct ecosystem service regulation in the community gardens of Los Angeles, CA. *Landscape Ecology* 30:367-653

(51) Riordan EC, TW Gillespie, L Pitcher, S Pincetl, **GD Jenerette**, and DE Pataki. 2015. Threats of future climate change and land use to vulnerable tree species native to Southern California. *Environmental Conservation* 2:127-138

(50) **Oikawa PY**, **GD Jenerette**, and DA Grantz. 2015. Offsetting high water demands with high productivity: Sorghum as a biofuel crop in a high irradiance arid ecosystem. *Global Change Biology Bioenergy* 7:974-983

(49) **Clarke LW**, **GD Jenerette**, and DJ Bain. 2015. Urban legacies and soil management affect the concentration and speciation of soil metals in Los Angeles community garden soils. *Environmental Pollution* 197:1-12

2014

(48) Chow WTL, TJ Volo, ER Vivoni, **GD Jenerette**, and BL Ruddell. 2014. Seasonal dynamics of energy balance in Phoenix, AZ. *International Journal of Climatology* 34:3863-3880

(47) Barron-Gafford GA, JM Cable, LP Bentley, RL Scott, TE Huxman, **GD Jenerette**, and K Ogle. 2014. Quantifying the time scales over which exogenous and endogenous conditions affect soil respiration. *New Phytologist* 202:442-454

(46) **Oikawa PY**, DA Grantz, **A Chatterjee**, **JE Eberwein**, **LA Allsman**, and **GD Jenerette**. 2014. Unifying soil respiration pulses, inhibition, and temperature hysteresis through dynamics of labile carbon and soil O₂. *Journal of Geophysical Research Biogeosciences* 119:521-536

(45) **Clarke LW**, L Li, **GD Jenerette**, and Z Yu. 2014. Plant biodiversity and ecosystem service production in home gardens across the Beijing Municipality of China. *Urban Ecosystems* 17:741-760

(44) Scott RL, TE Huxman, GA Barron-Gafford, **GD Jenerette**, JM Cable, and EP Hamerlynck. 2014. When vegetation alters ecosystem water availability. *Global Change Biology* 20:2198-2210

(43) Potts DL, GD Barron-Gafford, and **GD Jenerette**. 2014. Metabolic acceleration quantifies biological systems' ability to upregulate metabolism in response to episodic resource availability. *Journal of Arid Environments* 104:9-16

2013

(42) Barron-Gafford GA, RL Scott, **GD Jenerette**, EP Hamerlynck, and TE Huxman. 2013. Landscape and environmental controls over leaf and ecosystem carbon dioxide fluxes under woody plant expansion. *Journal of Ecology* 101:1471-1483

(41) **Jenerette GD**, **G Miller**, **A Buyantuev**, S Pincetl, DE Pataki, and TW Gillespie. 2013. Urban vegetation and income segregation in drylands: A synthesis of seven metropolitan regions in the southwestern United States. *Environmental Research Letters* 8 044001

(40) Pincetl S, S Prabhu, T Gillespie, and **GD Jenerette**, DE Pataki. 2013. Evolution of tree nursery offerings. *Landscape and Urban Planning* 118:10-17

(39) Pataki DE, HR McCarthy, T Gillespie, **GD Jenerette**, and S Pincetl. 2013. A trait based ecology of the Los Angeles urban forest. *Ecosphere* 4:72 doi:10.1890/ES13-00017.1

(38) **Clarke LW**, **GD Jenerette**, and A Davalia. 2013. The luxury of vegetation and the legacy of tree biodiversity in Los Angeles, CA. *Landscape and Urban Planning* 116:48-59

(37) Shen W, H Ren, **GD Jenerette**, D Hui, and H Ren. 2013. Atmospheric deposition and canopy exchange of anions and cations in two plantation forests under acid rain influence. *Atmospheric Environment* 64:242-250

2012

(36) **Jenerette GD** and **A Chatterjee**. 2012. Soil metabolic pulses: water, substrate, and biological regulation. *Ecology* 93:959-966

(35) Liu R, LP Pan, **GD Jenerette**, QX Wang, E Cieraad, and Y Li. 2012. Variation in annual precipitation alters structure, water use strategy, and efficiency of a desert halophyte community. *Agricultural and Forest Meteorology* 162-163:127-135

(34) Ogle K, RW Lucas, LP Bentley, JM Cable, GA Barron-Gafford, A Griffith, D Ignace, **GD Jenerette**, A Tyler, TE Huxman, ME Loik, SD Smith, and DT Tissue. 2012. Differential daytime and nighttime stomatal behavior in plants from North American deserts. *New Phytologist* 194:464-476

(33) Barron-Gafford GA, RL Scott, **GD Jenerette**, EP Hamerlynck, and TE Huxman. 2012. Temperature and precipitation controls over leaf- and ecosystem-level CO₂ flux along a woody plant encroachment gradient. *Global Change Biology* 18:1389-1400

(32) **Richardson J**, **A Chatterjee**, and **GD Jenerette**. 2012. Optimum temperatures for soil respiration along a semi-arid elevation gradient in southern California. *Soil Biology and Biochemistry* 46:89-95

2011

(31) McCarthy HR, DE Pataki, and **GD Jenerette**. 2011. Plant water use efficiency as a metric of urban ecosystem services. *Ecological Applications* 21:3115-3127

(30) **Chatterjee A** and **GD Jenerette**. 2011. Spatial variability of soil metabolic rate along a dryland elevation gradient. *Landscape Ecology* 26:1111-1123

(29) **Jenerette GD**, SL Harlan, W Stefanov, and C Martin. 2011. Ecosystem services and urban heat riskscape moderation: Water, green spaces, and social inequality in Phoenix, USA. *Ecological Applications* 21:2637-2651

(28) Shen W, YB Lin, **GD Jenerette**, and J Wu. 2011. Blowing litter across a landscape: effects on ecosystem nutrient flux and implications for landscape management. *Landscape Ecology* 26:629-644

(27) **Chatterjee A**, **GD Jenerette**. 2011. Changes in soil respiration Q₁₀ during drying-rewetting along a semi-arid elevation gradient. *Geoderma* 163:171-177

(26) Barron-Gafford G, RL Scott, **GD Jenerette**, and TE Huxman. 2011. The relative controls of temperature, soil moisture, and plant functional group on soil respiration at diel, seasonal, and annual scales. *Journal of Geophysical Research Biogeosciences* 116, G01023 doi:10.1029/2010JG001442

(25) Wu J, **GD Jenerette**, A Buyantuyev, and CL Redman. 2011. Quantifying spatiotemporal patterns of urbanization: The case of the two fastest growing metropolitan regions in the United States. *Ecological Complexity* 8:1-8

2010 and Earlier

(24) **Jenerette GD** and D Potere. 2010. Global analysis and simulation of land-use change associated with urbanization. *Landscape Ecology* 25:657-670

(23) Ivanov VY, S Fatichi, **GD Jenerette**, JF Espeleta, P Troch, and TE Huxman. 2010. Hysteresis of soil moisture spatial heterogeneity and a homogenizing effect of vegetation.

Water Resources Research 46:W09521, doi:10.1029/2009WR008611

(22) Hou Y, Z Luo, **GD Jenerette**, Y Qiao, and K Wang. 2010. Effects of elevated CO₂ and temperature on growth and morphology of fir (*Abies faxoniana*) and native herbs in tree-line ecotone: an experimental approach. *Polish Journal of Ecology* 58:311-322

(21) **Jenerette GD** and RL Scott, and AR Huete. 2010. Functional differences between summer and winter season rain assessed with MODIS derived phenology in a semiarid region. *Journal of Vegetation Science* 21:16-30

(20) Scott RL, EP Hamerlynck, **GD Jenerette**, MS Moran, GA Barron-Gafford. 2010. Carbon dioxide exchange in a semidesert grassland responding to drought-induced vegetation change. *Journal of Geophysical Research Biogeosciences* 115, G03026, doi: 10.1029/2010JG001348

(19) Chen S, G Lin, J Huang, and **GD Jenerette**. 2009. Dependence of carbon sequestration on the differential responses of ecosystem photosynthesis and respiration to rain pulses in a semiarid steppe. *Global Change Biology* 15:2450-2461

(18) **Jenerette GD**, RL Scott, GA Barron-Gafford, and TE Huxman. 2009. Gross primary production variability associated with meteorology, physiology, leaf area, and water supply in contrasting woodland and grassland semiarid riparian ecosystems. *Journal of Geophysical Research Biogeosciences* 114, G04010, doi:10.1029/2009JG001074

(17) Scott RL, **GD Jenerette**, DL Potts, and TE Huxman. 2009. The effect of drought on the water and carbon dioxide exchange of a woody-plant-encroached semiarid grassland. *Journal of Geophysical Research Biogeosciences* 114, G04004, doi:10.1029/2008JG000900

(16) **Jenerette GD**, RL Scott, and TE Huxman. 2008. Whole ecosystem metabolic pulses following precipitation events. *Functional Ecology* 22:924-930

(15) Shen W, **GD Jenerette**, D Hui, RP Phillips, and H Ren. 2008. Effects of changing precipitation regimes on dryland soil respiration and C pool dynamics at rainfall event, seasonal, and interannual scales. *Journal of Geophysical Research Biogeosciences* 113, G03204, doi:10.1029/2008JG000685

(14) Kaye JP, A Majumdar, C Gries, A Buyantuyev, NB Grimm, D Hope, **GD Jenerette**, W Zhu, and L Baker. 2008. Hierarchical Bayesian scaling of soil properties across urban, agricultural, and desert ecosystems. *Ecological Applications* 18:132-145

(13) **Jenerette GD**, SL Harlan, A Brazel, N Jones, L Larsen, and WL Stefanov. 2007. Regional relationships between surface temperature, vegetation, and human settlement in a rapidly urbanizing ecosystem. *Landscape Ecology* 22:353-365

(12) Harlan SL, AJ Brazel, **GD Jenerette**, NS Jones, L Larsen, L Prashad, and WL Stefanov. 2007. In the shade of affluence: The inequitable distribution of the urban heat island. *Research in Social Problems and Public Policy* 15:173-202

(11) **Jenerette GD** and R Lal. 2007. Modeled carbon sequestration variation in a linked erosion-deposition system. *Ecological Modelling* 200:207-216

(10) **Jenerette GD**, J Wu, NB Grimm, and D Hope. 2006. Points, patches, and regions: Scaling soil biogeochemical patterns in an urbanized arid ecosystem. *Global Change Biology* 12:1532-1544

(9) **Jenerette GD**, WA Marussich, and J Newell. 2006. Linking ecological footprints with ecosystem service valuation in the provisioning of urban freshwater. *Ecological Economics* 59:38-47

(8) **Jenerette GD** and L Larsen. 2006. A global perspective on changing sustainable urban water supplies. *Global and Planetary Change* 50:202-211

- (7) **Jenerette GD**, W Wu, S Goldsmith, WA Marussich, and WJ Roach. 2006. Contrasting water footprints of cities in China and the United States. *Ecological Economics* 57:346-358
- (6) **Jenerette GD** and J Wu. 2004. Interactions of ecosystem processes with spatial heterogeneity in the puzzle of nitrogen limitation. *Oikos* 107:273-282
- (5) Shen W, **GD Jenerette**, J Wu, and RH Gardner. 2004. Evaluating empirical scaling relations of pattern metrics with simulated landscapes. *Ecography* 27:459-469
- (4) **Jenerette GD**, J Lee, D Waller, and RE Carlson. 2002. A multivariate analysis of the ecoregion delineation for aquatic systems. *Environmental Management* 29:67-75
- (3) Luck MA, **GD Jenerette**, J Wu, and NB Grimm. 2001. The urban funnel model and spatially heterogeneous ecological footprint. *Ecosystems* 4:782-796
- (2) **Jenerette GD** and J Wu. 2001. Analysis and simulation of land-use change in the central Arizona - Phoenix region, USA. *Landscape Ecology* 16:611-626
- (1) Casamatta DA, AB Collier, **GD Jenerette**, and RG Verb. 1999. Spatial heterogeneity of the bacterial community in a newly rehabilitated wetland. *Journal of Freshwater Ecology* 14:371-378

Refereed Review Articles

- (5) **Jenerette GD**, GA Barron-Gafford, AJ Guswa, JJ McDonnell, and JC Villegas. 2012. Organization of complexity in water limited ecohydrology. *Ecohydrology* 5:184-199
- (4) **Jenerette GD** and W Shen. 2012. Experimental landscape ecology. *Landscape Ecology* 27:1237-1248
- (3) Pataki DE, CG Boone, TS Hogue, **GD Jenerette**, J McFadden, and S Pincetl. 2011. Socio-ecohydrology and the urban water challenge. *Ecohydrology* 4:341-347
- (2) **Jenerette GD** and R Lal. 2005. Hydrologic sources of carbon cycling uncertainty throughout the terrestrial-aquatic continuum. *Global Change Biology* 11:1873-1882
- (1) Ptacnik R, **GD Jenerette**, AM Verschoor, AF Huberty, AG Solimini, and JD Brookes. 2005. Applications of ecological stoichiometry for sustainable acquisition of ecosystem services. *Oikos* 109:52-62

Refereed Conference Proceedings

- (4) Martin CA, **GD Jenerette**, SL Harlan. 2012. Air and near surface temperature regimes in neighborhood parks of Phoenix, Arizona, USA during extreme summer heat. 4 pgs. 8th International Conference on Urban Climates
- (3) Hary A, A Akoglu, Y B Al-Nashif, S Hariri, **GD Jenerette**. 2010. Design and evaluation of self-healing Kepler for scientific workflows. 340-343. HPDC 2010 - Proceedings of the 19th ACM International Symposium on High Performance Distributed Computing
- (2) Jararweh Y, A Hary, Y B Al-Nashif, S Hariri, A Akoglu, **GD Jenerette**. 2009. Accelerated discovery through integration of Kepler with data turbine for ecosystem research. AICCSA, pp.1005-1012, 2009 IEEE/ACS International Conference on Computer Systems and Applications
- (1) **Jenerette GD**, J Lee, D Waller, and RE Carlson. 1998. The effect of spatial dimension on regionalization of lake water quality data. In T.K. Poiker and N. Chrisman (eds.) 8th International Symposium on Spatial Data Handling 256-265. International Geographical Union

Other Refereed Scholarly Publications

- (10) Jenerette GD, H Andrews, JR Eberwein, I Park. *Invited*. Biogeochemical cycling in chaparral. In H Safford, et al. (eds) The Ecological Value of Chaparral Landscapes:

Ecosystem Services and Resource Management

- (9) Pataki DE, **Jenerette GD**, S Pincetl, T Trammell, L Ervin. 2016. Urban Ecosystems. In H Mooney and E Zavaleta (eds) California's Ecosystems
- (8) Allen MF, CW Barrows, MD Bell, **GD Jenerette**, RF Johnson, EB Allen. 2014. Threats to California's desert ecosystems. *Fremontia* 42:3-8.
- (7) **Jenerette GD**. 2013. Ecological responses and interactions with drought in the southwestern United States. In K Schwabe and A Dinar (eds) Drought in Arid and Semi-Arid Regions, Springer-Verlag. 185-197
- (6) Wu J, A Buyantuyev, **GD Jenerette**, J Litteral, W Shen. 2012. Quantifying spatiotemporal patterns and ecological effects of urbanization: A multiscale landscape approach. In M. Richter and U. Weiland (eds) Applied Urban Ecology: A Global Framework, Blackwell. 35-53
- (5) **Jenerette GD** and **KP Alstad**. 2010. Water Use in Urban Ecosystems: Complexity, costs and services of urban ecohydrology. In J. Aitkenhead-Peterson and A. Volder (eds.) Urban Ecosystem Ecology 353-371
- (4) Scott RL, **GD Jenerette**, TE Huxman. 2010. Semiarid Ecohydrological Array – SECA. *Fluxletter* 2:10-12
- (3) **Jenerette GD** and J Wu. 2010. Quantitative measures and landscape ecology. In L. Kapustka, W. Landis, and A. Johnson (eds.) Environmental Risk Assessment and Management from a Landscape Perspective John Wiley and Sons. 75-96
- (2) Wu J, **GD Jenerette**, and JL David. 2003. Linking land use change with ecosystem processes: A hierarchical patch dynamics model. In S. Guhathakurta (ed.) Integrated Land Use and Environmental Models Springer-Verlag. 99-119
- (1) **Jenerette GD** and J Wu. 1999. On the definitions of scale. *Bulletin of the Ecological Society of America* 8:104-105

Research Funding (\$19.8M total; \$3.7M to Jenerette)

06/2016- 12/2017	United States Department of Agriculture , Resampling the Los Angeles Urban Forest, \$27,000 PI
04/2016- 03/2018	Earthwatch Institute , Towards designing a more sustainable urban forest. \$85,000 PI
04/2016- 03/2019	National Institute of Food and Agriculture , USDA Cultivating Diversity in a 2+2+2 Collaborative Project. \$90,490 coPI (with M McGiffen PI, and H Liu)
05/2016- 04/2019	National Institute of Food and Agriculture , Reducing gaseous nitrogen losses from high temperature agricultural systems. \$499,251 PI (with J Wang, P Oikawa)
09/2015- 08/2018	Earthwatch Institute , Linking urban tree leaf traits to potential cooling benefits across a large US metropolitan area. \$94,071 PI
07/2015- 07/2016	UC Agricultural and Natural Resources Division , Ensuring the success of ANR Flux: Evaluation of long-term network configuration and initial science applications. \$61,360 PI
08/2015- 08/2020	National Science Foundation , Urban Water Innovation Network (U-WIN): Transitioning Toward Sustainable Urban Water Systems. \$12,000,000 (\$319,210 to UCR) Sub-Award PI, Project Senior Personnel (with M Arabi Project PI, A Berkowitz, E Bou-Zeid, GE Pivo, R Haggerty, C Welty, J Bolson, M Sukop)

- 01/2015-12/2018 **National Aeronautical and Space Administration**, Enhanced data-driven decision support for highly invasive vectors. \$1,189,773 (\$161,630 to UCR) Sub-Award PI (with C Barker Project PI, WK Reisen, T Scott, F Melton)
- 07/2014 - 12/2015 **UCMexus**, Effect of land use, soil type and agricultural practices on preserving organic soil carbon stocks. \$14,900 coPI (with M Allen PI, E Allen, H Estrada Medina, J Jiminez-Osornio)
- 06/2014 - 05/2015 **National Science Foundation**, Dissertation Research: Connecting dryland soil trace gas emissions of NO_x, N₂O and CO₂ to microbial community dynamics along a nitrogen deposition gradient. \$19,745 PI in support of J Eberwein (DDIG)
- 08/2013 - 07/2015 **U.S. Agency for International Development**, Evaluating climate change impacts on the arid lands and water resources of Jordan, \$87,000 coPI (with Y Jaraweh PI)
- 11/2012 - 10/2015 **National Aeronautic and Space Administration**, Assessing relationships between urban land cover, surface temperature, and transpiration along a coastal to desert climate gradient, \$501,326 PI
- 08/2012 - 09/2013 **California Institute for Energy and the Environment**, Carbon balance in California deserts: Impacts of widespread solar power generation, \$149,890 coPI (with M Allen PI, L Santiago)
- 06/2012 - 05/2014 **National Science Foundation**, Dissertation Research: The effect of human management and soil properties on heavy metal content of Los Angeles Community Garden soils, \$14,980 PI in support of L Clarke (DDIG)
- 06/2012 - 08/2012 **California Avocado Commission**, Initial scoping of ecosystem services provided by avocado orchards in southern California, \$20,000 PI
- 10/2011 - 11/2013 **United States National Park Service**, Atmospheric nitrogen deposition assessment in the Santa Monica Mountains NRA and the effects on weed invasion, \$100,000 coPI (with E Allen PI, J Sickman, M Fenn)
- 07/2011 - 07/2014 **United States Forest Service**, Assessing the effects of local water district policies on urban forests and their implications across socio-economic groups, \$64,000 coPI (with K Baerenklau PI, K Schwabe)
- 10/2011 - 12/2016 **United States Forest Service**, Base-level vegetation mapping for the Angeles National Forest, \$164,740 PI
- 07/2011 - 06/2015 **National Institute of Food and Agriculture**, Life cycle assessment of sequestration and exchange of water, carbon and nitrogen in the dedicated bioenergy feedstock, energy cane, \$967,769 coPI (with D Grantz PI)
- 07/2011 - 06/2014 **National Science Foundation**, Collaborative research: Assessing decadal climate impacts on urban populations in the Southwestern USA, \$897,000 (\$147,000 to UCR) PI on Collaborative Proposal (with B Ruddell Project PI, M Maoustaouri, E Vivoni)
- 02/2011 - 02/2014 **United States Golf Association**, Water-Use efficiency and carbon sequestration influenced by turfgrass species and management practices, \$55,553 PI (with J Baird)
- 07/2009 - 06/2013 **National Science Foundation**, Collaborative research: Toward a biogeography of urban forests, \$791,498 (\$249,670 to UCR) PI on Collaborative Proposal (with D Pataki Project PI, S Pincetl, T Gillespie)
- 07/2009 - 06/2010 **National Science Foundation**, Research starter grant: An urban environmental observatory, \$50,000 PI

- 01/2009 - **Coachella Valley Association of Governments**, JS-CVCC CVMSHCP
06/2009 Monitoring Program 2009 Administrator, \$116,000 coPI (with M Allen Project PI, C Barrows, E Allen, R Redak, J Rotenberry, W Walton)
- 01/2009 - **Kearney Foundation**, Soil metabolic variability across a 3000 meter
12/2010 topographic gradient: Understanding the long term consequences of short duration dynamics, \$89,900 PI (with M Allen)
- 10/2010 - **National Park Service**, Alien invasion: Effects of atmospheric nitrogen
10/2012 deposition on sagebrush steppe vegetation dynamics at Upper Columbia Basin network parks, \$100,000 coPI (with E Allen Project PI, J Sickman)
- 09/2008 - **National Science Foundation**, Collaborative Research: Urban vulnerability to
02/2013 climate change: A systems dynamics analysis, \$1,500,000 (\$135,000 to UCR) PI on Collaborative Proposal (with S Harlan Project PI, C Martin, T Lant, S. Grossman-Clark, W. Stefanov, M Elser)
- 06/2008 - **United States Department of Agriculture**, LAMillion Trees: Distribution and
09/2008 physiological characteristics, \$15,500 PI

Synergistic Activities

Congressional Briefings

Association of Ecosystem Research Centers sponsored briefing to the U.S. Congress – Cities, Agriculture, and Wildlands: Ensuring Continued Ecosystem Services from Our Rapidly Changing Landscapes. Washington, D.C. October 2014

Ecological Society of America sponsored briefing to the U.S. House of Representatives and Senate – Water Resources in the West: Assessing Tradeoffs in a changing climate. Washington, DC. July 2009

Invited Outreach

Urban Forestry Advisory Group, Climate Action through Conservation, The Nature Conservancy. August 2014-December 2015

Nature Reserve of Orange County Science Panel Meeting, Irvine, CA. November 2013

Funding Agency Panel Member

National Science Foundation
Environmental Protection Agency

Funding Agency Ad hoc Reviewer

National Science Foundation
Department of Energy
Kearney Foundation of Soil Science

Editorial Board Member

Landscape Ecology 2008 - Present
Frontiers in Ecology and Evolution 2015 - Present

Journal Referee

Agricultural and Forest Meteorology • Applied Geography • Biogeosciences • Bioscience • Cities • Ecological Applications • Ecological Complexity • Ecological Economics • Ecological Modelling • Ecology • Ecology Letters • Ecosystems • Environmental Health Perspectives • Environmental Management • Environmental Pollution • Frontiers in Ecology and the Environment • Geographic Information Science • Global Change Biology • Global Ecology and Biogeography • Hydrological Processes • Journal of American Water Resources Association • Journal of Arid Environments • Journal of Ecology • Journal of Environmental

Management • Journal of Geophysical Research – Biogeosciences • Landscape and Urban Planning • Landscape Ecology • New Phytologist • Remote Sensing of the Environment • Science Advances • Science of the Total Environment • Scientific Reports • Water Resources Research • Urban Ecosystems

Societal Memberships and Service

Member: American Geophysical Union • Ecological Society of America • International Association for Landscape Ecology

Invited Member: American Geophysical Union Hydrology Section's Ecohydrology Technical Committee 2010-2015

Workshops and Symposia Organized

Accelerating Research and Discovery with EcoInformatics: Cyberinfrastructure, Instrumentation, and Theory. Biosphere 2 and CUAHSI Synthesis Workshop. Oracle, AZ. 2008

Collaborative Interdisciplinary Research for Graduate Students. Workshop at the Long Term Ecological Research Graduate Student Symposium. Blue River, OR. 2005

Case Studies of Short Term Collaborations. Workshop at the Long Term Ecological Research All Scientists Meeting Seattle, WA. 2003

Complexity Theory and Ecological Applications. Symposium at the U.S. International Association for Landscape Ecology Meeting, Tempe, AZ. 2001

Invited Workshop / Working Group Participant

Growing the Urban Forest, Socio-Environmental Synthesis Center, Annapolis, MD. February 2016

The Role of Environmental Change on the Human-Wildland Interface: The Lowland Maya as a Model System, Merida, Mexico. December 2015

Detecting Signatures of Socio-Ecological Innovation in Urban Ecosystems, Socio-Environmental Synthesis Center, Annapolis, MD. October 2015

Eddy Flux Measurements for the Groundwater-Surface Water Interaction Zone, Pacific Northwest National Laboratory, Richland, WA. September 2014

Urban Heat Island Network Workshop, St. Paul, MN. June 2013

CUAHSI Synthesis Team – Water Cycle Dynamics in a Changing Environment: Advancing Hydrologic Science through Synthesis. 2007-2009

Second International Young Scientists' Global Change Conference. System for Analysis, Research, and Training. Beijing, Peoples Republic of China. November 2006

Uncertainty and Variability in Ecological Inference, Forecasting, and Decision Making. Center for Global Change at Duke University. Durham, NC. June 2006

Global Ecology Workshop. Mathematical Biosciences Institute at the Ohio State University. Columbus, OH. June 2006

Monsoon Region Climate Applications: A Binational Workshop. National Oceanic and Atmospheric Administration. Guaymas, Mexico. May 2006

Dissertation Initiative for the Advancement of Climate Change Research Symposium (DISCCRS) II. National Science Foundation. Pacific Grove, CA. March 2006

Science Environment for Ecological Knowledge: Ecological Informatics Workshop. Long Term Ecological Research Network. Albuquerque, NM. January 2006

Long Term Ecological Research Graduate Student Symposium. Long Term Ecological Research Network. Blue River, OR. March 2005

Woodstoich: Ecological Stoichiometry Workshop. Center for Advanced Studies. Finse, Norway. August 2004

Chapman Conference on Eco-Hydrology of Semiarid Landscapes: Interactions and Processes. American Geophysical Union. Taos, NM. September 2002

Complex Systems Summer School. Santa Fe Institute. Santa Fe, NM. June 1997

Invited Presentations

United States – International Association of Landscape Ecologists, Asheville, NC April 2016

American Geophysical Union Fall Meeting, San Francisco, CA December 2015

Soil Science Society of America Annual Meeting, Minneapolis, MN November 2015

World Congress of the International Association of Landscape Ecologists, Portland, OR July 2015

2nd Southern California Chaparral Symposium, Arcadia, CA June 2015

American Geophysical Union Fall Meeting, San Francisco, CA December 2014

Natural History Museum, Los Angeles, CA December 2014

Pacific Northwest National Laboratory, Richland, WA September 2014

Ecological Society of America Annual Meeting, Sacramento, CA August 2014

American Association for the Advancement of Science Pacific Division, Riverside, CA June 2014

Air Pollution and Global Change Symposium, Pacific Grove, CA June 2014

International Conference of Geography and Environment, Mexico City, Mexico October 2013

University of California Los Angeles, Department of Atmospheric and Oceanic Sciences, Los Angeles, CA October 2013

University of California Agriculture and Natural Resources Statewide Conference, Ontario, CA April 2013

University of California Berkeley, Department of Environmental Science, Policy, and Management. Berkeley, CA March 2013

American Geophysical Union Fall Meeting, San Francisco, CA December 2011

University of Maryland Baltimore County, Center for Urban Environmental Research and Education, Baltimore, MD October 2011

8th World Congress International Association for Landscape Ecology, Beijing, China August 2011

Long Term Ecological Research Science Council Meeting, Jekyll Island, GA May 2011

Ecological Society of America Annual Meeting, Pittsburgh, PA August 2010

University of Puerto Rico, Department of Biology, San Juan, Puerto Rico February 2010

American Geophysical Union Fall Meeting, San Francisco, CA December 2009

Xinjiang Institute of Ecology and Geography, Chinese Academy of Science. Urumqi, China September 2009

Chinese Agricultural University. Beijing, China September 2009

University of Arizona, Sustainability of Semi-Arid Hydrology and Riparian Areas (SAHRA)
Tucson, AZ September 2009

Hydrological Sciences Synthesis Summer Institute. Vancouver, Canada. July 2009

South China Botanical Garden, Chinese Academy of Science. Guangzhou, China June 2008

Institute of Botany, Chinese Academy of Science. Beijing, China June 2008

University of California Irvine, Department of Earth System Science. Irvine, CA March 2008

University of California Los Angeles, Department of Civil and Environmental Engineering. Los Angeles, CA January 2008

University of Illinois Urbana-Champaign, Department of Natural Resources. Urbana-Champaign, IL March 2007

North Carolina State University, Department of Forestry and Environmental Resources. Raleigh, NC February 2007

University of California Riverside, Department of Botany and Plant Sciences. Riverside, CA February 2007

University of California Davis, College of Agricultural and Environmental Sciences. Davis, CA January 2007

Chinese Academy of Science, Institute of Botany. Beijing, China November 2006

Second International Young Scientists' Global Change Conference. Beijing, China November 2006

Monsoon Region Climate Applications: A Binational Workshop. Guaymas, Mexico May 2006

University of Washington, College of Forest Resources. Seattle, WA May 2006

Dissertation Initiative for the Advancement of Climate Change Research Symposium (DISCCRS) II. Pacific Grove, CA March 2006

University of California Davis, Department of Plant Sciences. Davis, CA June 2005

Auburn University, School of Forestry and Wildlife Sciences. Auburn, AL May 2004

Arizona Geographic Information Council Annual Meeting. Prescott, AZ August 2003

University of New Mexico, Biocomplexity Seminar Series. Albuquerque, NM April 2003

Chapman Conference on Eco-Hydrology of Semiarid Landscapes: Interactions and Processes. Taos, NM September 2002

University of Washington, Urban Ecology IGERT. Seattle, WA May 2002

National / International Presentations (Prior 5 Years) (*Lab members in bold*)

Rossi, RJ, DJ Bain, **GD Jenerette**. Phosphorus deposition to roadside soils: Contributions to a unique biogeochemical environment. Goldschmidt Conference, Yokohama, Japan June 2016

Tayyebi A and **GD Jenerette**. Urban heat island variation across a dramatic coastal to desert climate zone: An application to Los Angeles, CA metropolitan area. American Geophysical Union, San Francisco, CA December 2015

Eberwein J, C Carey, E Aronson, **GD Jenerette**. Wetting-induced pulses produced unexpectedly high emissions of N₂O and NO_x in a desert ecosystem. American Geophysical Union, San Francisco, CA December 2015

P Oikawa, D Baldocchi, S Knox, C Sturtevant, J Verfaillie, I Dronova, **GD Jenerette**, C Poindexter, Y Huang. Using eddy covariance of CO₂, ¹³CO₂ and CH₄, continuous soil respiration measurements, and phenocams to constrain a process-based biogeochemical

model for carbon market-funded wetland restoration. American Geophysical Union, San Francisco, CA December 2015

Park I, GD Jenerette, J Hooper. Evidence for recent invasion of historically resistant chaparral shrublands to grasslands. American Geophysical Union, San Francisco, CA December 2015

Crum S and GD Jenerette. Impacts of land use and land cover on surface and air temperature in urban landscapes. American Geophysical Union, San Francisco, CA December 2015

Liang LL and GD Jenerette. Estimation of water flux in urban area using eddy covariance measurements in Riverside, Southern California. American Geophysical Union, San Francisco, CA December 2015

Ibsen P, S Arps, S Shiflett, GD Jenerette. Biological and geographical sources of variation in leaf economic and hydraulic traits throughout the Los Angeles megacity. American Geophysical Union, San Francisco, CA December 2015

Lu XF, **Liang LL**, LX Wang, **GD Jenerette**, D Grantz. Partitioning of Evapotranspiration Using a stable water isotope technique in a high temperature agricultural production system. American Geophysical Union, San Francisco, CA December 2015

Oikawa PY, S Knox, C Sturtevant, J Verfaillie, I Dronova, C Poindexter, **GD Jenerette**, D Baldocchi. Improving process-based modeling of CO₂ and CH₄ exchange from managed wetlands in the Sacramento-San Joaquin River Delta. Ecological Society of America Annual Meeting, Baltimore, MD August 2015

Avolio ML, DE Pataki, S Pincetl, **GD Jenerette**, TW Gillespie, TLE Tramell. Plant community assembly in cultivated urban ecosystems. Ecological Society of America Annual Meeting, Baltimore, MD August 2015

Shiflett S, G Feyisa, Jenerette GD. C Relationships between urban land surface temperature, air temperature, and NDVI across a coastal to desert climate gradient. Ecological Society of America Annual Meeting, Baltimore, MD August 2015

Jenerette GD. Biodiversity and ecosystem services in the Los Angeles, CA metropolitan region. International Association of Landscape Ecologists World Congress, Portland, OR June 2015

Jenerette GD. Carbon cycling and sequestration in chaparral landscapes. 2nd Southern California Chaparral Symposium, Arcadia, CA June 2015

Jenerette GD. Are ecosystem services useful for a sustainable city? American Geophysical Union Annual Meeting. San Francisco, CA December 2014

Oikawa, P, **GD Jenerette** S Knox, C Sturtevant, J Verfaillie, D Baldocchi. Combining microbial enzyme kinetics models with light use efficiency models to predict CO₂ and CH₄ Ecosystem Exchange from Peatlands. American Geophysical Union Annual Meeting. San Francisco, CA December 2014

Crum, S and GD Jenerette. Land use and climate effects on soil respiration quantified with a landscape sensor network. American Geophysical Union Annual Meeting. San Francisco, CA December 2014

Shiflett, S, R Anderson, GD Jenerette. Evaporation and surface energy balance across an agricultural-urban landscape gradient in southern California, USA. American Geophysical Union Annual Meeting. San Francisco, CA December 2014

Liang LL, J Eberwein, L Allsman, D Grantz, and GD Jenerette. Soil CO₂, N₂O, and NO_x flux responses to high temperature agriculture. American Geophysical Union Annual Meeting. San Francisco, CA December 2014

Clarke, LW, GD Jenerette, ML Avolio, DE Pataki, TW Gillespie, S Pincetl, DJ Nowak, LR Hutya, MR McHale, JP McFadden, M Alonzo. Comparative urban biogeography: tree community and trait assembly patterns for twelve major U.S. metropolitan areas. Ecological Society of America Annual Meeting. Sacramento, CA August 2014

Jenerette GD. Heat wave vulnerability and mitigation in urban ecosystems. Ecological Society of America Annual Meeting. Sacramento, CA August 2014

Eberwein JR and GD Jenerette. Influence of C and N availability on repeated wetting-induced pulses of soil respiration in a southern California desert. Ecological Society of America Annual Meeting. Sacramento, CA August 2014

Swanson, A, ME De Guzman, **GD Jenerette**, LS Santiago, EB Allen, MF Allen. Implications of sil inorganic carbon dynamics in California desert ecosystems. Ecological Society of America Annual Meeting. Sacramento, CA August 2014

Avolio, ML, DE Pataki, S Pincetl, TW Gillespie, **GD Jenerette**, HR McCarthy, **LW Clarke**. The effect of resident trees preferences on urban forest biodiversity in southern California. Ecological Society of America Annual Meeting. Sacramento, CA August 2014

Bytnerowicz A, W Fraczek, R Johnson, M Fenn, L Zhang, **GD Jenerette**. From passive samplers to estimates of dry nitrogen deposition in the western United States. American Association for the Advancement of Science Pacific Division. Riverside CA June 2014

Jenerette GD. Vegetation and Urban Climate in a Changing World. American Association for the Advancement of Science Pacific Division. Riverside CA June 2014

Jenerette GD, PY Oikawa, L Liang, JR Eberwein, C Fertitta, DA Grantz. Accelerated biogeochemical cycling in high temperature agroecosystems. Air Pollution and Global Change Symposium. Pacific Grove, CA June 2014

Jenerette GD, A Buyantuyev, S Harlan, BL Ruddell, SW Myint. Regulation and consequences of parcel-scale microclimate variation in Phoenix, AZ. United States Chapter of the International Association of Landscape Ecologists. Anchorage, AK May 2014

Crum SM, GD Jenerette. Scaling soil respiration dynamics across regional land-use and climate gradients in southern California, USA. United States Chapter of the International Association of Landscape Ecologists. Anchorage, AK May 2014

Jenerette GD, A Buyantuyev, S Harlan, S Grossman-Clarke, BL Ruddell, SW Myint. Urban surface temperature vulnerability assessments. American Geophysical Union Annual Meeting. San Francisco, CA December 2013

Liang L, J Eberwein, P Oikawa, GD Jenerette, DA Grantz. Carbon dioxide(CO₂) and nitrous oxide (N₂O) fluxes in an agro-ecosystems under changing physical and biological conditions. American Geophysical Union Annual Meeting. San Francisco, CA December 2013

Scott RL, TE Huxman, G Barron-Gafford, **GD Jenerette**, JM Young. The ecohydrological consequences of woody plant encroachment: How accessibility to deep soil water resources affects ecosystem carbon and water exchange. American Geophysical Union Annual Meeting. San Francisco, CA December 2013

Rossi R, DJ Bain, **GD Jenerette, LW Clarke**, K Wilson. Responses of roadside soil cation pools to vehicular emission deposition in southern California. American Geophysical Union Annual Meeting. San Francisco, CA December 2013

Grantz DA, **LY Liang, PY Oikawa, CN Fertitta, JR Eberwein, GD Jenerette**. Drivers of NO_x, N₂O, and CO₂ in an arid biofuel production system. Association for the Advancement of Industrial Crops Annual Meeting. Washington DC October 2013

Bytnerowicz A, W Fraczek, R Johnson, **GD Jenerette**, EA Allen, M Fenn. From passive samplers to estimates of nitrogen deposition in arid and semi-arid areas of the western

United States. National Atmospheric Deposition Program Annual Meeting. Park City, UT
October 2013

Velasco LM, J Hooper, GD Jenerette. Variation in city tree ecophysiological characteristics under changing temperatures. Ecological Society of America Annual Meeting. Minneapolis, MN August 2013

Crum SM, GD Jenerette. Scaling soil respiration dynamics across regional land-use and climate gradients in southern California USA. Ecological Society of America Annual Meeting. Minneapolis, MN August 2013

Lan Z, Y Bai, **GD Jenerette.** N-induced biodiversity loss will persist with upscaling as beta diversity decreases by N. Ecological Society of America Annual Meeting. Minneapolis, MN August 2013

Fertitta CN, PA Oikawa, GD Jenerette, DA Grantz. Assessing the sustainability of *Sorghum bicolor* as a biofuel crop grown in a low desert environment: Constraints on productivity and water use efficiency . Ecological Society of America Annual Meeting. Minneapolis, MN August 2013

Avolio ML, DE Pataki, S Pincetl, TW Gillespie, **GD Jenerette, HR McCarthy.** Understanding the drivers of urban tree biodiversity in Los Angeles. Ecological Society of America Annual Meeting. Minneapolis, MN August 2013

Swanson AC, ME De Guzman, **GD Jenerette, LS Santiago, EB Allen, MF Allen.** Dynamics and importance of inorganic carbon in California desert ecosystems. Soil Ecology Society Annual Meeting. Camden, NJ June 2013

Clarke LW, GD Jenerette, D Bain. Risks and benefits in urban soil: Heavy metals and nutrient content in Los Angeles Community Gardens. 2013 UC ANR Statewide Conference, Ontario, CA May 2013

Oikawa PY, DA Grantz, A Chatterjee, JR Eberwein, LA Allsman, GD Jenerette. Factors regulating soil CO₂ and NO_x flux in response to high temperature, pulse water events, and nutrient fertilization. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Grantz DA, **PY Oikawa, GD Jenerette.** Carbon fluxes and yield of bioenergy Sorghum in an extreme desert production environment. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Clarke LW, GD Jenerette, DJ Bain. Risks and benefits of gardening in urban soil: Heavy metals and nutrient content in Los Angeles community gardens. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Ruddell BL, **GD Jenerette, M Moustaus, ER Vivoni, WT Chow, S Shaffer, TJ Volo, CA Martin, A Mahalov, S Harlan.** Modeling the urban climate at the human scale in a hot/dry region. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Chow WT, TJ Volo, ER Vivoni, **GD Jenerette, BL Ruddell.** Observations of the urban land surface energy balance in a Phoenix, AZ residential suburb. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Huxman TE, RL Scott, GA Barron-Gafford, EP Hamerlynck, **GD Jenerette, DT Tissue, DD Breshears, SR Saleska.** Understanding the biological underpinnings of ecohydrological processes. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Rossi R, DJ Bain, **GD Jenerette, LW Clarke.** Soil catio status in souther California: Interactions of vehicular emissions. American Geophysical Union Fall Meeting. San Francisco, CA December 2012

Clarke LW and **GD Jenerette**. Organization of extensive biodiversity and ecosystem service production within community gardens of Los Angeles, CA. Ecological Society of America Annual Meeting. Portland, OR August 2012

Eberwein JR, PA Oikawa, GD Jenerette. Influence of nitrogen availability on soil respiration kinetics. Ecological Society of America Annual Meeting. Portland, OR August 2012

Bytnerowicz A, RF Johnson, L Zhang, **GD Jenerette**, S Schilling, E Allen. Deposition of gaseous reactive nitrogen to forests and other ecosystems in the San Bernardino Mountains, CA. Ecological Society of America Annual Meeting. Portland, OR August 2012

Teaching and Advising

Postdoctoral Advising (10 total)

Julie Ripplinger 2016-present; Isaac Park 2015-present; Amin Tayyebi 2014-present; Sheri Shiflett 2014-2015; Gudina Feyisa 2013-2014; Liyin Liang 2013-2015; Jongyoun Kim 2013; Alex Buyantuyev 2013; Patricia Oikawa 2011-2013; Karrin Alstad 2009-2010; Amitava Chatterjee 2008-2010

PhD Student Advising (6 total)

Dion Kucera 2016-Present; Peter Ibsen 2015-present (GAANN Fellow); Holly Andrews 2015-present; Cara Fertitta 2012-present (GAANN Fellow); Steven Crum 2012-present; Jennifer Eberwein 2010-present (EPA STAR Fellow); Lorraine Weller 2008-2014

Visiting Scholar Host (6 total)

Zin Zhang 2015-2016; Lan Zhichun 2012-2013; Jen Hooper 2011-2013; Liangtao Li 2011-2012; Weijun Shen 2010-2011; Hou Ying 2008-2009

Undergraduate Research Advising (17 total)

Sandeep Aurora 2016-present; Bruno Pita 2016-present; Mia Rochford 2015-present; Sara Alperis 2015 (Bridges Fellow); Jeremy Gonzalez 2014; Neha Chandru 2013-2014; Colin Reis 2013; Ariana Contreras (CNAS Fellow, Chancellor's Research Fellow) 2012-2014; Jen Antes 2012-2013 (Bridges Fellow); Kyle Ricio 2012-2014 (Chancellor's Research Fellow); Alice Brown 2012; Sarah Juster (MRSP Fellow) 2011-2014; Angela Choi 2011-2013; Yuheng Ning 2011-2012; Anais Monay 2011-2012; Maeraj Sheikh 2010-2011 (CNAS Fellow); Josue Jaimes 2009-2012; Justin Richardson 2009-2010; Alea Miehl 2008-2009

Courses

University of California Riverside

Introductory Ecology and Evolution – 4 Credit, Undergraduate (470+ students)
Introductory Organismal Biology – 4 Credit, Undergraduate (400+ students)
Applied Ecological Modeling – 3 Credit Lecture, 1 Credit Lab, Graduate
Landscape Ecology – 4 Credit, Graduate
Sustainability Science – 2 Credit, Graduate
Ethnobotany – 2 Credit, Graduate

University of Arizona

Ecological responses to global changes – 1-3 Credit, Graduate

Arizona State University West

Ecological Modeling – 3 Credit, Undergraduate

Invited Trainer

Collaborative Graduate Student Research Workshop, Long Term Ecological Research Student Symposium, Blue River, OR

Ryan R. Julian

Department of Chemistry
University of California, Riverside
Riverside, CA 92521-0403

Phone: (951) 827-3958
Fax: (951) 827-4713
ryan.julian@ucr.edu

(a). Professional Preparation

University of Utah
California Institute of Technology
Indiana University

Chemistry
Physical Chemistry
Physical/Analytical Chemistry

B.S. 1999
Ph.D. 2003
2003-2005

(b). Appointments

2015-present Full Professor, Department of Chemistry University of California, Riverside
2010-2015 Associate Professor, Department of Chemistry University of California, Riverside
2005-2010 Assistant Professor, Department of Chemistry University of California, Riverside

(c). Products

(i) Related products

1. Ly, T.; Julian, R. R. "Elucidating the Tertiary Structure of Protein Ions In Vacuo with Site Specific Photo-initiated Radical Reactions" *J. Am. Chem. Soc.* **2010**, *132*, 8602-8609.
2. Sun, Q.; Tyler, R. C.; Volkman, B. F.; Julian, R. R. "Dynamic Interchanging Native States of Lymphotactin Examined by SNAPP-MS" *J. Am. Soc. Mass Spectrom.* **2011**, *22*, 399-407.
3. Zhang, X.; Julian R. R. "Investigating the Gas Phase Structure of KIX with Radical Directed Dissociation and Molecular Dynamics: Retention of the Native Structure" *Int. J. Mass Spectrom.* **2011**, *308*, 225-231
4. Tao, Y.; Quebbemann, N. R.; Julian, R. R. "Discriminating D-Amino Acid Containing Peptide Epimers by Radical Directed Dissociation Mass Spectrometry" *Anal. Chem.* **2012**, *84*, 6814-6820
5. Hendricks, N. G.; Lareau, N. M.; Stow, S. M.; McLean, J. A.; Julian, R. R. "Bond Specific Dissociation following Excitation Energy Transfer for Distance Constraint Determination in the Gas Phase" *J. Am. Chem. Soc.* **2014**, *136*, 13363-13370

(ii) Other important products

6. Ly, T.; Zhang, X.; Sun, Q.; Moore, B.; Tao, Y.; Julian, R. R. "Rapid, Quantitative, and Site Specific Synthesis of Biomolecular Radicals from a Simple Photocaged Precursor" *Chem. Commun.* **2011**, *47*, 2835-2837.
7. Moore, B. N.; Ly, T.; Julian, R. R. "Radical Conversion and Migration in Electron Capture Dissociation" *J. Am. Chem. Soc.* **2011**, *133*, 6997-7006.
8. Agarwal, A.; Diedrich, J. K.; Julian, R. R. "Direct Elucidation of Disulfide Bond Partners Using Ultraviolet Photodissociation Mass Spectrometry" *Anal. Chem.* **2011**, *83*, 6455-6458.
9. Moore, B. N.; Julian, R. R. "Dissociation Energies of X-H Bonds in Amino Acids" *Phys. Chem. Chem. Phys.*, **2012**, *14*, 3148-3154.
10. Diedrich, J. K.; Julian, R. R. "Facile Identification of Photocleavable Reactive Metabolites and Oxidative Stress Biomarkers in Proteins via Mass Spectrometry" *Anal. Bioanal. Chem.* **2012**, *403*, 2269-2277.

(d) Synergistic Activities

Software Development. My group developed Fragmentor, which is software for the analysis of hydrogen deficient radical peptide tandem mass spectra. It is freely available online at: (<http://www.faculty.ucr.edu/~ryanj/fragmentor.html>).

Editorial boards. I am a member of the Editorial Board for the *Journal of the American Society for Mass Spectrometry* and just finished a term on the *Analytical Chemistry* Features Advisory Panel.

Conference Organizing. I am currently organizing the 2015 Uppcon Meeting. I just finished a 3 year term on the Asilomar Conference organizing committee for the American Society for Mass Spectrometry. I co-organized the 2014 Sanibel Conference for the ASMS.

Community Outreach. I frequently volunteer as a science fair judge and provide science demonstrations at local elementary schools. I also volunteer a significant amount of time as movie consultant and have provided scientific and creative input into two movies that are slated for production.

(e) Collaborators and other Affiliations

Collaborators (48 months):

1. Steve Blanksby	Queensland University of Technology
2. Jennifer Brodbelt	University of Texas
3. Quan Cheng	UCR
4. Josh Coon	University of Wisconsin
5. Daniel Gallie	UCR
6. Richard Hooley	UCR
7. Cynthia Larive	UCR
8. Vince Lavallo	UCR
9. Joseph Loo	UCLA
10. John McLean	Vanderbilt
11. Todd Mitchell	University of Wollongong
12. Tom Rizzo	EPFL
13. Adam Trevitt	University of Wollongong
14. Frank Turecek	University of Washington
15. Brian Volkman	Medical College Wisconsin

Ph.D. and Postdoctoral Mentors:

1. Jesse L. Beauchamp, Ph.D. Advisor
2. David E. Clemmer, Postdoctoral Co-advisor
3. Martin F. Jarrold, Postdoctoral Co-advisor

Former Graduate Students and Postdoctoral Scholars (5 years):

Postdocs

Huong Thu Pham, currently a postdoc at Memorial University

Zhenjiu Liu, currently at Monsanto

Arun Agarwal, currently with Chlorox

Total (3)

Graduate Students

Tony Ly	postdoc at University of Dundee, UK
Jolene Diedrich	postdoc at Scripps
Qingyu Sun	Bruker Daltonics
Benjamin Moore	Genentech
Xing Zhang	UCR, computer science

Yuanqi Tao
Omar Hamdy
Total (7)

Bristol-Myers Squibb
FDA

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel in the order listed for Form Page 2.
Follow the sample format on next page for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Mohideen, Umar eRA COMMONS USER NAME umohideen	POSITION TITLE Professor

EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Banaras Hindu University, India	B.Tech.	1978-83	Engineering
The Pennsylvania State University, State College, PA	M.S.	1984-87	Solid State Science
Columbia University, New York, NY	Ph.D.	1987-92	Physics
Bell Laboratories, Murray Hill, NJ	Postdoc.	1992-94	Physics

A. Personal Statement

We have an internationally recognized group with expertise in applying optical interferometry for precision distance measurements and also applying it for precision force measurements using microfabricated cantilevers and membranes. These techniques have been applied to precision measurements of the Casimir force, single molecule force measurements and interaction energies of SNARE proteins. The PI Mohideen has an established reputation for interdisciplinary research with faculty in the department of Cell Biology & Neuroscience (CBNS) and Bio Engineering having worked and published collaborative research for the last fifteen years.

B. Positions and Honors.

Positions:

2002-	Professor, Department of Physics, Univ. of California-Riverside.
2004- 05	Vice Chair, Department of Physics, Univ. of California-Riverside.
2000-02	Associate Professor, Department of Physics, Univ. of California-Riverside.
1994- 00	Assistant Professor, Department of Physics, Univ. of California-Riverside.

Honors:

- **Fellow**, American Physics Society.
- **Fellow**, American Association for the Advancement of Science.
- Co-author of 768 page book "Advances in the Casimir Effect" Published by Oxford University Press, Oxford, UK. Selected to be part of their premier "International Series of Monographs in Physics."
- Plenary speaker at the 2008 Workshop on "Sixty Years of the Casimir Effect", held from June 23rd to 27th, Brasilia, Brazil.
- Plenary speaker at the 01, 03, 05, 07, 09, Workshop on Quantum Field Theory Under the Influence of External Conditions (QFEXT01, QFEXT03, QFEXT05, QFEXT07, QFEXT09) held in Leipzig-Germany, Norman-OK, Barcelona-Spain, Leipzig-Germany and Norman-OK, respectively
- Plenary speaker at the 2005 European Quantum Electro-Dynamics Conference held in Les Houches, France from June 5th -9th 2005, and the 2003 European Quantum Optics Conference held in Granada, Spain, from Sep. 27th to Oct. 2nd 2003.
- Co-organizer of 5 workshops and 2 meetings. The first workshop was organized with J.F. Babb on Casimir effects: Recent Developments held from Nov. 14 to Nov. 16, 2002 at the Institute for Theoretical Atomic and Molecular Physics at the Harvard-Smithsonian Center for Astrophysics and the Harvard Physics Department. The four workshops are on Quantum Field Theory Under the Influence of External Conditions (QFEXT03, QFEXT05, QFEXT07, QFEXT09) held in Norman-OK, Barcelona-Spain, Leipzig-Germany and

!

Norman-OK, respectively. The two meetings were the Sixth and Seventh A. Friedmann International Seminar on Gravitation and Cosmology held in Corsica, France, (2004), and Joao Pessao, Brazil, (2008).

- Invited physics department colloquia at 4 National Labs and at more than 21 universities.
- Fielded questions with published interviews on research from industrial trade journals, magazines and newspapers.

B. Selected peer-reviewed publications.

(10 publications selected from a total of 65 peer-reviewed journal publications based on relevance)

1. Ardekani S, Scott HA, Gupta S, Eum S, Yang X, Brunelle A.R., Wilson, S.M., Mohideen U., Ghosh, K. "Nanoliposomal Nitroglycerin Exerts Potent Anti-Inflammatory Effects". Scientific Reports 5 (2015).
2. Cabrera A, Bhaskaran A, Xu J, Yang X, Scott H, Mohideen U., Ghosh, K. "Senescence-associated choroidal endothelial cell stiffening contributes to choriocapillaris dysfunction seen in AMD". Investigative Ophthalmology & Visual Science 56 (2015).
3. X. Chen, W. Chen, A. Mulchandani, and U. Mohideen, "Application of displacement principle for detecting heavy metal ions and EDTA using microcantilevers," Sensors and Actuators B-Chemical, Volume: 161 Issue: 1 Pages: 203-208 (2012).
4. W. Liu, V. Montana, V. Parpura and U. Mohideen, "Single-Molecule Measurements of Dissociation Rates and Energy Landscapes of Binary trans SNARE Complexes in Parallel versus Antiparallel Orientation," Biophysical Journal, Volume: 101 Issue: 8 Pages: 1854-1862 (2011).
5. V. Montana, W. Liu, U. Mohideen, V. Parpura, "Single molecule measurements of mechanical interactions within ternary SNARE complexes and dynamics of their disassembly: SNAP25 vs. SNAP23," Journal of Physiology-London, Vol. 587, pp.1943-1960 (2009).
6. V. Parpura and U. Mohideen, "Molecular form follows function: (un)snaring the SNAREs," Trends in Neuroscience, Vol. 31, pages: pp. 435-443 (2008).
7. W. Liu, V. Montana, V. Parpura, and U. Mohideen, "Comparative Energy Measurements in Single Molecule Interactions," Biophysical Journal, Vol. 95, pp. 419-425 (2008).
8. W. Liu, V. Montana, J. Bai, E.R. Chapman, U. Mohideen and V. Parpura, "Single molecule mechanical probing of the SNARE protein interactions," Biophysics Journal, Vol. 91, pp. 744-758 (2006).
9. W. Liu, V. Montana, E. Chapman, U. Mohideen, and V. Parpura, "Botulinum toxin type B micromechanosensor," Proceedings of the National Academy of Sciences, Vol.100 (23), pp. 13621-13625 (2003).
10. M. Bordag, G.L. Klimchitskaya, U. Mohideen and V.M. Mostepanenko, "Advances in the Casimir Effect," Oxford University Press, Oxford, UK. 768 pages (2009).

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Leonard J. Mueller

eRA COMMONS USER NAME (credential, e.g., agency login): LMUELLER

POSITION TITLE: Professor of Chemistry

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Rochester, Rochester, NY	BS	05/1988	Chemistry
University of Cambridge, U.K.	CPGS	06/1989	Chemistry
California Institute of Technology, Pasadena, CA	PhD	06/1996	Chemistry
Massachusetts Institute of Technology, Cambridge, MA	Postdoc	06/1998	Chemistry

A. Personal Statement

As PI, I have assembled a close-knit team of scientists, all housed at UC Riverside, with expertise in biochemistry/enzymology (Dunn), X-ray crystallography (Fan), NMR spectroscopy (Mueller), organic synthesis (Hooley), and computational chemistry (Beran and Chang); our extensive published and new preliminary data show a focused and productive collaboration has been established. The goal of this research project is to establish the chemical level details in the enzymatic transformation of substrate to product in pyridoxal-5'-phosphate (PLP) dependent enzymes using a NMR crystallography – the synergistic combination of solid-state nuclear magnetic resonance, X-ray crystallography, and computational chemistry. Specifically, we are working to determine the chemically-detailed, three-dimensional structure of the substrate/analogue, co-enzyme, and side chains, allowing detailed mechanistic changes in protonation, charge states, and hybridization to be established. I have the ambition, technical expertise, and leadership skills necessary to direct this project. My graduate and postdoctoral education provided extensive training in the development and application of solid-state NMR spectroscopy and over the last ten years my research group has been at the forefront in the development and application of NMR crystallography to enzyme active sites. This work includes new experimental techniques in biological solid-state NMR and the development of ab initio computational methods to quantitatively interpret these shifts in terms of chemically-detailed, three-dimensional structures.

1. J. Lai, D. Nicks, Y. Wang, T. Domratcheva, T.R.M. Barends, F. Schwarz, R.A. Olsen, D.W. Elliott, M.Q. Fatmi, C.A. Chang, I. Schlichting, M.F. Dunn, and L.J. Mueller, "X-Ray and NMR Crystallography in an Enzyme Active Site: the Indoline Quinonoid Intermediate in Tryptophan Synthase," *Journal of the American Chemical Society*, **133**, 4-7 (2011)
2. L.J. Mueller and M.F. Dunn, "NMR Crystallography of Enzyme Active Sites: Probing Chemically-Detailed, Three-Dimensional Structure in Tryptophan Synthase," *Accounts of Chemical Research*, **46**(9), 2008-2017 (2013)
3. B.G. Caulkins, B. Bastin, C. Yang, T.J. Neubauer, R.P. Young, E. Hilario, Y.M. Huang, C.A. Chang, L. Fan, M.F. Dunn, M.J. Marsella, and L.J. Mueller, "Protonation States of the Tryptophan Synthase Internal Aldimine Active Site from Solid-State NMR Spectroscopy: Direct Observation of the Protonated Schiff Base Linkage to Pyridoxal-5'-Phosphate," *Journal of the American Chemical Society*, **136**(37), 12824-12827 (2014)

4. R.P. Young, B.G. Caulkins, D. Borchardt, D.N. Bulloch, C.K. Larive, M.F. Dunn, and L.J. Mueller, "Solution-State ^{17}O Quadrupole Central Transition NMR Spectroscopy in the Active Site of Tryptophan Synthase," *Angewandte Chemie International Edition*, **55**, 1350-1354 (2016)

B. Positions and Honors

Positions and Employment

8/96 – 6/98	Postdoctoral Fellow	Massachusetts Institute of Technology
7/98 – 6/05	Assistant Professor of Chemistry	University of California, Riverside
7/05 – 6/12	Associate Professor of Chemistry	University of California, Riverside
7/05 – present	Vice Chair, Department of Chemistry	University of California, Riverside
7/12 – present	Professor of Chemistry	University of California, Riverside

Other Experience

2009-present	Organizing Committee, Rocky Mountain Conference on Magnetic Resonance
2011-present	Associate Editor, <i>Magnetic Resonance in Chemistry</i>

Professional Memberships

1995-present	American Chemical Society
2002-present	International Society of Magnetic Resonance

Honors

1988	B.S. summa cum laude
1988	Churchill Foundation Fellowship
1988	National Science Foundation Graduate Fellowship
1991	National Defense Science and Engineering Graduate Fellowship
1991	Hertz Foundation Fellowship (declined in order to accept NDSEG Fellowship)
1996-1998	American Cancer Society Postdoctoral Fellow in Chemistry, MIT
1999	Research Corporation, Research Innovation Award
2002	UCR Regent's Faculty Fellowship
2004	NSF CAREER Award
2012	UCR Academic Senate Distinguished Teaching Award
2015	Regitze R. Vold Memorial Prize, Alpine Conference on Solid-State NMR

C. Contribution to Science

1. **NMR-Assisted Crystallography in Structural Biology:** A major goal of my research is to understand the transformation of substrate to product in enzyme active sites at the atomic level – that is to define the position of all atoms, including protons. To accomplish this, we are pioneering the development and application of NMR-assisted crystallography – the synergistic combination of solid-state NMR, X-ray crystallography, first-principles (ab initio) and molecular dynamics computational approaches, and synthetic organic chemistry – to enzyme systems. Specifically, my group is establishing the atomic-level details in the enzymatic transformation of substrate to product in pyridoxal-5'-phosphate-requiring enzymes. By doing so, we are advancing an understanding of the relationship between chemical structure, conformational dynamics, and enzyme mechanism. What will emerge will be one of the most chemically-detailed mechanistic pathways of a multi-step enzymatic transformation.
 - a. J. Lai, D. Niks, Y. Wang, T. Domratcheva, T.R.M. Barends, F. Schwarz, R.A. Olsen, D.W. Elliott, M.Q. Fatmi, C.A. Chang, I. Schlichting, M.F. Dunn, and L.J. Mueller, "X-Ray and NMR Crystallography in an Enzyme Active Site: the Indoline Quinonoid Intermediate in Tryptophan Synthase," *Journal of the American Chemical Society*, **133**, 4-7 (2011)
 - b. L.J. Mueller and M.F. Dunn, "NMR Crystallography of Enzyme Active Sites: Probing Chemically-Detailed, Three-Dimensional Structure in Tryptophan Synthase," *Accounts of Chemical Research*, **46**(9), 2008-2017 (2013)

- c. B.G. Caulkins, B. Bastin, C. Yang, T.J. Neubauer, R.P. Young, E. Hilario, Y.M. Huang, C.A. Chang, L. Fan, M.F. Dunn, M.J. Marsella, and L.J. Mueller, " Protonation States of the Tryptophan Synthase Internal Aldimine Active Site from Solid-State NMR Spectroscopy: Direct Observation of the Protonated Schiff Base Linkage to Pyridoxal-5'-Phosphate," *Journal of the American Chemical Society*, **136**(37), 12824-12827 (2014)
- d. R.P. Young, B.G. Caulkins, D. Borchardt, D.N. Bulloch, C.K. Larive, M.F. Dunn, and L.J. Mueller, "Solution-State ^{17}O Quadrupole Central Transition NMR Spectroscopy in the Active Site of Tryptophan Synthase," *Angewandte Chemie International Edition*, **55**, 1350-1354 (2016)

2. **Resonance Assignments and Structure in Organic and Biological Solids:** Resonance assignments are an essential first step in structural studies with NMR and one of my group's most sustained contributions has been in the development of scalar-coupling-driven correlation spectroscopy for organic and biological solids. In this arena, we have introduced powerful new techniques to assign through-bond connectivity in complex organic solids, effect ^{13}C - ^{13}C correlation at natural abundance isotope levels, and obtain 2D and 3D correlation spectra with substantially increased spectral resolution in biological solids as large as 143 kDa.

- a. R.A. Olsen, J. Struppe, D.W. Elliott, R.J. Thomas and L.J. Mueller, "Through-Bond ^{13}C - ^{13}C Correlation at the Natural Abundance Level: Refining Dynamic Regions in the Crystal Structure of Vitamin-D₃ with Solid-State NMR," *Journal of the American Chemical Society*, **125**(39), 11784-11785 (2003)
- b. L. Chen, R.A. Olsen, D.W. Elliott, J.M. Boettcher, D.H. Zhou, C.M. Rienstra, and L.J. Mueller, "Constant-Time Through-Bond ^{13}C Correlation Spectroscopy for Assigning Protein Resonances with Solid-State NMR Spectroscopy," *Journal of the American Chemical Society*, **128**(31), 9992-9993 (2006)
- c. L. Chen, J.M. Kaiser, T. Polenova, J. Yang, C.M. Rienstra, and L.J. Mueller, "Backbone Assignments in Solid-State Proteins Using J-Based 3D Heteronuclear Correlation Spectroscopy," *Journal of the American Chemical Society* **129**(35): 10650-10651 (2007)
- d. M. Tang, G. Comellas, L.J. Mueller, and C.M. Rienstra, "High Resolution ^{13}C -Detected Solid-State NMR Spectroscopy of a Deuterated Protein," *Journal of Biological NMR*, **48**(2), 103-111 (2010)

3. **NMR Crystallography in Materials Science:** Building on the success of this approach, we have a parallel effort underway on the development of NMR crystallography in materials science, focusing on solid-state structure and dynamics in organic photoreactions. This is an ongoing, NSF-funded collaboration with the Bardeen group at UCR. A highlight of this work involves the identification of metastable crystalline intermediates in the solid-state photoreaction of anthracene derivatives and related compounds using ^{13}C solid-state NMR. Our paradigm-shifting results show that the photomechanical response of these molecular crystal nanostructures is determined by non-equilibrium intermediate states and cannot be predicted based solely on knowledge of the equilibrium reactant and product crystal structures.

- a. T. Kim, L. Zhu, L.J. Mueller, and C.J. Bardeen, "Mechanism of photo-induced bending and twisting in crystalline microneedles and microribbons composed of 9-methylantracene," *Journal of the American Chemical Society*, **136**, 6617-6625 (2014)
- b. L. Zhu, A. Agarwal, J. Lai, R.O. Al-Kaysi, F.S. Tham, T. Ghaddar, L. Mueller, C.J. Bardeen, "Solid-state photochemical and photomechanical properties of molecular crystal nanorods composed of anthracene ester derivatives," *Journal of Materials Chemistry*, **21**(17), 6258-6268 (2011)

4. **Structure and Dynamics from Solid-State and Solution-State NMR:** In addition to these major initiatives, my group also maintains close and vigorous collaborations with several other groups at UCR. Recently, these have led to the solid-state NMR characterization of non-Watson-Crick hydrogen bonding motifs in nucleobases – part of a longstanding collaboration with the Morton group. We have also expanded considerably our collaboration with the Larive group at UCR to characterize hydrogen bonding in oligosaccharides in solution using both NMR and molecular dynamics simulations. We have successfully predicted and observed several novel hydrogen bonding interactions that help stabilize molecular conformations in solution. Understanding how elements of local structure impact the solution conformation of oligosaccharides can potentially provide insight into the nature of polysaccharide-protein interactions. Although oligosaccharides are thought to be flexible in solution, we have found that specific structural

motifs are favored by intramolecular hydrogen bonds that restrict the conformation and that we hypothesize pre-organize the local structure for high-affinity protein binding.

- a. S. Yaghmaei, S. Khodagholian, J.M. Kaiser, F.S. Tham, L.J. Mueller, and T.H. Morton, "Chelation of a Proton by an Aliphatic Tertiary Diamine," *Journal of the American Chemical Society*, **130**(25) 7836-7838 (2008)
- b. H.U. Ung, A.R. Moehlig, R.A. Kudla, L.J. Mueller, J. Oomens, G. Berden, and T.H. Morton, "Proton-Bound Dimers of 1-Methylcytosine and its Derivatives: Vibrational and NMR Spectroscopy," *Physical Chemistry Chemical Physics*, **15**, 19001-19012 (2013)
- c. C.N. Beecher, R.P. Young, D.J. Langeslay, L.J. Mueller, and C.K. Larive, "Hydroxyl Proton Hydrogen Bonding in the Heparin Oligosaccharide Arixtra in Aqueous Solution," *Journal of Physical Chemistry B*, **118**(2) 482-491 (2014)
- d. D.J. Langeslay, R.P. Young, S. Beni, C.N. Beecher, L.J. Mueller, and C.K. Larive, "Sulfamate proton solvent exchange in heparin oligosaccharides: Evidence for a persistent hydrogen bond in the antithrombin-binding pentasaccharide Arixtra," *Glycobiology*, **22** (9): 1173-1182 (2012)

Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/leonard.mueller.1/bibliography/41151539/public/?sort=date&direction=descending>

D. Research Support

Current Research Support

NIH R01GM097569 Mueller (PI) 9/30/2011-8/31/2016

"Chemically-Rich Structure and Dynamics in the Active Site of Tryptophan Synthase"

The goal of this project is to determine the chemical level details for the enzymatic transformation of substrate to product in tryptophan synthase using a synergistic combination of solid-state nuclear magnetic resonance, X-ray crystallography, synthetic organic chemistry, and computational chemistry.

Role: PI

NSF DMR1508099 Bardeen (PI) 8/1/2015-7/31/2018

"Reconfigurable Molecular Crystals through Solid-State Photochemistry"

The goal of this project is to develop new techniques for preparing and probing structure and dynamics of photomechanical molecular crystals.

Role: co-PI

Completed Research Support

NSF DMR1207063 Bardeen (PI) 7/1/2012-6/30/2015

"Preparation and Characterization of Microscopic Photomechanical Molecular Crystals"

The goal of this project is to develop new techniques for preparing and probing structure and dynamics of photomechanical molecular crystals.

Role: co-PI

NSF DUE1140522 Eichler (PI) 7/1/2012-6/30/2015

"Developing Pedagogies of Engagement in Foundation Chemistry Courses: Enhancing Minority Retention in STEM Majors"

Role: co-PI

DAWN NAGEL, Ph.D.

Department of Botany and Plant Sciences
1129 Batchelor Hall
University of California, Riverside
Riverside, CA 92521
Email: dawnn@ucr.edu

EDUCATION

University of Georgia	Athens, GA	Ph.D., Plant Biology	2003 - 2008
University of Georgia	Athens, GA	B.S., Biology	1998 - 2000

RESEARCH EXPERIENCE

Assistant Professor: University of California, Riverside 06/2016 - present

The long term goal of my research is to understand the underlying regulatory mechanisms of how the circadian clock modulate the plant's ability to sense and respond to temperature stress. We use functional genomics, genetics and a variety of genome-scale approaches to address these questions. Mechanistic discoveries from my proposed research will contribute to the development of crop cultivars that are better resistant to temperature extremes.

Postdoctoral Fellow: Dr. Steve Kay, The Scripps Research Institute, La Jolla 06/2009 – 06/2016

(Previously at University of California, 2009-2014, San Diego and University of Southern California, 2014-2016, The Scripps Research Institute, La Jolla 02/2016 – 06/2016). Goals were to understand mechanistically how circadian clock genes are regulated to sustain robust rhythms, and in turn regulate numerous biological pathways. I used functional genomics approaches in combination with a variety of molecular and genomic techniques to screen for novel regulators underlying clock function, and to discover and characterize clock controlled transcriptional targets regulating key biotic and abiotic stress responses.

Postdoctoral Scholar: Dr. Susan Wessler, University of Georgia 01/2009 – 05/2009

Designed and performed computational analyses to identify and characterize transposable elements in the sequenced maize genome.

Graduate Research Assistant: Dr. Susan Wessler, University of Georgia 08/2003 – 12/2008

Combined computational and experimental approaches to determine the content and understand the impact of transposable elements on eukaryotic genomes.

Research Assistant/Coordinator: Dr. Susan Wessler, University of Georgia 01/2000 – 07/2003

Conducted experiments relevant to research projects in the lab. Assisted with supervision of undergraduate students and provided general lab support.

Undergraduate Student: Dr. Susan Wessler, University of Georgia 03/1998 – 12/1999

Performed experiments under the supervision graduate students. Maintained the lab, including buffer preparation and ordering supplies. Provided technical assistance to members of the lab.

AWARDS

2013 NAASC International Conference on Arabidopsis Research Under-represented Minority Funding

2012 NAASC International Conference on Arabidopsis Research Under-represented Minority Funding

2010 National Institute of Health Ruth L. Kirschstein National Research Service Awards for Individual

Postdoctoral Fellowships

2006 UGA Center for Undergraduate Research Opportunities Excellence in Undergraduate Mentoring Award.

PUBLICATIONS

Nagel D H*, Doherty C J*, Pruneda-Paz J L, Schmitz R J, Ecker J R, and Kay S A. **(2015)** Genome-wide Identification of CCA1 Targets Uncovers an Expanded Clock Network in Arabidopsis. **Proceedings National Academy of Sciences** 112: E4802-10.

Nagel, D H, Pruneda-Paz, J L, and Kay, S A. **(2014)** FBH1 affects warm temperature responses in the Arabidopsis circadian clock. **Proceedings National Academy of Sciences** 111: 14595 - 14600.

Pruneda-Paz J L*, Breton G*, **Nagel D H**, Kang S E, Bonaldi K, Doherty C J, Ravelo S, Galli M, Ecker J R, and Kay SA. **(2014)** A genome-scale resource for the functional characterization of Arabidopsis transcription factors. **Cell Reports** 8: 622 -632.

Nagel D H and Kay S A **(2012)**. Complexity in the Wiring and Regulation of Plant Circadian Networks. **Current Biology** 22: R648-R657.

Yang G, **Holligan Nagel D**, Feschotte C and Wessler S R **(2009)**. Tuned for Transposition: Molecular Determinants Underlying the Hyperactivity of a Stowaway MITE. **Science** 325: 1391-1394.

Patrick S. Schnable *et al.* (**Holligan Nagel D**) **(2009)**. The B maize genome: complexity, diversity and dynamics. **Science** 326: 1112-1115.

Fusheng Wei, *et al.* (**Nagel D H**) **(2009)**. Detailed Analysis of a Contiguous 22-Mb Region of the Maize Genome. **PLoS Genetics** 5: e1000728

Kwon S J, Cho Y C, Kwon S W, Oh C S, Suh J P, Shin Y S, Kim Y G, (**Nagel**) **Holligan D**, Wessler S R, Hwang H G and Ahn S N. **(2008)**. QTL mapping of agronomic traits using an RIL population derived from a cross between temperate japonica cultivars in rice (*Oryza sativa* L.). **Breeding Science** 58: 271-279.

(**Nagel**) **Holligan D**, Zhang X, Jiang N, Pritham E J and Wessler S R **(2006)**. The transposable element landscape of the model legume *Lotus japonicus*. **Genetics** 174: 2215 - 2228.

Tuskan GA, *et al.* [(**Nagel**) **Holligan D**], **(2006)**. The genome of black cottonwood, *Populus trichocarpa* (Torr. & Gray). **Science** 313 (5793): 1596-604.

Biedler J, Qi Y, (**Nagel**) **Holligan D**, Della Torre A, Wessler S R, and Tu Z **(2003)**. Transposable element (TE) display and rapid detection of TE insertion polymorphism in the *Anopheles gambiae* species complex. **Insect Mol. Biol.** 12 (3): 211-216.

TEACHING EXPERIENCE

2015 Lecturer: BIMM116/PSYC133 - Circadian Rhythms - Bio Clocks (PI: Susan Golden). Lectured a class of ~300 students on the Plant Circadian Clock. Designed and conducted in class concept learning activities for three sections.

2006 Workshop Contributor: University of Georgia.

Contributed to a one-week training module for two high school teachers from High Tech High Los Angeles on how to search and identify transposable elements using the available genomic sequences at NCBI.

2003 and 2004 Graduate Teaching Assistant: Biology 2107 Honors University of Georgia.

Provided assistance to students related to the course work and graded quizzes and exams. Held review and study sessions to assist students with relevant course work.

PRESENTATIONS

Invited Speaker:

2014 Center for Circadian Biology Workshop: University of California, San Diego. Functional Genomics approaches to identify novel regulators of the Arabidopsis circadian clock.

2014 Invited Guest Seminar Speaker: Ibis Pharmaceuticals, CA. Functional Genomics Approaches to Understand How Organisms Sense and Respond to a Dynamic Environment.

2014 Gordon Research Conference: Plant Molecular Biology, Holderness NH. Transcriptional targets of clock controlled outputs.

2007 University of Georgia Plant Biology Graduate Student Symposium, Athens GA. Developing an active assay for *Lotus japonicus* transposable elements.

2004 EMBO Workshop on Molecular Mechanisms of Transposition, its Regulation and Evolution, Roscoff, France. Transposable elements in Model Legumes.

Poster presentations:

2014 University of Southern California Molecular and Cellular Biology Retreat. Lake Arrowhead, CA. Functional Genomics approaches to identify novel regulators of the Arabidopsis circadian clock.

2014 Gordon Research Conference: Plant Molecular Biology, Holderness NH. Transcriptional targets of clock controlled outputs.

2013 The 24rd International Conference on Arabidopsis Research (ICAR), Sydney, Australia. A Novel Circadian Clock Regulator in Arabidopsis.

2012 The 23rd International Conference on Arabidopsis Research (ICAR), Vienna, Austria. A Novel Circadian Clock Regulator in Arabidopsis.

2006 University of Georgia Plant Center Retreat, Lake Lanier GA. Developing an active transposon assay for *Lotus* Transposable Elements.

2005 47th Annual Maize Genetics Conference, Lake Geneva, Wisconsin. Transposable elements in the model Legume *Lotus japonicus*: abundance, diversity and intra-specific polymorphism.

2003 Plant Transposon Meeting, Iowa State University, Ames IA. Functional analysis of the two ORFs of the active rice *Pong* element.

MENTORING EXPERIENCE

2013 – present Online Mentor for American Society of Plant Biologists (ASPB) Planting Science Mentoring Program.

2005 – 2007 Mentored undergraduate research students Deep Shah and Paul Ruddle. Designed small projects to identify transposable elements in plants, and conducted experiments to test several hypotheses.

2002 – 2003 Mentored minority undergraduate research student Tesheka Stevenson, who recently graduated with her Ph.D from the Department of Genetics and Molecular Biology at Emory University.

OUTREACH/VOLUNTEER SERVICE

2010 – 2011 Served as a postdoc representative on the Division of Biological Sciences Biology/Salk Retreat Planning Committee. Designed and organized activities to enhance interaction and mentorship between postdocs and faculty.

2010 Volunteered at the San Diego Festival of Science and Engineering, as a postdoc representative of UCSD, in the section on “Ask me I am a Scientist”.



SEÁN O'LEARY
ASSISTANT PROFESSOR

DEPARTMENT OF BIOCHEMISTRY
3488B BOYCE HALL
RIVERSIDE, CALIFORNIA 92521-0122

August 5th, 2016

Russ Hille,
Distinguished Professor of Biochemistry,
University of California, Riverside,
2404 Boyce Hall,
Riverside, CA 92521-0122.

Re: Interdepartmental Graduate Program in Biophysics

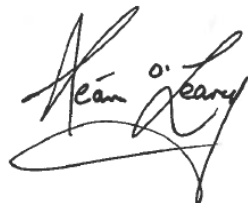
Dear Russ,

I would like to express my enthusiastic support for the proposed Interdepartmental Graduate Program in Biophysics at the University of California, Riverside.

During my past six years as a postdoctoral researcher at Stanford University School of Medicine, I was involved both in performing and in mentoring trainees in Biophysics research, focusing on applications of single-molecule fluorescence microscopy to study complex biochemical systems. Our research was a natural fit for, and benefitted enormously from students in the Biophysics program. The potential of a similar program at UCR is therefore really exciting. I will be delighted to participate in the program as it is established.

If I can assist in any way, please do not hesitate to contact me.

Sincerely,



Seán O'Leary

Curriculum Vitae

Seán O'Leary

Personal Information:

Address:

Department of Biochemistry,
University of California, Riverside,
3488B Boyce Hall,
Riverside, CA 92521.

Phone: +1 (951) 827-4222

E-mail: sean.oleary@ucr.edu

Education:

- 2010 **Ph.D.**, Chemistry and Chemical Biology, Cornell University
Dissertation: "Exploring Novel Enzymology in Bacterial Metabolism: Cysteine Synthase, Urate Oxidase, and Bacimethrin Biosynthesis."
Advisor: Tadhg P. Begley
- 2008 **M.S.**, Chemistry and Chemical Biology, Cornell University
- 2005 **B.Sc.(Hons)**, Chemistry, University College Dublin, Ireland

Research Experience:

- 2016 – **Assistant Professor of Biochemistry**, University of California, Riverside
- 2014 – 2016 **Basic Life Sciences Research Associate** and
2010 – 2014 **Postdoctoral Scholar**, Stanford University School of Medicine
Project: Single-molecule, biophysical and biochemical studies on eukaryotic translation initiation
Advisor: Joseph D. Puglisi
- 2009 – 2010 **Research Assistant**, Texas A&M University
Projects: Biochemical studies on PKS11, a type-III polyketide synthase from *M. tuberculosis*.
Reconstitution and characterization of bacimethrin biosynthesis.
Advisor: Tadhg P. Begley
- 2005 – 2009 **Graduate Research Assistant**, Cornell University
Projects: Pre-steady-state kinetic studies on CysM, a cysteine synthase from *M. tuberculosis*.
Biochemical characterization of HpxO, a novel flavin-dependent urate oxidase from *Klebsiella pneumoniae*.
Investigation of the trapping of a glycosyl cation at the active site of crystals of uridine phosphorylase from *Escherichia coli* and *Bos taurus*.
Studies on the biosynthesis of bacimethrin.
Studies on the mechanism of formation of the DNA dimeric thymine lesion known as the "spore photoproduct".
Advisor: Tadhg P. Begley

Honors and Awards:

- 2014 – NIH Pathway to Independence Career Development Award (K99/R00) (GM111858)
- 2011 Dean's Postdoctoral Fellowship, Stanford University School of Medicine

2006	Hugh Ryan Memorial Medal, University College Dublin
2005	Eva Philbin Bowman Medal, University College Dublin
2004	University Scholarship, University College Dublin
2003	University Scholarship, University College Dublin
2002	University Scholarship, University College Dublin (<i>Two scholarships</i>)
2001	Entrance Scholarship, University College Dublin

Publications:

19. Petrov, A., Groseley, R., Chen, J., **O'Leary, S. E.**, Puglisi, J. D. (2016) Multiple parallel pathways of translation initiation on the CrPV IRES. *Mol. Cell* 62(1), 92–103.
18. Choi, J., Jeong, K.-W., Demirci, H., Chen, J., Petrov, A., Prabhakar, A., **O'Leary, S. E.**, Dominissini, D., Rechavi, G., Soltis, M., Ehrenberg, M., and Puglisi, J. D. (2016) *N*⁶-methyladenosine in mRNA disrupts tRNA selection and translation elongation dynamics. *Nat. Struct. Mol. Biol.* 23(2), 110–115.
17. Chen, J., Coakley, A., O'Connor, M., Petrov, A., **O'Leary, S. E.**, Atkins, J. F., and Puglisi, J. D. Coupling of mRNA structure rearrangement to ribosome movement during bypassing of non-coding regions. *Cell* 163(5), 1267–1280.
16. Fuchs, G., Petrov, A. N., Marceau, C. D., Popov, L. M., Chen, J., **O'Leary, S. E.**, Wang, R., Carette, J. E., Sarnow, P., and Puglisi, J. D. (2015) Kinetic pathway of 40S ribosomal subunit recruitment to hepatitis C virus internal ribosome entry site. *Proc. Natl. Acad. Sci. USA* 112(2), 319–325.
15. Chen, J., Petrov, A., Johansson, M., Tsai, A., **O'Leary, S. E.**, and Puglisi, J. D. (2014) Dynamic pathways of -1 translational frameshifting. *Nature* 512(7514), 328–332.
14. Cooper, L. E.*, **O'Leary, S. E.***, and Begley, T. P. (2014). Biosynthesis of a thiamin antivitamin. *Biochemistry* 53(14), 2215–2217. *Joint first-authorship.
13. Chen, J., Petrov, A., Dalal, R., Tsai, A., **O'Leary, S. E.**, Chapin, K., Cheng, J., Ewan, M., Hsuing, P.-L., Lundquist, P., Turner, S., Hsu, D. R., and Puglisi, J. D. (2013). High throughput platform for real-time monitoring of biological processes by multicolor single-molecule fluorescence. *Proc. Natl. Acad. Sci. USA* 111(2), 664–669.
12. **O'Leary, S. E.**, Petrov, A., Chen, J., and Puglisi, J. D. (2013) Dynamic recognition of the mRNA cap by *Saccharomyces cerevisiae* eIF4E. *Structure* 21(12), 2197–2207.
11. Vivona, S., Cipriano, D., **O'Leary, S.**, Li, Y. H., Fenn, T., and Brunger, A. T. (2013) Disassembly of all SNARE complexes by *N*-ethylmaleimide-sensitive factor (NSF) is initiated by a conserved 1:1 interaction between α -soluble NSF attachment protein (SNAP) and SNARE complex. *J. Biol. Chem.* 288(34), 24984–24981.
10. Gokulan, K., **O'Leary, S. E.**, Russell, W. K., Russell, D. H., Lalgondar, M., Begley, T. P., Ioerger, T. R., and Sacchettini, J. C. (2013) Crystal structure of *Mycobacterium tuberculosis* PKS11 reveals intermediates in the synthesis of methyl-branched alkylpyrones. *J. Biol. Chem.* 288(23), 16484–16494.
9. Chen, J., Petrov, A., Tsai, A., **O'Leary, S. E.**, and Puglisi, J. D. (2013) Coordinated conformational and compositional dynamics drive ribosome translocation. *Nat. Struct. Mol. Biol.* 20(6), 718–727.
8. Hicks, K. A., **O'Leary, S. E.**, Begley, T. P., and Ealick, S. E. (2013) Structural and mechanistic studies of HpxO, a novel flavin adenine dinucleotide-dependent urate oxidase from *Klebsiella pneumoniae*. *Biochemistry* 52(3), 477–487.
7. Chen, J., Tsai, A., **O'Leary, S. E.**, Petrov, A., and Puglisi, J. D. (2012) Unraveling the dynamics of ribosome translocation. *Curr. Opin. Struct. Biol.* 22(6), 804–814.
6. Petrov, A., Chen, J., **O'Leary, S.**, Tsai, A., and Puglisi, J. D. (2012) Single-molecule analysis of translational dynamics. *Cold Spring Harb. Perspect. Biol.* (Hershey, J. W. B., Sonenberg, N., Matthews, M. B., Eds.), doi: 10.1101/cshperspect.a011551.

5. Petrov, A., Kornberg, G., **O'Leary, S.**, Tsai, A., Uemura, S., and Puglisi, J. D. (2011) Dynamics of the translational machinery. *Curr. Opin. Struct. Biol.* 21(1) 137–145.
4. Paul, D., **O'Leary, S. E.**, Toms, A., Rajashankar, K., Bu, W., Settembre, E. C., Sanders, J. M., Begley, T. P., and Ealick, S. E. (2010), Glycol formation in crystals of uridine phosphorylase. *Biochemistry* 49, 3499–3509.
3. Hazra, A., Chatterjee, A., Chatterjee, D., Hilmey, D. G., Sanders, J. M., Hanes, J. W., Krishnamoorthy, K., McCulloch, K. M., Waitner, M. J., **O'Leary, S.**, and Begley, T. P. (2009), Coenzyme and prosthetic group biosynthesis, in *Encyclopedia of Microbiology* (Schaechter, M., Ed.) 3rd ed., pp 79–88, Academic Press, San Diego.
2. **O'Leary, S. E.**, Hicks, K. A., Ealick, S. E., and Begley, T. P. (2009) Biochemical characterization of the HpxO enzyme from *Klebsiella pneumoniae*, a novel FAD-dependent urate oxidase. *Biochemistry* 48(14), 3033–3035.
1. **O'Leary, S. E.**, Jurgenson, C. T., Ealick, S. E., and Begley, T. P. (2008) O-Phospho-L-serine and the thiocarboxylated sulfur carrier protein CysO-COSH are substrates for CysM, a cysteine synthase from *Mycobacterium tuberculosis*. *Biochemistry* 47(44), 11606–11615.

Invited talks:

2. Uppsala University, Uppsala, Sweden, 8/10/2016.
1. Pacific Biosciences, Menlo Park, CA, 3/17/2016.

Jeff Perry, Ph.D.

Jeff.perry@ucr.edu

Department of Biochemistry, UC Riverside 3401 Watkins Drive, Riverside, Ca 92521.

Professional Appointments:

- Oct 2014 - Present **Assistant Professor of Biochemistry**, University of California, Riverside.
- Oct 2015 - Present **Adjunct Professor**, Universidad Francisco de Vitoria, Madrid, Spain.
- Jan 2015 - Present **Co-Founder**, Arma Pharmaceuticals Inc., Delaware.
- Dec 2012 - Present **Co-Founder**, Neuromantis Pharmaceuticals Inc., San Diego, Ca.
- Oct 2005 - Present **Adjunct International Professor**, School of Biotechnology, Amrita University, India.

Education:

- July 2001 **Ph.D.** Natural Science, University of Cambridge, UK.
Thesis: Structural Studies on Cell Surface Glycoproteins.
Advisor: Sir Tom L. Blundell, FRS, FMedSci, PhD, Head of Biochemistry Department.
- June 1996 **B.Sc.** Imperial College of Science Technology and Medicine, UK.
Biochemistry with a Year in Industry (Hons).

Research and Training Experience:

- 2011-2014 **Staff Scientist**, The Scripps Research Institute, Department of Integrative Structural and Computational Biology, La Jolla, Ca.
- 2006-2011 **Senior Research Associate**, The Scripps Research Institute.
Advisor: Dr. John A. Tainer.
Project: Structural biochemistry studies DNA repair and genome stability pathways.
- 2001-2006 **Postdoctoral Fellow**, Lawrence Berkeley National Laboratories & Visiting Scientist, TSRI.
Advisors: Dr. John A. Tainer & Dr. Priscilla K. Cooper.
Project: Structural biochemistry studies DNA repair and genome stability pathways.
- 1996-2001 **Ph.D. Student**, University of Cambridge, Department of Biochemistry, UK
Advisor: Prof. Sir Tom L. Blundell, FRS, FMedSci,
Project: Structural Biochemistry Studies on Cell Surface Glycoproteins.
- 1996 **Research Student**, Computational Chemistry Department, Pfizer Central Research Ltd, UK.
Advisor: Dr. David G. Brown. Project: Analyses of neutrophil inhibitory factor
- 1996 **Undergraduate Research Project Student**, Imperial College, UK
Advisor: Dr. K. Brown. Project: Cloning and Characterization of *M. tuberculosis* KATG.
- 1995 **Undergraduate Industrial Placement**, Glaxo-Welcome, UK
Advisor: Dr. Onkar Singh, Project: Biochemical characterization of the HIV-1 Rev protein.

New Investigator NIH Extramural Grant Support:

NIH/NIAMS New Investigator R03 AR059968-01A1 (PI)

07/01/2011 – 03/31/2015

“Structural Biochemistry Studies on MAP Kinase Allosteric Binding Sites”

NIH/NIGMS The HIV Interaction and Viral Evolution (HIVE) Center P50 GM103368 (Lead PI – Olson)

Collaborative Development Program Award on “Advanced SAXS technologies for HIVE center studies”

(Awarded as a Subcontract to Tainer & Perry as co-PIs)

03/01/2013 – 08/01/2014

Grant Applications In Preparation/Re-Submission:

“Roles of RNF4 at dysfunctional telomeres” NIH R01 (Boddy/Perry/Lazzerini-Denchi)

“A Unicellular Model for Determining DNA Repair Functions of the RecQ4 Disease-Suppressing Helicase”

NIH R01 (Boddy/Perry)

“Defining WD-repeat protein:small molecule interactions” NIH R01 (Perry/Reed/Cheltsov)

“Targeting Arm1 for cancer chemotherapy selectivity” NIH SBIR (Hoelz/Perry)

“A Novel therapeutic target for treating Parkinson's disease” NIH R01 (Perry/Reed/Cheltsov)

Honors and Awards:

1996-2000 Pfizer Central Research Ltd, UK, CASE sponsored Ph.D. studentship

Skills and Interests:

- Discovery of novel components in the SUMO and Ubiquitin post-translational modification pathways.
- Extensive experience in the production of protein crystals, collection and analysis of diffraction, and subsequent data analysis, structure determination, model building and refinement, and pdb submission.
- Experienced in small angle x-ray scattering methods.
- Adept in molecular biology, protein expression, purification and protein biochemistry methods.
- Skilled in structural bioinformatics analyses, including protein comparative modeling.
- Experienced in crystallographic, computational and biochemical methods in structural-based drug design.
- Extensive experience in both writing and in reviewing manuscripts and grants.

Scientific Achievements:

- Authorship of 4 manuscripts highlighted in the Faculty of 1000.
- Reviewer of 60 manuscripts for leading journals (Nature, Cell, Nature Struct & Mol Biol, etc)
- Reviewer of 17 grant applications (EBI, USA, Wellcome Trust, UK, M.R.C., UK, etc).

Teaching Experience:

2014-present Biochemistry UG courses at UCR, BCH-10, 96, 97 98i, 100, 110A & 120, 197.

2005-present Teaching ‘Structural Bioinformatics’ course for Bioinformatics MSc, and ‘Structure-based Drug Discovery’ for Biotechnology and Microbiology MSc degrees, Amrita University, Kerala, India.

2004-present Supervision of laboratory technicians, graduate students and post-doctoral fellows.

1999-2000 Biochemistry undergraduate tuition, St. Edmund’s College, University of Cambridge, UK.

PDBs:

Human MnSOD structures: 1SZX, 1XDC, 1XIL, 1ZSP, 1ZTE, 1ZUQ, 2GDS & 2P4K.

Human WRN Exonuclease Structures: 2FBT, 2FBV, 2FBX, 2FBY & 2FC0.

Human p38a Kinase inhibitor complex: 3HVC.

Human Sumo Like Domain: 3RD2; Yeast Sumo Like Domain: 3GOE.

Yeast Sumo Like Domain-Ubc9 SUMO E2 complex: 3RCZ.

Human RNF4 RING Domain: 4PPE.

Patents: Two patents filed.

Invited Presentations:

- 1) 'RNF4 DNA Repair Functions at Telomeres', Dynamic Structures in Damage Responses and Cancer, Cancun, Mexico, Feb 2014.
- 2) **Plenary Lecture**: 'Combined Crystallographic and SAXS Studies for Studying Macromolecular Complexes', Amrita Bioquest, Kerala, India, Aug 2013.
- 3) 'SAXS at the SIBYLS beamline', HIVE Structural Biology Workshop, Bethesda, June 2013.
- 4) 'Defining Key Molecular Mechanisms of the Sumoylation Pathway Functioning to Regulate DNA Repair', Current Opinion in structural biology and DNA repair, Amsterdam, Holland, Oct 2011.
- 5) 'Molecular Mimicry in the SUMO pathway', Structural Biology and Drug Discovery Conference, Cancun, Mexico, Dec. 2010.
- 6) 'WRN-Exonuclease Domain Crystal Structure', Structural Biology of DNA Repair Workshop, Berkeley, 2004.
- 7) 'Interface Exchange, Implications for Genomic Stability'. EMBO workshop, Maintenance of Genomic Integrity, Galway, Ireland, 2004.

Publications:

1. Andrew Hollands, Ross Corriden, Gabriela Gysler, Samira Dahesh, Joshua Olson, Syed Raza Ali, Maya T. Kunkel, Ann E. Lin, Stefano Forli, Alexandra C. Newton, Geetha B. Kumar, Bipin G. Nair, **J. Jefferson P. Perry**, and Victor Nizet. Natural product anacardic acid from cashew nut shells stimulates neutrophil extracellular trap production and bactericidal activity *J. Biol. Chem* (2016) Jul 1;291(27):13964-73.
2. Tsai CL, Williams GJ, **Perry JJ**, Tainer JA. An AAA+ ATPase Clamshell Targets Transposition. *Cell*. 2015 Aug 13;162(4):701-3
3. Zhao L, Chen XJ, Zhu J, Xi YB, Yang X, Hu LD, Ouyang H, Patel SH, Jin X, Lin D, Wu F, Flagg K, Cai H, Li G, Cao G, Lin Y, Chen D, Wen C, Chung C, Wang Y, Qiu A, Yeh E, Wang W, Hu X, Grob S, Abagyan R, Su Z, Tjondro HC, Zhao XJ, Luo H, Hou R, **Perry JJ**, Gao W, Kozak I, Granet D, Li Y, Sun X, Wang J, Zhang L, Liu Y, Yan YB, Zhang K. Lanosterol reverses protein aggregation in cataracts. **Nature**. 2015 Jul 22. [Epub ahead of print]. [**Faculty1000prime Recommended**](#).
4. Fan H, Hahm J, Diggs S, **Perry JJ**, Blaha G. Structural and Functional Analysis of BipA, a Regulator of Virulence in enteropathogenic Escherichia coli. *J Biol Chem*. 2015 Jul 10. [Epub ahead of print].
5. Zhang ZM, Liu S, Lin K, Luo Y, **Perry JJP**, Wang Y, Song J. Crystal Structure of Human DNA Methyltransferase 1. *J Mol Biol*. 2015 Jun 10. pii: S0022-2836(15)00341-1. doi: 10.1016/j.jmb.2015.06.001. [Epub ahead of print].
6. **Perry JJP**, Ballard GD, Albert AE, Dobrolecki LE, Malkas LH, Hoelz DJ. Human C6orf211 encodes Armt1, a protein carboxyl methyltransferase that targets PCNA and is linked to the DNA damage response. *Cell Rep*. 2015 Mar 3;10(8):1288-96. doi: 10.1016/j.celrep.2015.01.054. Epub 2015 Feb 26.
7. RNF4 Interacts with both SUMO and Nucleosomes to Promote the DNA Damage Response. Grocock LM, Nie M, Prudden J, Moiani D, Wang T, Cheltsov A, Arvai AS, Hitomi C, Tainer JA, Luger K, **Perry JJP***, Lazzerini-Denchi E* & Boddy MN*. *EMBO Reports* (2014) Epub Apr 8. ***Co-corresponding author**.
8. Shibata A, Moiani D, Arvai AS, **Perry JJP**, Harding SM, Genois MM, Maity R, van Rossum-Fikkert S, Kertokallio A, Romoli F, Ismail A, Ismalaj E, Petricci E, Neale MJ, Bristow RG, Masson JY, Wyman C, Jeggo P & Tainer JA. DNA Double Strand Break Repair Pathway Choice Is Directed by Distinct MRE11 Nuclease Activities. *Mol. Cell* (2014) Jan 9;53(1):7-18. Epub 2013 Dec 5. [**Faculty1000prime – Recommended**](#).
9. **Perry JJP** & Tainer JA. Developing advanced x-ray scattering methods combined with crystallography and computation. Invited Review. *Methods* (2013). Mar;59(3):363-71. Epub 2013 Jan 29.
10. Omanakuttan A, Nambiar J, Harris RM, Chinchubose B, Pandurangan N, Varghese RK, Kumar GB, Tainer JA, Banerji A, **Perry JJP** & Nair BG. Anacardic acid inhibits the catalytic activity of matrix metalloproteinase-2 and matrix metalloproteinase-9. *Mol. Pharmacology* (2012) Oct;82(4):614-22. Epub June 28th.
11. Pratt A, Getzoff E, **Perry JJP***. Amyotrophic lateral sclerosis: Update and New Developments. Review. *Degenerative Neurological and Neuromuscular Disease* (2012) Feb;2012(2):1-14. ***Corresponding author**.
12. Grocock L, Prudden J, **Perry JJP**, Boddy MN. RecQ4 Orthologue Hrq1 is Critical for DNA Interstrand Crosslink Repair and Genome Stability in Fission Yeast. *Mol. Cell. Biol.* (2012) Jan;32(2):276-87. Epub Nov 7th 2011.

13. Shin DS, Pratt, A, Getzoff ED & **Perry JJP***. Amyotrophic Lateral Sclerosis, Advanced Understanding of Neurodegenerative Diseases, Raymond Chuen-Chung Chang (Ed.), (2011) ISBN: 978-953-307-529-7, InTech. <http://www.intechopen.com/articles/show/title/amyotrophic-lateral-sclerosis>. ***Corresponding author.**
14. Trego KS, Chernikova SB, Davalos AR, **Perry JJP**, Finger LD, Ng C, Tsai MS, Yannone SM, Tainer JA, Campisi J, Cooper, PK. The DNA Repair Endonuclease XPG Interacts Directly and Functionally with the WRN Helicase Defective in Werner Syndrome. *Cell Cycle* (2011). Jun 15;10 (12).
15. **Perry JJP** & Tainer JA. All Stress Out Without ATM Kinase. *Science Signaling* (2011) April 5; 4(167):18.
16. Prudden, J* & **Perry, JJP***, Minghua Nie, Arvai, A, C. Hitomi, Guenther, G, Tainer J.A, Boddy, M.N. DNA Repair and Global Sumoylation are Regulated by Distinct Ubc9 Non-covalent Complexes. *Mol Cell Biol.* (2011) *Epub March 28th*. ***Co-first author.**
17. Heideker J, Prudden, J, **Perry JJP**, Tainer JA, Boddy MN. SUMO-targeted ubiquitin ligase, Rad60, and Nse2 SUMO ligase suppress spontaneous Top1-mediated DNA damage and genome instability. *PLOS genetics* (2011). March 3; 7(3): e1001320.
18. **Perry JJP**, Asiathamby A, Barnebey A, Kiamanesh F, Chen DJ, Han S, Tainer JA & Yannone SM. Identification of a coiled-coil in WRN that facilitates multimerization and promotes exonuclease processivity. *Journal of Biological Chemistry* (2010) Aug 13; 285 (33):25699-707 Epub June 1st
19. **Perry JJP**, Cotner-Gohara, E, Ellenberger T & Tainer, JA. Structural dynamics in DNA damage signaling and repair. *Current Opinion in Structural Biology*. Invited Review (2010) June 20:1-12. Epub May 1st.
20. **Perry JJP**, Shin DS, Getzoff ED & Tainer JA. The Structural Biochemistry of the Superoxide Dismutases. Invited Review. *Biochimica et Biophysica* (2010) Feb; 1804(2):245-262.
21. **Perry JJP**, Shin DS & Tainer JA. Structural biology of Amyotrophic Lateral Sclerosis, Book Chapter of 'Molecular mechanisms of DNA repair defects', Editor Shamim I Ahmad, Landes Biosciences Publication, Adv Exp Med Biol. 2010;685:9-20 (2010). Epub Nov 5 (2009).
22. **Perry JJP**, Harris R, Moiani, D, Olson A & Tainer JA. MAP kinase p38 α C-terminal domain binding pocket characterized by crystallographic and computational Analyses. *J. Mol. Biol.* (2009) Aug 7; 391 (1): 1-11.
23. **Perry JJP***, Hitomi K, Tainer JA. Flexibility Promotes Fidelity. Preview. *Structure* (2009) May 13;17(5):633-4. ***Corresponding author.**
24. Prudden J* & **Perry JJP***, Arvai A, Tainer JA & Boddy MN. Molecular mimicry of SUMO promotes DNA repair. *Nature Struct. & Mol. Biol.* (2009) May; 16, 509-516. ***Co-first author.** [Faculty 1000 – 4.8 – 'Must read' Manuscript.](#)
25. **Perry JJP***, Hearn AS, Cabelli DE, Lepock JR, Tainer JA, Nick HS, Silverman DN*. Contribution of human manganese superoxide dismutase tyrosine 34 to structure and catalysis. *Biochemistry* (2009) April; 48 (15):3417–3424. ***Co-corresponding author.**
26. Heideker J, **Perry JJP** & Boddy MN. Genome stability roles for SUMO-targeted ubiquitin ligases. Invited review. *DNA repair* (2009) Apr 5;8(4):517-24.
27. Mohan SS, **Perry JJP**, Poulouse N, Nair BG, Anilkumar G. Homology modeling of Glut4, an insulin regulated facilitated glucose transporter and docking studies with ATP and its inhibitors. *Journal of Biomolecular Structure and Dynamics*. (2009) Feb;26(4):455-64.
28. Perbernard S, **Perry JJP**, Tainer JA, Boddy MN. Nse1 RING-like domain supports functions of the Smc5-Smc6 holocomplex in genome stability. *Mol Biol Cell.* (2008) Oct;19(10):4099-109.
29. Chrencik JE, Brooun A, Zhang H, Irimpan M, Hura GL, Foster SA, **Perry JJP**, Ramage P, Widmer H, Bokach, Tainer JA, Gisbert Wechbecker, Kuhn P. Structural basis of guanine nucleotide exchange mediated by the T-cell essential Vav1. *J. Mol. Biol.* (2008) Jul 25;380(5):828-43.
30. **Perry JJP**, Tainer JA, Boddy MN, A SIM-ultaneous role for SUMO and Ubiquitin. Invited Review. *Trends in Biochemical Science* (2008) May;33(5):201-8. **Cover Article.**
31. **Perry JJP*** & Tainer JA, Structural biology of Cockayne syndrome, Book Chapter of 'Molecular mechanisms of Cockayne syndrome', Editor Shamim I Ahmad, Landes Biosciences Publication, Epub Mar 27 (2008). ***Corresponding Author.**
32. Prudden J, Pebernard S, Raffa G, Slavin DA, **Perry JJP**, Tainer JA, McGowan CH, Boddy MN, SUMO-targeted ubiquitin ligases in genome stability. *EMBO J.* (2007) Sep 19;26(18):4089-101. [Faculty 1000 – 6.0 – 'Must Read' Manuscript, Nature Reviews Molecular Cell Biology Research Highlight, and Science-STKE Editor's Choice.](#)
33. **Perry JJP**, Fan L, Tainer JA. Developing master keys to brain pathology, cancer and aging from the structural biology of proteins controlling reactive oxygen species and DNA repair. *Neuroscience* (2007) Apr 14;145(4):1280-1299.

34. **Perry JJP**, Yannone SM, Holden LG, Hitomi C, Asaithamby A, Han S, Cooper PK, Chen DJ & Tainer JA. WRN exonuclease structure and molecular mechanism imply an editing role in DNA end processing. *Nature Struct. Mol. Biol.* (2006) May; 13 (5), p414-422.
35. Ren X, Tu C, Bhatt D, **Perry JJP**, Tainer JA, Cabelli DE, & Silverman DE. Kinetic and structural characterization of human manganese superoxide dismutase containing 3-fluorotyrosine. *Journal of Molecular Structure* (2006) 790 (1-3), 168-173, Jun 5.
36. Ayala I, **Perry JJP**, Szczepanski J, Tainer JA, Vala MT, Nick HS & Silverman DN. Hydrogen bonding in human manganese superoxide dismutase containing 3-fluorotyrosine. *Biophys. J.* (2005) Dec;89(6):4171-9.
37. Greenleaf WB, **Perry JJP**, Hearn AS, Cabelli DE, Lepock JR, Stroupe ME, Tainer JA, Nick HS & Silverman DN. Role of hydrogen bonding in the active site of human manganese superoxide dismutase. *Biochemistry* (2004) Jun 8;43(22):7038-7045.
38. Burke DF, Deane CM, Nagarajaram HA, Campillo N, Martin-Martinez M, Mendes J, Molina F, **Perry J**, Reddy BV, Soares CM, Steward RE, Williams M, Carrondo MA, Blundell TL, & Mizuguchi K. An iterative structure-assisted approach to sequence alignment and comparative modeling. *Proteins: Struct. Funct. Genet.* (1999) Suppl. 3(9):55-60.

NICOLE E. RAFFERTY

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Education

Ph.D. in Zoology (2011)

University of Wisconsin-Madison

Advisor: Anthony Ives

M.S. in Zoology (2006)

University of Wisconsin-Madison

Advisor: Janette Boughman

B.S. in Ecology, Evolution, and Conservation Biology (2003)

University of Washington

Advisor: Dee Boersma

magna cum laude, Distinction in Biology, Phi Beta Kappa

Academic Appointments

2017-present

Assistant Professor

Department of Biology

Cooperating Faculty Member

Department of Entomology

University of California-Riverside

2016

Research Associate

Department of Entomology

Affiliate: Center for Environmental Research, Education, and Outreach

Washington State University

2015

Postdoctoral Fellow

Department of Ecology and Evolutionary Biology

University of Toronto

Mentor: James Thomson

2011-2014

NIH Fellow

Postdoctoral Excellence in Research and Teaching Program

Department of Ecology and Evolutionary Biology; Center for Insect Science

University of Arizona

Mentor: Judith Bronstein

Publications

* indicates mentored student

Published or In Press

Morton*, E.M., and **N.E. Rafferty**. In press. Plant-pollinator interactions under climate change: the use of spatial and temporal transplants. Applications in Plant Sciences.

Rafferty, N.E., and P.D. Naby. 2017. A global test for phylogenetic signal in shifts in flowering time under climate change. Journal of Ecology 105:627-633. (authors contributed equally)

- *Editor's Choice article*
- *Journal cover photo*



de Keyzer, C.W., **N.E. Rafferty**, D.W. Inouye, and J.D. Thomson. 2017. Confounding effects of spatial variation on shifts in phenology. Global Change Biology 23:1783-1791.

Rafferty, N.E., C.D. Bertelsen, and J.L. Bronstein. 2016. Later flowering is associated with a compressed flowering season and reduced reproductive output in an early season floral resource. Oikos 125:821-828.

de Keyzer, C.W., S.R. Colla, C.F. Kent, **N.E. Rafferty**, L.L. Richardson, and J.D. Thomson. 2016. Delving deeper: questioning the decline of long-tongued bumble bees, long-tubed flowers and their mutualisms with climate change. Journal of Pollination Ecology 18:36-42.

Rafferty, N.E., P.J. CaraDonna, and J.L. Bronstein. 2015. Phenological shifts and the fate of mutualisms. Oikos 124:14-21.

- *Recommended by Faculty of 1000*
- *Journal cover photo (credit: David W. Inouye)*



Rafferty, N.E. 2013. Pollination Ecology. For Oxford Bibliographies in Ecology. Ed. D.J. Gibson. New York: Oxford University Press.

Rafferty, N.E., and A.R. Ives. 2013. Phylogenetic trait-based analyses of ecological networks. Ecology 94:2321-2333.

Rafferty, N.E., and N.M. Waser. 2013. Book review: *Evolution of Plant-Pollinator Relationships*, ed. S. Patiny. Quarterly Review of Biology 88:238-239.

Rafferty, N.E., P.J. CaraDonna, L.A. Burkle, A.M. Iler, and J.L. Bronstein. 2013. Phenological overlap of interacting species in a changing climate: an assessment of available approaches. Ecology and Evolution 3:3183-3193.

Scaven*, V.L., and **N.E. Rafferty**. 2013. Physiological effects of climate warming on flowering plants and insect pollinators and potential consequences for their interactions. Current Zoology 59:418-426.

Rafferty, N.E., and A.R. Ives. 2012. Pollinator effectiveness varies with experimental shifts in flowering time. Ecology 93:803-814.

- *Featured on journal cover*

Gilman, R.T., N.S. Fabina, K.C. Abbott, and **N.E. Rafferty**. 2012. Evolution of plant-pollinator mutualisms in response to climate change. Evolutionary Applications 5:2-16.

- *Journal cover photo*
- *Popular press by Science Daily and Treehugger*



Rafferty, N.E., and A.R. Ives. 2011. Effects of experimental shifts in flowering phenology on plant-pollinator interactions. Ecology Letters 14:69-74.

- *Journal cover photo*



Rafferty, N.E., and J.W. Boughman. 2006. Olfactory mate recognition in a sympatric species pair of three-spined sticklebacks. Behavioral Ecology 17:965-970.

Rafferty, N.E., P.D. Boersma, and G.A. Rebstock. 2005. Intraclutch egg-size variation in Magellanic penguins. Condor 107:921-926.

In Revision or Review

Rafferty, N.E. In review. Effects of global change on insect pollinators: multiple drivers lead to novel communities. Current Opinion in Insect Science.

Grants, Fellowships, and Awards

2016	Research Grant, Washington Tree Fruit Research Commission PI with 3 co-PIs (\$76,634) “Development and validation of a precision pollination model”
2015-2016	Research Grant, British Ecological Society PI (\$23,515) “How do joint spatial and temporal shifts affect plant-pollinator interactions?”
2015	Ecology and Evolutionary Biology Departmental Postdoctoral Fellowship, University of Toronto
2011-2014	Postdoctoral Excellence in Research and Teaching Fellowship, NIH
2011	John Jefferson Davis Travel Award, University of Wisconsin (\$400)
2010	John and Virginia Emlen Award for Outstanding Graduate Work in Zoology, University of Wisconsin (\$4,500)
2010	John Jefferson Davis Travel Award, University of Wisconsin (\$400)
2009	Carl A. Bunde Graduate Research Award, University of Wisconsin (\$4,500)
2004-2007	Graduate Research Fellowship, NSF
2006	Research Grant, American Society of Primatologists (\$1,445)
2006	Graduate Research Grant, University of Wisconsin (\$1,315)
2003	Research Apprenticeship Grant, Friday Harbor Marine Labs (\$3,000)

Presentations

Invited Talks: Conferences

Rafferty, N.E. Forthcoming in 2017. Phenological responses to climate change differ for the upper and lower limits of plant populations along elevational gradients. Ecological Society of America Annual Meeting, Portland, Oregon.

Rafferty, N.E. 2016. Using experiments and historical data to study temporal and spatial shifts in plant-pollinator communities under climate change. Botanical Society of America Annual Meeting, Savannah, Georgia.

Rafferty, N.E., and J.D. Thomson. 2015. Climate change-induced shifts in flowering phenology: consequences for floral traits, plant-pollinator interactions, and reproductive output of plants. Entomological Society of America Pacific Branch Annual Meeting, Coeur d'Alene, Idaho.

Rafferty, N.E., P.J. CaraDonna, and J.L. Bronstein. 2014. Characteristics predicted to predispose mutualisms to phenological mismatches. Ecological Society of America Annual Meeting, Sacramento, California.

Rafferty, N.E., and J.L. Bronstein. 2013. The consequences of delayed flowering phenology in a sky-island plant, pointleaf manzanita. Ecological Society of America Annual Meeting, Minneapolis, Minnesota.

Rafferty, N.E., P.J. CaraDonna, L.A. Burkle, A.M. Iler, and J.L. Bronstein. 2012. Phenology of species interactions in a changing climate: an assessment and illustration of approaches. Botanical Society of America Annual Meeting, Columbus, Ohio.

Invited Talks: Departmental Seminars and Other Venues

2017 Department of Ecology and Evolutionary Biology, University of California-Los Angeles

2016 School of Biological Sciences, Washington State University
Department of Entomology, University of California-Riverside
Palouse Ecology, Evolution and Systematics, Washington State University and University of Idaho
Department of Biology, University of North Carolina
Department of Biology, University of California-Riverside

2014 USA National Phenology Network Headquarters, Tucson, Arizona
Department of Biology, Eastern Michigan University

Contributed Talks and Posters: Conferences

Rafferty, N.E., C.W. de Keyser, and J.D. Thomson. 2016. Patterns of bumble bee visitation and seed set across an elevational gradient in the context of climate change. Ecological Society of America Annual Meeting, Fort Lauderdale, Florida.

Rafferty, N.E., and J.L. Bronstein. 2012. Reproduction varies with flowering time in pointleaf manzanita. Phenology Research and Observations of Southwest Ecosystems Symposium, Tucson, Arizona. (poster)

Rafferty, N.E., and A.R. Ives. 2011. Pollinator effectiveness and composition vary with experimental shifts in flowering time. Ecological Society of America Annual Meeting, Austin, Texas.

Rafferty, N.E. 2010. Effects of experimental shifts in flowering phenology on plant-pollinator interactions. Ecological Society of America Annual Meeting, Pittsburgh, Pennsylvania.

Gilman, R.T., N.S. Fabina, K.C. Abbott, and N.E. Rafferty. 2009. Evolution and robustness of plant-pollinator mutualisms in a changing environment. Society for the Study of Evolution Annual Meeting, Moscow, Idaho.

Contributed Talks: Departmental Seminars and Other Venues

2015 Department of Ecology and Evolutionary Biology, University of Toronto

2011 Department of Ecology and Evolutionary Biology, University of Arizona
Biology Colloquium, University of Wisconsin

Teaching Experience

2017 *Ecological Communities Under Global Change*
Department of Biology
University of California-Riverside

2016 *General Entomology* (writing-intensive)
Department of Entomology
Washington State University

2013 *Environmental Biology* (integrated lecture & lab)
Department of Biology
Pima Community College

Professional Service

Associate Editor, *Journal of Ecology* (2013–present)

Manuscript Reviewer, *American Journal of Botany* / *American Naturalist* / *Annals of Botany* /
Biological Conservation / *Current Zoology* / *Ecology* / *Ecology Letters* / *Ecosphere* / *Evolution* /
Functional Ecology / *Global Change Biology* / *International Journal of Insect Science* /
International Journal of Plant Sciences / *Journal of Animal Ecology* / *Journal of Ecology* /
Journal of the Torrey Botanical Society / *Nature Climate Change* / *New Phytologist* / *Oikos* /
Quarterly Review of Biology

Co-organizer, Organized Oral Session on “Phenology in a community context”, Ecological Society of
America Annual Meeting, Portland, Oregon (2017)

Ad Hoc Proposal Reviewer, Population and Community Ecology Program, Division of Environmental
Biology, NSF (2012, 2015, 2016)

Proposal Reviewer, Resource Conservation and Climate Change Program Area, Strategic Environmental
Research and Development Program, Department of Defense (2016)

Proposal Reviewer, Functioning and Adaptation of Species, Agro-ecosystems, and Marine and Continental
Ecosystems Program, French National Research Agency (2015)

Proposal Reviewer, National Fellowship Program, Sigma Delta Epsilon/Graduate Women in Science
(2015)

Book Manuscript Reviewer jointly with J.L. Bronstein and J.L. Barker, *What Every Science Student Should
Know*, University of Chicago Press (2014)

Book Proposal Reviewer, Ecology and Conservation Program, Springer (2014)

Co-organizer, Women in Natural Sciences, Panel discussions and seminars on professional issues for
women in ecology and related disciplines, Department of Ecology and Evolutionary Biology,
University of Arizona (2013–2014)

Participant, Pollination Ecology and Restoration Meeting, Co-organized by Hummingbird Monitoring
Network and Arizona-Sonora Desert Museum, Santa Rita Experimental Range Headquarters,
Arizona (2013)

Invited Participant, USA National Phenology Network Research Coordination Network Meeting,
Milwaukee, Wisconsin (2012)

Student Mentoring

University of California-Riverside:

Andrea Keeler (2017–present), Ph.D. student

Skyler Kim (2017), undergraduate

Eva Morton (2017), undergraduate

University of Arizona:

Victoria Scaven (2012-2014), undergraduate
Devon Makki (2014), undergraduate
Meghan Iacueli (2013), undergraduate
Xi Chen (2011), undergraduate

University of Wisconsin:

Abigail Smith (2008-2009), undergraduate

Public Service and Outreach

Judge, 11th Annual Undergraduate Research Symposium, University of California-Riverside (2017)

Consulted on piece on spring flowering and plant-pollinator synchrony for *Science Friday*, National Public Radio (2017)

Judge, Showcase for Undergraduate Research and Creative Activities, Washington State University (2016)

Judge, Ecology and Evolutionary Biology Undergraduate Poster Session, University of Arizona (2014)

Volunteer, Arizona Insect Festival, University of Arizona (2013, 2014)

Judge, Flowing Wells High School Science Fair, Tucson, Arizona (2012)

Invited Speaker, "Climate change and shifts in flowering time: effects on plant-pollinator interactions", 11th Annual Science Day, University of Wisconsin Arboretum (2011)

Invited Speaker, "Effects of experimental shifts in flowering phenology on plant-pollinator interactions", 10th Annual Science Day, University of Wisconsin Arboretum (2010)

Invited Speaker, "Climate change-induced shifts in flowering phenology and plant-pollinator interactions", 9th Annual Science Day, University of Wisconsin Arboretum (2009)

Professional Memberships

American Society of Naturalists
Botanical Society of America
British Ecological Society
Ecological Society of America

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University of California, Riverside
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Riverside, CA 92521
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EDUCATION

- 2007 University of California, Berkeley
Ph.D. in Microbiology; Department of Plant and Microbial Biology
"Characterization of genes required for septation and cell fusion in *Neurospora crassa*." Research Advisor: Professor N. Louise Glass
- 1998 University of Chicago
B.A. in Chemistry, General Honors, Honors in Chemistry
"The regulation of expression of expansins in the parasitic plant *Striga asiatica*." Research Advisor: Professor David G. Lynn
-

RESEARCH AND PROFESSIONAL EXPERIENCE

- 07-2014-present Assistant Professor in Plant Cell Biology and Plant Cell Biologist
- 2013-2014 Principal Investigator, University of Wyoming, Molecular Biology
NSF-MCB award #1244202
- 2011- 2013 Postdoctoral Researcher, University of Wyoming, Molecular Biology
Postdoctoral Advisor: Professor Anne W. Sylvester
- 2007-2011 American Cancer Society Postdoctoral Research Fellow
University of California, San Diego, Cell and Developmental Biology
Postdoctoral Advisor: Professor Laurie G. Smith
- 2000-2007 Graduate Student, Graduate Group in Microbiology
University of California, Berkeley, Plant and Microbial Biology
Graduate Student Advisor: Professor N. Louise Glass
-

PUBLICATIONS

- 2017 Martinez, P., Luo, A., Sylvester, A. W., and **Rasmussen, C. G.** Proper division plane orientation and mitotic progression together allow normal growth of maize. PNAS
doi:10.1073/pnas.1619252114

Contributions:

Most of the work on this paper was done at UCR. Some tool development and strain generation was done at University of Wyoming. Pablo Martinez, UCR graduate student

in the Rasmussen lab, performed the majority of experiments and prepared most of the figures and helped write the manuscript. Anding Luo and Anne W. Sylvester, University of Wyoming postdoc and Professor respectively, contributed new tools. Carolyn Rasmussen directed the research, contributed new tools, assembled some figures, did some experiments, wrote the manuscript, and is the corresponding author.

- 2017 Mir, R., Aranda, L.Z.* , Biaocchi, T., Luo, A., Sylvester, A.W., and **Rasmussen, C.G.** A DII Domain-Based Auxin Reporter Uncovers Low Auxin Signaling During Telophase and Early G1. *Plant Physiol.* 173 173(1):863-871. doi: 10.1104/pp.16.01454

Contributions:

Most of the work on this paper was done at UCR. Some tool development and initial experiments were done at University of Wyoming. Ricardo Mir, a UCR postdoc in the Rasmussen Lab, performed the majority of experiments and made most of the figures and helped write the manuscript. Leslie Aranda, a UCR undergraduate researcher performed some experiments. Tiffany Biaocchi, UCR graduate students first quantified the DII signal in telophase and G1 cells. Anding Luo and Anne W. Sylvester, University of Wyoming postdoc and professor respectively, contributed new tools. Carolyn Rasmussen directed the research, contributed new tools, assembled some figures, did some experiments, wrote the manuscript, and is the corresponding author.

- 2016 **Rasmussen, C.G.** Using live cell markers in maize to analyze cell division orientation and timing *Methods Mol Biol.* 1370:209-25 “Plant cell division” Marie-Cecille Caillaud, editor.

Contributions:

Carolyn Rasmussen (UCR) developed the quantitative live cell imaging technique and wrote a methods book chapter on it.

- 2013 **Rasmussen, C.G.**, Wright A.J., and Müller, S. The role of the cytoskeleton and associated proteins in determination of the plant cell division plane. *The Plant Journal.* 75: 258–269.
- 2011 **Rasmussen, C.G.***, Humphries, J. A.*, and Smith, L.G. Division plane determination in plants. *Annual Reviews Plant Biol.* 62:387-409
*Authors contributed equally to this work
- 2011 Riquelme, M. *et al.*, Architecture and development of the *Neurospora crassa* hypha - a model cell for polarized growth. *Fungal Biology* 115(6):446-474
- 2011 **Rasmussen, C.G.**, Sun, B. and Smith, L. G. TANGLED localization at the cortical division site of plant cells occurs by several mechanisms. *J Cell Sci.* 124(2):270-9
(Highlighted in J. Cell Sci. 124: e204 2011)
- 2010 Simonin, A.R.*, **Rasmussen, C.G.***, Yang, M., and Glass, N.L., Genes encoding a striatin-like protein (*ham-3*) and a Forkhead associated protein (*ham-4*) are required for hyphal fusion in *Neurospora crassa*. *Fungal Genet Biol.* 47(10):855-868
* Authors contributed equally to this work
- 2008 **Rasmussen, C.G.**, Morgenstein, R.M., Peck, S. and Glass, N.L. Lack of the GTPase RHO-4 in *Neurospora crassa* causes both reduced numbers and aberrant stabilization of

- microtubules at hyphal tips. Fungal Genet Biol. 45(6):1027-39
(Cover photograph)
- 2007 **Rasmussen, C.G.** and Glass, N.L., Localization of RHO-4 indicates differential regulation of conidial versus vegetative septation in the filamentous fungus *Neurospora crassa*. Eukaryotic Cell 6(7):1097-1107
(**Highlighted in Nature Reviews Microbiology 5, 659 (2007)**, Cover photograph)
- 2005 **Rasmussen, C.G.** and Glass, N.L., A Rho-type GTPase, *rho-4*, is required for septation in *Neurospora crassa*. Eukaryotic Cell 4(11):1913-1925.
- 2004 Glass N.L., **Rasmussen C.**, Roca M.G., Read N.D., Hyphal homing, fusion and mycelial interconnectedness. Trends Microbiol. 12(3):135-41.
- 2003 Galagan, J.E. *et al.*, The genome sequence of the filamentous fungus *Neurospora crassa*. Nature 422(6934):859-68.
- 2002 Xiang, Q., **Rasmussen, C.**, and Glass N.L., The *ham-2* locus, encoding a putative transmembrane protein, is required for hyphal fusion in *Neurospora crassa*. Genetics 160(1):169-80.

TEACHING EXPERIENCE

Supervisor of Graduate Student Research

Pablo Martinez, Biochemistry and Molecular Biology (BCMB) graduate student, started 10/2015

Marschal Bellinger, Plant Biology (PB) graduate student, started 01/2016

Alison Mills, Biochemistry and Molecular Biology (BCMB) graduate student, started 3/2017

Rotation students

Leticia Meza PB (Fall 2017), Danielle Garceau PB (Winter 2016), Leo Islas Genetics, Genomics and Bioinformatics (Fall 2015), Tiffany Biaocchi BCMB (Winter 2015), Michael Schwartz PB (Winter 2015).

Supervisor of Undergraduate Research

2014-current Leslie Aranda – MARC-U-STAR awardee, co-author

2015-current McKenzie Pickle- NSF-REU awardee, ASPB SURF awardee

2015-current Victoria Morris – HHMI- SALSA awardee, ASPB SURF awardee

2015-current Sareen Leon

2016-current Grecia Lizaola-Velazquez, Raquel Diffenbacher, Jocelyne Aranda (RISE scholar awardee 2017), Danielle Thomas (RISE scholar awardee 2017), Tammy Peng (Dynamic Genome HHMI SALSA awardee 2017)

2014 Christopher Hoyt- NSF-REU awardee

2014 Jenna Roper – MARC-U-STAR awardee

Teaching

BPSC011 Plants and Human Affairs, undergraduate level 4-unit class (Winter Quarters)

BPSC237 Plant Cell Biology, graduate level 4-unit class co-taught with Professor Zhenbiao Yang (Fall Quarters)

BPSC 240 Mathematical modeling in patterning and cell shape (Winter Quarter, 2015).
BPSC 250 (Fall Quarter, 2014 and Winter Quarter 2017 with Zhenbiao Yang).

FUNDING AND AWARDS

Pending

2017 Hellman Fellowship (\$30,000 requested)
2017 USDA Hispanic Serving Institution Education grant (\$249,150 requested, PI with 3 UCR Co-PIs David Nelson, Linda Walling and Patricia Springer)
2017 UCR-Research Support Allocation Process (RSAP, \$17,500 requested)
2016 NSF-MCB (PI, \$870,309 requested)

Funded

2015 UCR Omnibus Travel Award (\$1,400)
2015 Internal Research and Education Development (RED) grant for Mathematical modeling (\$10,000)
2014-2015 IIGB Internal Chemical genomics grant (\$5,000)
2013-2018 NSF-MCB (Cellular Dynamics and Functions) proposal #1244202 and 1505848 (\$521,024.00)
2008-2011 American Cancer Society Postdoctoral Fellowship #PF-08-280-01 (\$148,000)
2008 Finalist for Life Sciences Research Fellowship LSRF (No money awarded)
2006 Graduate Division Travel Grant UC Berkeley (\$500)
2004 David D. Perkins Award for Neurospora Research (\$100)
2004 Department of Plant and Microbial Biology Travel Grant (\$500)
2001 National Science Foundation Graduate Fellowship Honorable Mention
2001 Patricia St. Lawrence Graduate Fellowship (\$3,500)

TALKS AND SEMINARS

2017 Keynote speaker, Annual Conference of the Nordic Microscopy Society, SCANDEM, Reykjavik, Iceland.
2017 Invited talk, 59th Annual Maize Genetics Conference, Saint Louis, MO
2017 Seminar, University of Georgia, Athens, GA
2016 Invited talk, Gordon Research Conference, Plant and Microbial Cytoskeleton, Andover, NH.
2016 Invited talk, Plant Cell Dynamics Meeting, Saint Louis, MO
2016 Seminar, Penn State University, PA
2015 Seminar, CMBD-GGB-MCBL joint seminar series, UCR, Riverside, CA
2014 Invited talk, Twelfth Annual Award Symposium, Center for Plant Cell Biology (CEPCEB), UCR, Riverside, CA
2014 Seminar, University of Saskatchewan, Saskatoon, Canada
2013 Seminar, University of California, Riverside, CA
2013 Seminar, University of California, Davis, CA
2013 Seminar, University of British Columbia, Vancouver, Canada

- 2012 Invited talk, American Society for Plant Biology (ASPB) Conference, Austin, TX
- 2012 Invited talk, 54th Annual Maize Meeting, Portland, OR
- 2011 Seminar, Plant Gene Expression Center, USDA, Albany, CA
- 2011 Invited talk, Cell Cycle Symposium, Salk Institute, San Diego, CA
- 2011 Invited talk, San Diego Center for Systems Biology (SDCSB), UC San Diego, CA
- 2011 Invited talk, La Jolla Mesa Plant Biology Talks, UC San Diego, CA
- 2010 Seminar, John Innes Center, Norwich, UK
- 2010 Invited talk, American Society for Plant Biology (ASPB) Conference, Montreal, Canada
- 2010 Invited talk, Plant and Microbial Cytoskeleton Gordon Research Conference (GRC), Andover, NH
- 2009 Plant Development Supergroup, UC San Diego, CA
- 2008 Plant Development Supergroup, UC San Diego, CA
- 2007 Invited Seminar, Centro de Investigacion Cientifica y de Educacion Superior de Enseñada (CICESE), Enseñada, Mexico
- 2006 Genetics and Development Supergroup, UC Berkeley, CA
- 2005 Fungal Genetics Conference, Asilomar, CA.
- 2005 Invited Seminar, Max Plank Institute, Marburg, Germany
- 2005 Invited Seminar, Applied Microbiology, University of Basel, Switzerland.
- 2004 Neurospora Conference, Asilomar, CA
- 2004 Seminar, UC Davis, CA 2004
- 2002 Graduate Student Microbiology Symposium, UC Berkeley, CA
- 2002 Neurospora Conference, Asilomar, CA.

SYNERGISTIC ACTIVITIES

- 2017 Lab outreach activities for Plant Discovery Day (at UCR) and Science Night for Stork Elementary School
- 2017 Grant review Laboratory of Excellence Saclay Plant Science (Labex SPS)
- 2016 Reviewer for journal articles in Plant Cell (2), Plant Physiology and Developmental Biology
- 2015 Reviewer for journal articles in Molecular Plant, Plant Cell
- 2015 Activities leader for Plant Discovery Day 5/2015
- 2015 Grant review DOE-BES
- 2014-2016 Maize Editorial Board
- 2014 Mentorship panel for Postdocs *"From Trainee to Tenure-Track Faculty: How to Navigate Within the Academic System to Reach the Top of the Pyramid."* Dec 9
- 2014 Grant review for NSF-IOS and BBSRC.
- 2014 Reviewer for journal articles in PLOS-ONE, Plant Cell Reports
- 2013-2014 Activities leader for Women in Science (WIS) conference at UW.
- 2010-2014 Member of professional societies AAAS and ASPB.
- 2011 Ad hoc reviewer for the Plant Journal.
- 2011 Science Fair Expo Day "Ask Me, I'm a Scientist or Engineer" volunteer.
- 2009-2012 American Cancer Society Cancer Action Network (ACS CAN) Member.
- 2009-2010 Participant in Making Strides Against Breast Cancer fundraising walk.

2008-2009 Activities leader for several one-day events and curriculum development for BioBridge, a program that promotes scientific leadership in traditionally underserved high school students at University of California, San Diego.

REFERENCES

Professor Anne W. Sylvester (Postdoctoral research advisor)

Department of Molecular Biology

224 AnSci/MOLB

1000 E. University Ave

Laramie, WY 82071

307-766-4993 annesyl@uwyo.edu

Professor Laurie G. Smith (Postdoctoral research advisor)

Section of Cell and Developmental Biology

5218 Muir Biology - MC 0116

9500 Gilman Drive La Jolla, CA 92093-0116

858-822-2531 lgsmith@ucsd.edu

Professor N. Louise Glass (Dissertation advisor)

Plant and Microbial Biology

111 Koshland Hall Rm. 341A

Berkeley, CA 94720-3102

510-643-2399 lglass@berkeley.edu

LOUIS S. SANTIAGO

Botany and Plant Sciences
University of California
2150 Batchelor Hall
Riverside, CA 92521

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email: santiago@ucr.edu

Faculty web page: <http://plantbiology.ucr.edu/people/faculty/santiago.html>

Lab web page: <http://ecophys.ucr.edu/>

Google Scholar Citations: <http://scholar.google.com/citations?user=qxbpxTsAAAAJ&hl=en>

Education

2003 PhD in Botany, University of Florida
1998 MS in Botany, University of Hawaii at Manoa
1993 BA in Integrative Biology, University of California at Berkeley

Other Education: 2002 Stable Isotope Ecology Course, University of Utah
2009 Mass Spectrometer Operator Course, University of Ottawa

Professional Experience

- Associate Professor of Physiological Ecology, Botany and Plant Sciences, Associate Physiological Ecologist, Agricultural Experiment Station, University of California, Riverside (UCR), 2012 – present
- Assistant Professor of Physiological Ecology, Botany and Plant Sciences, Assistant Physiological Ecologist, Agricultural Experiment Station, UCR, 2006 – 2012
- Research Associate, Smithsonian Tropical Research Institute, 2011 – present
- Co-Director, Facility for Isotope Ratio Mass Spectrometry, UCR, 2008 – present
- NSF Minority Postdoctoral Research Fellow, Integrative Biology, University of California, Berkeley, and Center for Scientific Investigation of the Yucatan (CICY), Merida, Mexico, 2003 – 2006
- Environmental Protection Agency – Science to Achieve Results (STAR) Graduate Research Fellow, 2000 – 2003
- Graduate Research and Teaching Assistant, 1995 – 2003
- Editorial Assistant, Mondo 2000 Publishing, Berkeley, CA, 1994

Grants, Awards and Fellowships

- “DROUGHT: Functional Diversity and Response to Drought in Tropical Forests”. Co-Principal Investigator with Damien Bonal, Center for the Study of Amazonian Biodiversity (CEBA), 2016-2019 \$282,000.
- “Woody plant responses to extreme drought in California: Characterizing species-level drought survival and mortality mechanisms”. Principal Investigator, National Science Foundation 2015-2017 \$182,000.
- “Air pollution studies: Understanding the deposition behavior and plant responses to gaseous ammonia pollution”. Principal Investigator, USDA Forest Service, 2015-2019 \$15,000.
- “Hydraulics and Sap of Trees from the Amazonian Tropics (HydroSTAT)”. Co-Principal Investigator with Damien Bonal, Center for the Study of Amazonian Biodiversity (CEBA), 2014 \$25,000.
- “DRought And Mortality in Amazonian forests (DRAMA)”. Co-Principal Investigator with Damien Bonal, Center for the Study of Amazonian Biodiversity (CEBA), 2013 \$25,000.
- “Carbon Balance in California Deserts: Impacts of Widespread Solar Power Generation”. Co-Principal Investigator with Michael Allen, California Institute for Energy and the Environment, 2012-2013 \$149,000.
- “Invasive Species in Wilderness”. Principal Investigator, Bureau of Land Management, current, 2012-2016 \$13,000.
- “Ecosystem Ozone (O₃) Flux and Stomatal Uptake: Assessment of Environmental Controls and Functional Responses of Mixed Conifer Sites Along Two Pollution Gradients”. Co-Principal Investigator with Karrin Alstad, USDA Forest Service 2012-2013 \$72,000.
- USDA E. Kika de la Garza Fellowship, United States Department of Agriculture, Washington DC, July-August 2011.
- “PROMETHEUS: toward a web wiki for protocols and standard methods in plant ecology and physiology”. Multi-participant workshop, Australian Vegetation Research Network (http://www.vegfunction.net/wg/68/68_Prometheus.htm). Organizer with Lawren Sack and Will Cornwell. Australian National University, October 2009.

- “Physiological and Biochemical Characterization of the Effects of Oxidant Air Pollutants, Ozone and Gas-Phase Nitric Acid on Plants and Lichen for Their Use as Early Warning Biomonitoring of these Air Pollutants”. Co-Principal Investigator with Pam Padgett, USDA Forest Service, 2009-2010 \$29,000.
- “Nutrient Limitation of Photosynthesis in Tropical Forest”. Principal Investigator, University of California, Regent’s Faculty Fellowship, 2009-2010 \$4,500.
- “Consequences of drought-induced vegetation change for water cycling in desert chaparral”. Principal Investigator. National Science Foundation, 2008-2011 \$175,000.
- “Wetland dynamics of the Yalahau region, Quintana Roo, Mexico: A pulse-based ecosystem”. Co-Principal Investigator with Scott Fedick. University of California Institute for Mexico and the United States (UC Mexus), 2008-2009. \$24,999.
- “Modeling ecosystem water cycling based on species-specific contributions to water uptake and transpiration in communities along a chaparral-desert transition in southern California”. Co-Principal Investigator with Lee Buckingham. The Community Foundation - California Desert Research Fund, 2008-2009 \$3,200.
- Principal Investigator. UCR Travel Grants, 2008-2009 \$2,040.
- “Using Stable Isotopes to Identify the Components of Forest Canopy Evapotranspiration”. Principal Investigator, National Science Foundation, 2007-2008 \$50,000.
- “Water-Use Efficiency: Relating $\delta^{13}\text{C}$ to Instantaneous Measures”. Multi-participant workshop, Australian Vegetation Research Network (http://www.vegfunction.net/wg/21/21_WUE.htm). Organizer with Ian Wright and Will Cornwell. Australian National University, May 2007.
- “Cooperative Research and Training in Stable Isotope Methods: Applications in ecology, agriculture, and food chemistry”. UC Mexus 2006-2007 \$15,000.
- “Physiological Responses of Redwood Forest Understory Plants to Water and Nitrogen Inputs by Fog”. Principal Investigator, National Science Foundation Postdoctoral Fellowship, 2003-2006 \$150,000.
- “Symbiotic Nitrogen Fixation and Patterns of Species Diversity in a Tropical Dry Forest in Mexico”. Principal Investigator, National Science Foundation, International Research Fellowship Program 2004, Supplementary award.

- “Functional Diversity of Leaf Characteristics along an Environmental Gradient in Tropical Forest”. Environmental Protection Agency, Science to Achieve Results (STAR) Graduate Fellowship 2000-2003.
- Smithsonian Tropical Research Institute Short-Term Fellowship 2000.
- Florida-Georgia Alliance Graduate Fellowship 1998-1999.
- Mellon Foundation Grant for Comparative Research between La Selva and BCI 1997.

Editorial and Professional Positions

- Editorial Board, *Journal of Sustainable Forestry* (2010 – present)
- Founding Editor, *Prometheus Wiki* (2009 – present)
- Editorial Review Board, *Tree Physiology* (2008 – present)
- Referee of one book chapter from the textbook *Biology* 8th Edition, Benjamin Cummings, Pearson Higher Education.
- Referee or panelist for National Science Foundation, Integrative Organismal Systems 2007, 2008, 2009, 2012; Environmental Biology 2004, 2005, 2007, 2010.
- Referee and panelist for faculty grants, postdoctoral grants, and dissertation research proposals, University of California Institute for Mexico and the United States (UC Mexus) 2008, 2013.
- Referee for 1 proposal, National Fund for Scientific & Technological Development (FONDECYT), Chile, 2009.
- External Reviewer, Xishuangbanna Tropical Botanical Garden, China, 2010.
- Referee and panelist for 5 proposals for the Mildred E. Mathias Graduate Student Research Grant Competition, University of California, 2011.

Peer-Reviewed Publications (65 total)

De Guzman ME, **Santiago LS**, Schnitzer SA, Álvarez-Cansino L (*in press*) Trade-offs between water transport capacity and drought resistance in neotropical canopy liana and tree species. **Tree Physiology**

Cornwell WK, Wright IJ, Turner J, Maire V, Barbour MM, Cernusak LA, Dawson TE, Ellsworth DS, Farquhar GD, Griffiths H, Keitel C, Knohl A, Reich PB, Williams DG, Bhaskar R, Cornelissen JHC, Richards A, Schmidt S, Valladares F, Körner C, Schultze E-D, Buchmann N, **Santiago LS** (*in press*) A global dataset of leaf ¹³C values. **Scientific Data**

- Vitoria AP, Vieira TdO, Camargo PdB, **Santiago LS** (2016) Using leaf $\delta^{13}\text{C}$ and photosynthetic parameters to understand acclimation to irradiance and leaf age effects during tropical forest regeneration. **Forest Ecology and Management** 379:50-60
- Sack L, Ball MC, Brodersen C, Davis SD, Des Marais DL, Donovan LA, Givnish TJ, Hacke UG, Huxman T, Jansen S, Jacobsen AL, Johnson DM, Koch GW, Maurel C, McCulloh KA, McDowell NG, McElrone A, Meinzer FC, Melcher PJ, North G, Pellegrini M, Pockman WT, Pratt RB, Sala A, **Santiago LS**, Savage JA, Scoffoni C, Sevanto S, Sperry J, Tyerman SD, Way D, Holbrook NM (2016) Plant hydraulics as a central hub integrating plant and ecosystem function: meeting report for 'Emerging Frontiers in Plant Hydraulics' (Washington, DC, May 2015). **Plant, Cell & Environment** 39:2085-2094
- Pivovarovoff AL, Pasquini SC, De Guzman ME, Alstad KP, Stemke J, **Santiago LS** (2016) Multiple strategies for drought survival among woody plant species. **Functional Ecology** 30:517-526
- Pivovarovoff AL, **Santiago LS**, Vourlitis GL, Grantz DA, Allen MF (2016) Plant hydraulic responses to long-term dry season nitrogen deposition alter drought tolerance in a Mediterranean-type ecosystem. **Oecologia** 181:721-731
- Pivovarovoff AL, Burlett R, Lavigne B, Cochard H, **Santiago LS**, Delzon S (2016) Testing the 'microbubble effect' using the Cavitron technique to measure xylem water extraction curves. **AoB plants** 8:plw011
- Ali AA, Xu C, Rogers A, McDowell NG, E. MB, Fisher R, Wullschlegel SD, Reich PB, Vrugt JA, Baurle WL, **Santiago LS**, Wilson CJ (2015) Global scale environmental control of plant photosynthetic capacity. **Ecological Applications** 25:2349-2365
- Santiago LS** (2015) Nutrient limitation of eco-physiological processes in tropical trees. **Trees-Structure and Function** 29:1291-1300
- Pasquini SC, Wright SJ, **Santiago LS** (2015) Lianas always outperform tree seedlings regardless of soil nutrients: results from a long-term fertilization experiment. **Ecology** 96:1866-1876
- Maire V, Wright IJ, Prentice C, Batjes NH, Bhaskar R, Bodegom Pv, Cornwell WK, Ellsworth DS, Niinemets Ü, Ordoñez J, Reich PB, **Santiago LS** (2015) Global soil and climate effects on leaf photosynthetic traits and rates. **Global Ecology and Biogeography** 6:706-717
- Dickens SJM, Allen EB, **Santiago LS**, Crowley D (2015) Extractable nitrogen and microbial community structure respond to grassland restoration regardless of historical context and soil composition. **AoB plants** 7:plu085
- Liu H, Xu Q, He P, **Santiago LS**, Yang K, Ye Q (2015) Divergent evolution of Magnoliaceae may explain phylogenetic niche conservatism in ecophysiological traits. **Scientific Reports** 5:12246

- Gorai M, Laajili W, **Santiago LS**, Neffati M (2015) Rapid recovery of photosynthesis and water relations following soil drying and re-watering is related to the adaptation of desert shrub *Ephedra alata* subsp. *alenda* (Ephedraceae) to arid environments. **Environmental and Experimental Botany** 109:113-121
- Stripe CM, **Santiago LS**, Padgett P (2014) Contrasting physiological responses of ozone- tolerant *Phaseolus vulgaris* and *Nicotiana tobaccum* varieties to ozone and nitric acid. **Environmental Science Processes & Impacts** 16:2488-2495
- Pouzoulet J, Pivovarov AL, **Santiago LS**, Rolshausen PE (2014) Can vessel dimension explain tolerance toward fungal vascular wilt diseases in woody plants? Lessons from Dutch elm disease and esca disease in grapevine. **Frontiers in Plant Science** 5
- Pivovarov AL, Sack L, **Santiago LS** (2014) Coordination of stem and leaf hydraulic conductance in southern California shrubs: a test of the hydraulic segmentation hypothesis. **New Phytologist** 203:842-850
- Schreeg LA, **Santiago LS**, Wright SJ, Turner BL (*in press*) Stem, root and older leaf N:P ratios are more responsive indicators of soil nutrient availability than new foliage. **Ecology**
- Evans JR, **Santiago LS** (2014) PrometheusWiki Gold Leaf Protocol: gas exchange using LI-COR 6400. **Functional Plant Biology** 41:223-226
- Santiago LS**, Dawson TE (2014) Light-use efficiency of California redwood forest understory plants along a moisture gradient. **Oecologia** 174:351-363
- Shen Y, **Santiago LS**, Shen H, Ma L, Lian JY, Cao HL, Lu HP, Ye WH (2014) Determinants of change in subtropical tree diameter growth with ontogenetic stage. **Oecologia** 175:1315-1324
- Pietrasiak N, Drenovsky RE, **Santiago LS**, Graham RC (2014) Biogeomorphology of a Mojave Desert landscape - Configurations and feedbacks of abiotic and biotic land surfaces during landform evolution. **Geomorphology** 206:23-36
- Estrada-Medina H, **Santiago LS**, Graham RC, Allen MF, Jiménez-Osornio JJ (2013) Source water, phenology and growth of two tropical dry forest tree species growing on shallow karst soils. **Trees-Structure and Function** 27:1297-1307
- Shen Y, **Santiago LS**, Ma L, Lin GJ, Lian JY, Cao HL, Ye WH (2013) Forest dynamics of a subtropical monsoon forest in Dinghushan, China: recruitment, mortality and the pace of community change. **Journal of Tropical Ecology** 29:131-145

- García-Verdugo C, Friar E, **Santiago LS** (2013) Ecological role of hybridization in adaptive radiations: a case study in the *Dubautia arborea*–*D. ciliolata* (Asteraceae) complex. **International Journal of Plant Sciences** 174:749-759
- Dickens SJM, Allen EB, **Santiago LS**, Crowley D (2013) Exotic annuals reduce soil heterogeneity in coastal sage scrub soil chemical and biological characteristics. **Soil Biology and Biochemistry** 58:70-81
- Pietrasiak N, Regus JU, Johansen JR, Lam D, Sachs JL, **Santiago LS** (2013) Biological soil crust community types differ in key ecological functions. **Soil Biology and Biochemistry** 65:168-171
- Santiago LS**, Wright SJ, Harms KE, Yavitt JB, Korine C, Garcia MN, Turner BL (2012) Tropical tree seedling growth responses to nitrogen, phosphorus and potassium addition. **Journal of Ecology** 100:309-316
- Pasquini SC, **Santiago LS** (2012) Nutrients limit photosynthesis in seedlings of a lowland tropical forest tree species. **Oecologia** 168:311-319
- Li J, Ban J, **Santiago LS** (2011) Nonparametric tests for homogeneity of species assemblages: a data depth approach. **Biometrics** 67:1481-1488
- Wright SJ, Yavitt JB, Wurzbarger N, Turner BL, Tanner EVJ, Sayer EJ, **Santiago LS**, Kaspari M, Hedin LO, Harms KE, Garcia MN, Corre MD (2011) Potassium, phosphorus, or nitrogen limit root allocation, tree growth, or litter production in a lowland tropical forest. **Ecology** 92:1616-1625
- Onoda Y, Westoby M, Adler PB, Choong AMF, Clissold FJ, Cornelissen JHC, Diaz S, Dominy NJ, Elgart A, Enrico L, Fine PVA, Howard JJ, Jalili A, Kitajima K, Kurokawa H, McArthur C, Lucas PW, Markesteijn L, Perez-Harguindeguy N, Poorter L, Richards L, **Santiago LS**, Sosinski EE, Van Bael SA, Warton DI, Wright IJ, Wright SJ, Yamashita N (2011) Global patterns of leaf mechanical properties. **Ecology Letters** 14:301-312
- Lambrecht SC, **Santiago LS**, DeVan CM, Cervera JC, Stripe CM, Buckingham LA, Pasquini SC (2011) Plant water status and hydraulic conductance during flowering in the southern California coastal sage shrub *Salvia mellifera* (Lamiaceae). **American Journal of Botany** 98:1286-1292
- Stemke JA, **Santiago LS** (2011) Consequences of light absorptance in calculating electron transport rate of desert and succulent plants. **Photosynthetica** 42:195-200
- López-Medellín X, Ezcurra E, González-Abraham C, Hak J, **Santiago LS**, Sickman JO (2011) Oceanographic anomalies and sea-level rise drive mangroves inland in the Pacific coast of Mexico. **Journal of Vegetation Science** 22:143-151

- Hasselquist NJ, Allen MF, **Santiago LS** (2010) Water relations of evergreen and drought-deciduous trees along a seasonally dry tropical forest chronosequence. **Oecologia** 164:881-890
- Ricalde MF, Andrade JL, Durán R, Dupuy JM, Simá JL, Us-Santamaría R, **Santiago LS** (2010) Environmental regulation of carbon isotope composition and crassulacean acid metabolism in three plant communities along a water availability gradient. **Oecologia** 164:871-880
- Sack L, Cornwell WK, **Santiago LS**, Barbour MM, Choat B, Evans JR, Munns R, Nicotra A (2010) A unique web resource for physiology, ecology and the environmental sciences: PrometheusWiki. **Functional Plant Biology** 37:687-693
- Goode LK, Erhardt EB, **Santiago LS**, Allen MF (2010) Carbon stable isotopic composition of soluble sugars in *Tillandsia* epiphytes varies in response to shifts in habitat. **Oecologia** 163:583-590
- Hasselquist NJ, **Santiago LS**, Allen MF (2010) Belowground nitrogen dynamics in relation to hurricane damage along a tropical dry forest chronosequence. **Biogeochemistry** 98:89-100
- Silvera K, **Santiago LS**, Cushman JC, Winter K (2010) The incidence of crassulacean acid metabolism in Orchidaceae derived from carbon isotope ratios: a checklist of the flora of Panama and Costa Rica. **Botanical Journal of the Linnean Society** 163:194-222
- Jones TJ, Luton CD, **Santiago LS**, Goldstein G (2010) Hydraulic constraints on photosynthesis in subtropical evergreen broad leaf forest and pine woodland trees of the Florida Everglades. **Trees-Structure and Function** 24:471-478
- Santiago LS** (2010) Can growth form classification predict litter nutrient dynamics and decomposition rates in lowland Panamanian wet forest? **Biotropica** 42:72-79
- Ballina-Gomez HS, Iriarte-Vivar S, Orellana R, **Santiago LS** (2010) Compensatory growth responses to defoliation and light availability in two native Mexican woody plant species. **Journal of Tropical Ecology** 26:163-171
- Santiago LS**, Kim S-C (2009) Correlated evolution of leaf shape and physiology in the woody *Sonchus* alliance (Asteraceae: Sonchinae) in Macaronesia. **International Journal of Plant Sciences** 170:83-92
- Simonin, KA, **Santiago LS**, Dawson, TE (2009) Fog interception by *Sequoia sempervirens* (D. Don) crowns decouples physiology from soil water deficit. **Plant, Cell and Environment** 32:882-892

- Cernusak LA, Tscherkez G, Keitel C, Cornwell WK, **Santiago LS**, Knohl A, Barbour MM, Williams DG, Reich PB, Ellsworth DS, Dawson TE, Griffiths HG, Farquhar GD, Wright IJ, Westoby M (2009) Why are non-photosynthetic tissues generally ^{13}C enriched compared to leaves in C_3 plants? Review and synthesis of current hypotheses. **Functional Plant Biology** 36:199-213
- Silvera K, **Santiago LS**, Cushman JC, Winter K (2009) Crassulacean acid metabolism and epiphytism linked to adaptive radiations in the Orchidaceae. **Plant Physiology** 149:1838-1847
- Ballina-Gómez HS, Iriarte-VB S, Orellana R, **Santiago LS** (2008) Crecimiento, supervivencia y herbivoría de plántulas de una especie de sotobosque neotropical, *Brosimum alicastrum* (Moraceae). **Revista de Biología Tropical** 56:2055-2067
- Cornwell WK, Cornelissen JHC, Amatangelo K, Dorrepaal E, Eviner VT, Godoy O, Hobbie SE, Hoorens B, Kurokawa H, Perez-Harguindeguy N, Quested HM, **Santiago LS**, Wardle DA, Wright IJ, Aerts R, Allison S, Bodegom Pv, Brovkin V, Chatain A, Callaghan T, Díaz S, Garnier E, Gurvich DE, Kazakou E, Klein JA, Read J, Reich PB, Soudzilovskaia NA, Vaieretti MV, Westoby M (2008) Plant species traits are the predominant control on litter decomposition rates within biomes worldwide. **Ecology Letters** 11:1065-1071
- Santiago LS** (2007) Extending the leaf economics spectrum to decomposition: Evidence from a tropical forest. **Ecology** 88:1126-1131
- Santiago LS**, Wright SJ (2007) Leaf functional traits of tropical forest plants in relation to growth form. **Functional Ecology** 21:19-27
- Dawson TE, Burgess SSO, Tu KP, Oliveira RS, **Santiago LS**, Fisher JB, Simonin KA, Ambrose AR (2007) Nighttime transpiration in woody plants from contrasting ecosystems. **Tree Physiology** 27:561-575
- Cuevas-Glory L, Pino JA, **Santiago LS**, Sauri-Duch E (2007) A review of volatile analytical methods for determining the botanical origin of honey. **Food Chemistry** 103:1032-1043
- Gutiérrez MV, **Santiago LS** (2006) A comparison of sap flow measurements and potometry in two tropical lowland tree species with contrasting wood properties. **Revista de Biología Tropical** 54:73-81
- Silvera K, **Santiago LS**, Winter K (2005) Distribution of crassulacean acid metabolism in orchids of Panama: evidence of selection for weak and strong modes. **Functional Plant Biology** 32:397-407
- Santiago LS**, Silvera K, Andrade JL, Dawson TE (2005) El uso de isótopos estables en biología tropical. **Interciencia** 30:536-542

- Santiago LS**, Mulkey SS (2005) Leaf productivity along a precipitation gradient in lowland Panama: patterns from leaf to ecosystem. **Trees–Structure and Function** 19:349-356
- Santiago LS**, Schuur EAG, Silvera K (2005) Nutrient cycling and plant-soil feedbacks along a precipitation gradient in lowland Panama. **Journal of Tropical Ecology** 21:461-470
- Santiago LS**, Goldstein G, Meinzer FC, Fisher JB, Machado K, Woodruff D, Jones T (2004) Leaf photosynthetic traits scale with hydraulic conductivity and wood density in Panamanian forest canopy trees. **Oecologia** 140:543-550
- Santiago LS**, Kitajima K, Wright SJ, Mulkey SS (2004) Coordinated changes in photosynthesis, water relations and leaf nutritional traits of canopy trees along a precipitation gradient in lowland tropical forest. **Oecologia** 139:495-502
- Santiago LS**, Mulkey SS (2003) A test of gas exchange measurements on excised branches of ten tropical tree species. **Photosynthetica** 41:343-347
- Santiago LS** (2000) Use of coarse woody debris by the plant community of a Hawaiian montane cloud forest. **Biotropica** 32:633-641
- Santiago LS**, Goldstein G, Meinzer FC, Fownes J, Mueller-Dombois D (2000) Transpiration and forest structure in relation to soil waterlogging in a Hawaiian montane cloud forest. **Tree Physiology** 20:673-681
- Santiago LS**, Lau TS, Melcher PJ, Steele OC, Goldstein G (2000) Morphological and physiological responses of Hawaiian *Hibiscus tiliaceus* populations to light and salinity. **International Journal of Plant Sciences** 161:99-106

Web of Knowledge Core-Collection Statistics (19 August 2016)

- Sum of the Times Cited: 2281
- *h*-index: 21

Edited Book and Contributed Chapters

- Goldstein G, **Santiago LS** (eds) (2016) Tropical Tree Physiology: adaptations and responses in a changing environment. Springer International Publishing, Switzerland
- Santiago LS**, Bonal D, De Guzman ME, Ávila-Lovera E (2016) Drought Survival Strategies of Tropical Trees. In: Goldstein G, **Santiago LS** (eds) Tropical Tree Physiology: adaptations and responses in a changing environment. Springer International Publishing, Switzerland, pp 243-258

- Santiago LS**, Goldstein G (2016) Is Photosynthesis Nutrient Limited in Tropical Trees? In: Goldstein G, **Santiago LS** (eds) *Tropical Tree Physiology: adaptations and responses in a changing environment*. Springer International Publishing, Switzerland, pp 299-315
- Goldstein G, **Santiago LS**, Campanello PI, Avalos G, Zhang Y-J, Villagra M (2016) Facing Shortage or Excessive Light: How Tropical and Subtropical Trees Adjust Their Photosynthetic Behavior and Life History Traits to a Dynamic Forest Environment. In: Goldstein G, **Santiago LS** (eds) *Tropical Tree Physiology: adaptations and responses in a changing environment*. Springer International Publishing, Switzerland, pp 319-336
- Campanello PI, Manzané E, Villagra M, Zhang Y-J, Panizza AM, Di Francescantonio D, Rodriguez SA, Chen YJ, **Santiago LS**, Goldstein G (2016) Carbon Allocation and Water Relations of Lianas versus Trees. In: Goldstein G, **Santiago LS** (eds) *Tropical Tree Physiology: adaptations and responses in a changing environment*. Springer International Publishing, Switzerland, pp 103-124
- Santiago LS**, Pasquini SC, DeGuzman ME (2015) Physiological implications of the liana growth form. In: Schnitzer SA, Bongers F, Burnham R, Putz FE (eds) *Ecology of Lianas* pp 288-298
- Santiago LS**, Jones T, Goldstein G (2010) Physiological variation in Hawaiian *Metrosideros polymorpha* across a range of habitats: from dry forests to cloud forests. In: Bruijnzeel LA, Scatena FN, Hamilton JG, Juvik JO, Bubb P (eds) *Mountains in the Mist: Science for Conserving and Managing Tropical Montane Cloud Forests*. Cambridge University Press, Cambridge, UK, pp 456-464

Coverage by Popular Press

- "What Does a Dying Forest Sound Like?" *Smithsonian.com*, 21 April 2016
- "Botanist to study responses of trees, shrubs to extreme drought" *UC News*, 23 September 2015
- "Programa busca incentivar estudio de agricultura" *La Prensa*, Riverside, 12 May 2011
- "Fall colors in ... Riverside? Stop your snickering" *Los Angeles Times*, 16 December 2010
- "A Complex Relationship". *UCR Magazine*, Spring 2009, Vol. 4, No. 2, p. 16
- "Drought's Effect on Plants Studied" *The Press Enterprise*, 18 September 2008, p. C3
- "UC Riverside Botanist to Study Role of Plants in Southern California Drought" *The Water Cooler: California's Water Blog*, 11 September 2008
- "Decomposition of Leaves Related to Global Warming" *Inside UCR*, 18 July 2007, p. 3

Presentations at Professional Meetings (76 total)

Santiago LS, Bonal D, De Guzman ME, Stahl C, Ávila-Lovera E (2016). Drought survival strategies of tropical trees. Association for Tropical Biology and Conservation, Montpellier, France

Ávila-Lovera E, Tezara W, Herrera A, Ezcurra E, **Santiago LS** (2016) Do photosynthetic stems have higher water use efficiency than leaves? Implications for drought responses of tropical and subtropical plants. Association for Tropical Biology and Conservation, Montpellier, France

Goldstein G, **Santiago LS**, Campanello PI, Avalos G, Zhang YJ, Villagra M (2016) Facing shortage of excessive light: how tropical and subtropical trees adjust their photosynthetic behavior and life history traits to a dynamic forest environment. Association for Tropical Biology and Conservation, Montpellier, France

Torres M, Ávila-Lovera E, De Guzman ME, Torres L, **Santiago LS** (2016) Drought resistance of tropical relict species in subtropical arid shrublands of southern California. Association for Tropical Biology and Conservation, Montpellier, France

De Guzman ME, **Santiago LS**, Bonal D, Baraloto C, Fortunel C, Vogenberg JE, Brodie M (2016) Hydraulic strategies of vessel occluding plants in lowland tropical forest. Association for Tropical Biology and Conservation, Montpellier, France

Acosta-Rangel A, Lovatt C, **Santiago LS** (2016) Functional responses of Avocado trees to environmental stress. Association for Tropical Biology and Conservation, Montpellier, France

Allen MF, Swanson A, Hernandez R, Ávila-Lovera E, Jenerette D, **Santiago LS**, Barrows C (2016) Soil ecosystem observatories in the desert: Soil CO₂ flux dynamics and implications for a changing climate. Ecological Society of America, Ft. Lauderdale, Florida

Santiago LS (2016) Managing Tropical Biodiversity for Watershed Yield: Approaches, Challenges and Policy Implications, Rosenberg International Forum on Water Policy, Panama City, Panama

Acosta-Rangel A, Lovatt CJ, **Santiago LS** (2015) Efecto del estrés abiótico en la floración del aguacate. VIII Congreso Colombiano de Botánica, Manizales, Colombia

De Guzman ME, **Santiago LS**, Schnitzer S, Álvarez-Cansino L (2015) Comparative physiology of lianas and trees: Can hydraulic strategies explain increasing liana abundance in tropical forest? Association for Tropical Biology and Conservation, Honolulu, Hawaii

Álvarez-Cansino L, van der Heijden G, **Santiago LS**, Schnitzer SA (2015) Lianas and trees show different responses to seasonal drought. Society for Tropical Ecology, Zürich, Switzerland

Santiago LS (2015) Characterizing drought survival strategies in tropical trees. Society for Tropical Ecology, Zürich, Switzerland

Mauk PA, Suarez D, **Santiago LS**, Crowley D, Arpaia ML, Celis N, Li R, Acosta-Rangel A (2015) The response of 'Hass' avocado to salinity as influenced by rootstock, World Avocado Congress, Lima, Peru

Pivovarovoff AL, Vourlitis GL, Allen MF, Grantz DA, **Santiago LS** (2014) Individual hydraulic response strategies of two chaparral and two coastal sage scrub shrubs to long-term dry season nitrogen deposition. In: International Mediterranean Ecosystems Conference, Olmué, Chile

Santiago LS, Wright SJ, Turner B (2013) Are Tropical Forest Responses to Rising Atmospheric CO₂ Nutrient-Limited? American Geophysical Union, San Francisco, California

Pivovarovoff A, **Santiago LS** (2013) Functional traits better correlate with wet season than dry season water potentials in a Californian chaparral plant community. Ecological Society of America, Minneapolis, Minnesota

Swanson AC, De Guzman ME, Jenerette GD, **Santiago LS**, Allen EB, Allen MF (2013) Dynamics and importance of inorganic carbon in California desert ecosystems. Soil Ecology Society, Camden, New Jersey

Pivovarovoff A, De Guzman ME, Yates L, Hill G, **Santiago LS** (2012) Hydraulic strategies of woody plant species in the San Geronio Wilderness. California Desert Research Symposium, Redlands, California

Pivovarovoff A, **Santiago LS** (2012) Coordination of stem and leaf hydraulic conductances in California chaparral and coastal sage scrub: A test of the hydraulic segmentation hypothesis. Ecological Society of America, Portland, Oregon

Santiago LS, Sickman JO, Goulden ML, DeVan CM, Pasquini SC, Pivovarovoff AL (2011) Seasonality of leaf carbon isotopic composition and leaf water isotopic enrichment in a mixed evergreen forest in southern California. Eos Trans. AGU, Fall Meet. Suppl., Abstract 92(52): B21H-0364

Santiago LS, Alstad, KP, de Guzman ME, Pasquini SC, Pivovarovoff AL (2011), Consequences of drought-induced vegetation change for water cycling along a desert-shrubland gradient, International Mediterranean Ecosystems Conference (MEDECOS), Los Angeles, California

Santiago LS, Alstad KP, Pasquini SC, Pivovarovoff AL, Ambriz J, Stemke JA (2011) Xylem vulnerability and hydraulic architecture as determinants of plant drought resistance on a desert-shrubland gradient, Ecological Society of America, Austin, Texas

Pasquini SC, Wright SJ, **Santiago LS** (2011) Are lianas physiologically and morphologically different from trees at the seedling stage? An evaluation using a long-term nutrient enrichment study, Ecological Society of America, Austin, Texas

Pivovarovoff, AL, **Santiago LS** (2011) Decoupled stem and leaf hydraulic conductance in California chaparral and coastal sage scrub plant species, Ecological Society of America, Austin, Texas

Estrada-Medina H, Graham RC, Allen MF, Tuttle W, **Santiago LS**, Osornio JJ (2011) Subsurface features: Beyond shallow soils in Yucatan, Ecological Society of America, Austin, Texas

López-Medellín X, Ezcurra E, González-Abraham C, Hak J, Sickman J, **Santiago LS** (2011) Mangrove ecology and sea-level changes in the Pacific coasts of Baja California Sur, Ecological Society of America, Austin, Texas

Dickens SJ, Allen EB, **Santiago LS**, Crowley DE (2011) Environment is a stronger determinant of exotic plant feedbacks to soil than vegetation type in southern California ecosystems, Ecological Society of America, Austin, Texas

Santiago LS, Alstad KP, Pasquini SC, Pivovarovoff AL, Ambriz J, Stemke J (2011) Xylem vulnerability and hydraulic architecture as determinants of drought resistance in desert chaparral vegetation, Southern California Academy of Sciences, Pomona, California

Dickens SJ, Allen EB, **Santiago LS**, Crowley DE (2010) Exotic plant invasion interrupts chaparral ecosystem resistance, resilience and succession, Cal-IPC Symposium, Ventura, California

Santiago LS, Pasquini SC, Wright SJ (2010) Physiological consequences of nutrient limitation in lowland tropical forest seedlings, Association for Tropical Biology and Conservation, Bali, Indonesia

Nicotra AB, **Santiago LS**, Sack L, Cornwell W (2010) PrometheusWiki: PROtocols, METHods, explanations and updated standards for ecological and environmental plant physiology, Association for Tropical Biology and Conservation, Bali, Indonesia

Nicotra AB, Cornwell W, Sack L, **Santiago LS** (2010) PrometheusWiki: PROtocols, METHods, explanations and updated standards for ecological and environmental plant physiology, Botanical Society of America, Providence, Rhode Island

Nicotra AB, Sack L, **Santiago LS**, Cornwell W (2010) PrometheusWiki: Protocols, methods, explanations and updated standards for ecological and environmental plant physiology, Ecological Society of America, Pittsburgh, Pennsylvania

Reyes-García C, Andrade JL, Espada-Manrique C, Orellana R, **Santiago LS**, Chilpa-Galván NC, Cach-Pérez M (2010) Potential changes in the distribution of epiphytic bromeliads along a precipitation gradient in the Yucatan peninsula using climate change scenarios, Workshop on Crassulacean Acid Metabolism, Panama City, Panama

Cervera JC, **Santiago LS** (2010) Predicting shifts in distribution of sympatric cacti from southeastern California: Physiological responses and productivity of crassulacean acid metabolism species to climate change may help explain changes in distribution ranges, Workshop on Crassulacean Acid Metabolism, Panama City, Panama

Silvera K, Whitten M, Williams NH, Neubig KM, Albion RL, **Santiago LS**, Winter K, Cushman JC (2010) Evolution of crassulacean acid metabolism in tropical orchids: integrating phylogenetic, ecophysiological and molecular genetic approaches, Workshop on Crassulacean Acid Metabolism, Panama City, Panama

Santiago LS, Korine C, Wright SJ (2009) Nutrient limitation of seedling growth in a tropical forest, Ecological Society of America, Albuquerque, New Mexico

Pasquini SC, **Santiago LS** (2009) Nutrient limitation of photosynthesis in the tropical forest understorey, Ecological Society of America, Albuquerque, New Mexico

Dickens SJ, Allen EB, **Santiago LS** (2009) Soil responses following exotic plant invasion and restoration of coastal sage scrub of Southern California, Ecological Society of America, Albuquerque, New Mexico

Dickens SJ, Allen EB, **Santiago LS** (2009) Above and belowground feedbacks following exotic plant invasion and restoration of coastal sage scrub of southern California, California Native Plant Society, Sacramento, California

Dickens SJ, Allen EB, **Santiago LS** (2009) Soil responses following exotic plant invasion and restoration of coastal sage scrub of Southern California, The Society of Nematologists and Soil Ecology Society Conference, Burlington, Vermont

Dickens SJ, Allen EB, **Santiago LS** (2009) Soils, exotic plant invasion and restoration of coastal sage scrub of Southern California, Palos Verde Peninsula Land Conservancy Scientific Research Guidance Committee Meeting, Palos Verde, California

Santiago L, Cornwell W, Wright I, Martinelli L, Reich P, Cernusak L, Dawson T, Silvera K, Griffiths H, Farquhar G (2008) Regulation of carbon isotope discrimination during photosynthesis: Results from a global database, Mexican Scientific Society of Ecology (SCME), Merida, Mexico

Silvera K, **Santiago LS**, Winter K, Cushman JC (2008) Distribution of photosynthetic patterns and crassulacean acid metabolism in Neotropical orchids, Mexican Scientific Society of Ecology (SCME), Merida, Mexico

Cervera Herrera JC, **Santiago LS** (2008) Predictions of the productivity of CAM plants in response to climate change in southern California, Mexican Scientific Society of Ecology (SCME), Merida, Mexico

Ricalde Pérez MF, Simá Gómez L, Andrade Torres JL, Durán García R, **Santiago LS** (2008) Seasonal patterns and extent of CAM activity in plants from two ecosystems of the Yucatan Peninsula along an aridity gradient, Mexican Scientific Society of Ecology (SCME), Merida, Mexico

Ballina Gómez HS, Iriarte Vivar Balderrama S, Orellana Lanza R, Peraza Sánchez S, **Santiago L**, Parra Tabla V (2008) Influence of light on the responses of morphology and physiology to herbivory, Mexican Scientific Society of Ecology (SCME), Merida, Mexico

Salzman LK, Allen MF, **Santiago LS** (2008) Using leaf-level gas exchange and soil flux to estimate the carbon exchange in a mixed conifer and hardwood forest, Ecological Society of America, Milwaukee, Wisconsin

Dickens SJM, Allen EB, **Santiago L** (2008) Above and belowground feedbacks following exotic plant invasion and restoration of coastal sage scrub of Southern California, Southern California Academy of Sciences, Dominguez Hills, California

Santiago LS, Cornwell WK, Wright IJ, Barbour MM, Buchmann N, Cernusak LA, Dawson TE, Ellsworth DS, Farquhar GD, Griffiths H, Keitel C, Knohl A, Martinelli LA, Reich PB, Williams DG, Westoby M (2008) Regulation of carbon isotope discrimination during photosynthesis: Results from a global database. American Society of Plant Biologists, Merida, Mexico

Silvera K, **Santiago LS**, Rodriguez L, Whitten M, Williams NH, Neubig KM, Winter K, Cushman JC (2008) Crassulacean acid metabolism in tropical orchids: integrating isotopes, habitat preference and gene expression. American Society of Plant Biologists, Merida, Mexico

Cornwell WK, **Santiago LS**, Wright IJ, Barbour MM, Buchmann N, Cernusak LA, Dawson T, Ellsworth DS, Farquhar GD, Griffiths H, Keitel C, Knohl A, Martinelli LA, Reich PB, Williams D, Westoby M (2008) Regulation of carbon isotope discrimination during C₃ photosynthesis: Results from a global database, Botanical Society of America, Vancouver, Canada

Santiago LS (2007) High rates of total N fixation in a tropical dry forest, Ecological Society of America, San Jose, California

Simonin KA, **Santiago LS**, Dawson TE (2007) Canopy wetness decouples plants from soil water deficit, Ecological Society of America, San Jose, California

Santiago LS (2007) Drought tolerance strategies of tropical forest plants from contrasting habitats, Association for Tropical Biology and Conservation, Morelia, Mexico

Silvera K, **Santiago LS**, Whitten WM, Williams NH, Neubig K, Winter K, Cushman JC (2007) Evolution of crassulacean acid metabolism in Neotropical orchids, C₄ and CAM: From Molecular Diversity to Ecological Convergence, Cambridge, UK

Cornwell WK, Cornelissen H, Amatangelo K, Dorrepaal E, Eviner V, Godoy O, Hobbie SE, Hoorens B, Kurokawa H, Perez-Harguindeguy N, Quested H, **Santiago LS**, Wardle DA, Wright IJ, Aerts R, Allison S, vanBodegom P, Brovkin V, Chatain A, Callaghan T, Díaz S, Garnier E, Gurvich DE, Kazakou E, Klein JA, Read J, Reich PB, Soudzilovskaia NA, Vaieretti MV, Westoby M (2007) The leaf economic spectrum drives litter decomposition within regional floras worldwide, American Geophysical Union, San Francisco, California

Santiago LS, Dawson TE (2006) Use of fog N by understory vegetation in California redwood forests, American Geophysical Union, San Francisco, California

Santiago LS, Dawson, TE (2006) Photosynthetic light-use efficiency of California redwood forest understory plants along a moisture gradient, Botanical Society of America, Chico, California

Santiago LS, Dawson TE (2005) Biological N fixation rates in a tropical dry forest ecosystem. American Geophysical Union, San Francisco, California

Santiago LS (2005) Ecophysiological correlates of plant mortality rates in a wet tropical forest, Center for Tropical Forest Science Symposium, Panama City, Panama

Santiago LS, Quintal-Tun F, Andrade JL, Dawson TE (2005) Dominance of legumes in the Neotropics: Symbiotic nitrogen fixation contributes to high photosynthetic rates, Ecological Society of America, Montreal, Quebec, Canada

Meinzer FC, Goldstein G, Bucci SJ, James S, **Santiago LS**, Scholz FG (2005) Functional convergence in tropical forest canopy physiology, Ecological Society of America, Montreal, Quebec, Canada

Silvera K, **Santiago LS**, Winter K (2005) Strongly and weakly expressed crassulacean acid metabolism in orchids of Panama, International Botanical Congress, Vienna, Austria

Silvera K, **Santiago LS**, Winter K (2004) $\delta^{13}\text{C}$ values and the incidence of CAM in orchids of Panama, International Congress of Crassulacean Acid Metabolism, Tahoe City, California

Silvera K, **Santiago LS**, Winter K (2004) Incidence of crassulacean acid metabolism in orchids of Panama and Costa Rica, Mexican Botanical Congress, Oaxaca, Mexico

Santiago LS, Dawson TE (2004) The contribution of symbiotically-fixed nitrogen to nitrogen cycling in a deciduous forest in the Yucatan, Mexican Botanical Congress, Oaxaca, Mexico

Santiago LS (2003) Linking plant physiological ecology to ecosystem science: effects of life history traits on leaf decomposition, Ecological Society of America, Savannah, Georgia

Silvera K, **Santiago LS**, Schuur EAG, Williams NH, Whitten WM, Winter K (2003) Evolution of photosynthetic pathways in the Orchidaceae: Evidence from stable isotopes and phylogenetic analysis, Ecological Society of America, Savannah, Georgia

Santiago LS (2002) Leaf photosynthesis and chemistry predict leaf decomposition rate in the lowland wet forest of Fort Sherman, Panama. Association for Tropical Biology, Panama City, Panama

Santiago LS, Mulkey SS (2002) Productivity along a precipitation gradient in lowland Panama: patterns from leaf to ecosystem. Association for Tropical Biology, Panama City, Panama

Santiago LS (2001) Photosynthetic capacity and associated leaf traits along a precipitation gradient in lowland tropical forest. Ecological Society of America, Madison, Wisconsin

Gutiérrez MV, **Santiago LS** (1999) A comparison of sap flow measurements and potometry in two tropical lowland tree species with contrasting wood properties. International Botanical Congress, St. Louis, Missouri

Santiago LS (1998) A bottom-up approach to scaling canopy transpiration in a Hawaiian montane cloud forest, Second International Canopy Conference, Sarasota, Florida

Santiago LS, Lau TS, Melcher PJ, Steele OC, Goldstein G (1997) Growth and physiological plasticity in response to experimental manipulation of light and salinity in the pantropical woody species *Hibiscus tiliaceus*, Association for Tropical Biology, San Jose, Costa Rica

Santiago LS, Goldstein G, Mueller-Dombois D (1997) Transpiration and leaf area responses to soil waterlogging in a Hawaiian montane cloud forest, Ecological Society of America, Albuquerque, New Mexico

Invited Seminars

Occidental College, Los Angeles, October 2015

Universidad de los Andes, Bogota, Colombia, (given in Spanish) April 2015

Los Alamos National Laboratory, New Mexico, June 2014

Smithsonian Tropical Research Institute, Tupper Seminar, September 2012

University of California, Los Angeles, January 2012

Rancho Santa Ana Botanic Garden, Claremont, November 2011
 Hewett Lecture, Earth Sciences, UCR, November 2011
 Guangdong Academy of Forestry, Guangzhou, China, September 2011
 Chinese Academy of Sciences, Guangzhou, China, August 2011
 Botany and Plant Sciences Department, April 2011
 Evolution, Ecology and Organismal Biology Graduate Program, UCR, March 2011
 Botany and Entomology Undergraduate Student Association, UCR, Riverside, March 2011
 Guangdong Academy of Forestry, Guangzhou, China, September 2010
 University of California, San Diego, January 2010
 Statistics Department, UCR, Riverside, January 2010
 Whittier College, November 2009
 Barro Colorado Island, Smithsonian Tropical Research Institute, Panama, August 2008
 California State University, Fullerton, April 2008
 Department of Biology, UCR, February 2008
 Botany and Entomology Undergraduate Student Association, UCR, Riverside, June 2008
 Embassy of France, Washington, DC, October 2007
 University of California, Irvine, June 2007
 California State University, San Jose, April 2007
 Lunch Bunch, UCR, November 2006
 Macquarie University, Sydney, Australia, November 2006
 California State University, San Bernardino, October 2006
 California State University, Humboldt, March 2006
 National Autonomous University of Mexico, Morelia, Mexico (given in Spanish), January 2006
 Ecolunch, University of California, Berkeley, March 2005
 Center for Scientific Study of the Yucatan (CICY), (given in Spanish) February 2004
 Botany Department, University of Florida, April 2003
 Ecophysiology Group, University of Miami, July 2002
 Ecolunch, University of Florida, November 2001
 Barro Colorado Island, Smithsonian Tropical Research Institute, Panama, November 2000
 Center for Scientific Study of the Yucatan (CICY), (given in Spanish) July 2000
 Tupper Seminar, Smithsonian Tropical Research Institute, Panama, July 1999
 Tropi-Lunch, University of Florida, August 1998
 Department of Botany, University of Panama, (given in Spanish) July 1998
 Hawaiian Botanical Society, Honolulu, Hawaii, September 1997
 Hawaiian Botanical Society, Honolulu, Hawaii, December 1996

Service to the University of California, Riverside

Service to the Department of Botany and Plant Sciences

- Undergraduate Advisor (2011 – present)
- Faculty Job Search Committees: Landscape Ecologist (2007), Climatologist (2011), Subtropical Horticulturalist (2012), Community Ecologist (2013)
- Member, Graduate Education Advisory Committee (2008 – 2011)

Service to the Evolution, Ecology and Organismal Biology Graduate Program

- Member, Executive Committee (2008 – 2013)
- Member, Committee for Graduate Admissions (2008 – 2013)

Service to the College of Natural and Agricultural Sciences

- Member, Job Search Committee, Director of EDGE Institute (2016)
- Member, Job Search Committee, Director of Center for Conservation Biology (2016)
- Member, Steering Committee for the Center for Conservation Biology (2010 – present)
- Co-director, Facility for Isotope Ratio Mass Spectrometry (2008 – present)

Service to the University of California, Riverside Campus and the UC System

- Member, Job Search Committee, Citrus Agricultural Economist (2016)
- Member, Job Search Committee, Dean of School of Public Policy (2013)
- Faculty Team Member, Site Evaluator for UC Natural Reserve System (2010)
- Member, Job Search Committee, Director of UC Mexus (2008)
- Member, Chancellor's Postdoctoral Fellowship Selection Committee (2007, 2008)
- Co-organizer, UCR-ECOSUR-Mexico Symposium (2007)
- Panelist, Graduate Diversity Summit (2007)

Teaching

- Botany and Plant Sciences 166/243, Plant Physiological Ecology (2007 – present)
- Botany and Plant Sciences 143, Plant Physiology (2013, 2016)
- Biology 5B, Introduction to Organismal Biology (2011, 2013, 2015)
- Botany and Plant Sciences 240, Current Topics, Graduate Seminar (2008, 2010)
- Botany and Plant Sciences 260, Seminar in Plant Physiology and Genetics (2008, 2009)
- Botany and Plant Sciences 200A-200B, Plant Biology Core (2010, 2011)

Advising and Mentoring

- Major professor for 3 Masters of Sciences students graduated in 2009, 2010, 2015
- Major professor for 3 current PhD students, 1 graduated in 2015
- Qualifying Exam Committee member for 45 students (2006 – 2016)
- PhD Dissertation Committee member for 21 students (2006 – 2016)
- External/International PhD Dissertation Committee member/mentor for 7 students
- Mentor for >20 UCR undergraduate students (2006 – present)

Professional Affiliations

American Geophysical Union
Association for Tropical Biology and Conservation
Ecological Society of America
Society for Tropical Ecology (gtö)

BWF PATH BIOGRAPHICAL SKETCH

NAME: Song, Jikui (Last, First, Middle)	POSITION TITLE: Assistant Professor of Biochemistry
Email Address: jikui.song@ucr.edu	CURRENT INSTITUTIONAL ADDRESS: 5485 Boyce Hall Department of Biochemistry University of California, Riverside Riverside, CA 92521
Phone Number: 951-827-4221	

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(S)	FIELD OF STUDY
University of Science and Technology of China, Hefei, Anhui	BS	07/1994	Chemical Physics
Institute of Biophysics, Chinese Academy of Sciences, Beijing	MS	07/1997	Molecular Biology
University of Wisconsin, Madison, WI	MS	12/2001	Computer Sciences
University of Wisconsin, Madison, WI	PHD	12/2002	Biochemistry
Memorial Sloan-Kettering Cancer Center, New York, NY	Postdoctoral Fellow	12/2011	Structural Biology and Epigenetics

NOTE: NO PAGE LIMITATIONS

A. Positions and Honors

List in chronological order previous positions, concluding with the present position. List any honors.

Positions and Employment

2002 - 2007 Assistant Researcher, Center for Eukaryotic Structural Genomics, University of Wisconsin, Madison, WI
 2007 - 2011 Research Associate/Senior Research Scientist, Memorial Sloan-Kettering Cancer Center, New York, NY
 2012 - Assistant Professor, Department of Biochemistry, University of California, Riverside, CA

Other Experience and Professional Memberships

Biophysical Society (2015-)
 Protein Science Society (2016-)

Honors

2013 Basil O'Connor Starter Scholar Research Award, March of Dimes Foundation
 2013 Robert T. Poe Faculty Development Grant, Chinese American Faculty Association of Southern California
 2013 Regents' Faculty Fellowship, University of California, Riverside
 2014 Hellman Fellowship, Hellman Family Foundation
 2015 Kimmel Scholar Award, Sidney Kimmel Foundation for Cancer Research

B. Peer-reviewed Publications

List publications by career stages in chronological order.

[*Equally Contributing Authors; #Corresponding author(s)]

Graduate school and earlier publications

1. Qasim MA, Lu SM, Ding J, Bateman KS, James MN, Anderson S, **Song J**, Markley JL, Ganz PJ, Saunders CW, Laskowski M Jr. Thermodynamic criterion for the conformation of P1 residues of substrates and of inhibitors in complexes with serine proteinases. *Biochemistry*. 1999; 38(22):7142-50. PMID:10353824
 2. Hemmi H, Studts JM, Chae YK, **Song J**, Markley JL, Fox BG. Solution structure of the toluene 4-monooxygenase effector protein (T4moD). *Biochemistry*. 2001;40(12):3512-24. PMID: 11297417

3. **Song J**, Markley JL. NMR chemical shift mapping of the binding site of a protein proteinase inhibitor: changes in the (1)H, (13)C and (15)N NMR chemical shifts of turkey ovomucoid third domain upon binding to bovine chymotrypsin A(alpha). *Journal of molecular recognition*. 2001; 14(3):166-71. PMID: 11391787
4. **Song J**, Laskowski M Jr, Qasim MA, Markley JL. NMR determination of pKa values for Asp, Glu, His, and Lys mutants at each variable contiguous enzyme-inhibitor contact position of the turkey ovomucoid third domain. *Biochemistry*. 2003; 42(10):2847-56. PMID: 12627950
5. **Song J**, Markley JL. Protein inhibitors of serine proteinases: role of backbone structure and dynamics in controlling the hydrolysis constant. *Biochemistry*. 2003; 42(18):5186-94. PMID: 12731859
6. **Song J**, Laskowski M Jr, Qasim MA, Markley JL. Two conformational states of Turkey ovomucoid third domain at low pH: three-dimensional structures, internal dynamics, and interconversion kinetics and thermodynamics. *Biochemistry*. 2003; 42(21):6380-91. PMID: 12767219

Post-doctoral publications

7. **Song J**, Vinarov D, Tyler EM, Shahan MN, Tyler RC, Markley JL. Hypothetical protein At2g24940.1 from *Arabidopsis thaliana* has a cytochrome b5 like fold. *Journal of biomolecular NMR*. 2004; 30(2):215-8. PMID: 15702529
8. **Song J**, Zhao Q, Thao S, Frederick RO, Markley JL. Solution structure of a calmodulin-like calcium-binding domain from *Arabidopsis thaliana*. *Journal of biomolecular NMR*. 2004; 30(4):451-6. PMID: 15630565
9. **Song J**, Tyler RC, Wrobel RL, Frederick RO, Vojtek FC, Jeon WB, Lee MS, Markley JL. Solution structure of At3g04780.1-des15, an *Arabidopsis thaliana* ortholog of the C-terminal domain of human thioredoxin-like protein. *Protein science*. 2005; 14(4):1059-63. PMID:15741346, PMCID: PMC2253455
10. Tyler RC, Aceti DJ, Bingman CA, Cornilescu CC, Fox BG, Frederick RO, Jeon WB, Lee MS, Newman CS, Peterson FC, Phillips GN Jr, Shahan MN, Singh S, **Song J**, Sreenath HK, Tyler EM, Ulrich EL, Vinarov DA, Vojtik FC, Volkman BF, Wrobel RL, Zhao Q, Markley JL. Comparison of cell-based and cell-free protocols for producing target proteins from the *Arabidopsis thaliana* genome for structural studies. *Proteins*. 2005; 59(3):633-43. PMID: 15789406
11. **Song J**, Zhao Q, Lee MS, Markley JL. 1H, 15N and 13C resonance assignments of the putative Bet v 1 family protein At1g24000.1 from *Arabidopsis thaliana*. *Journal of biomolecular NMR*. 2005; 32(4):335. PMID: 16211487
12. Zhao Q, **Song J**, Jin Z, Danilova V, Hellekant G, Markley JL. Probing the sweet determinants of brazzein: wild-type brazzein and a tasteless variant, brazzein-ins(R18a-I18b), exhibit different pH-dependent NMR chemical shifts. *Biochemical and biophysical research communications*. 2005; 335(1):256-63. PMID: 16105551
13. Fox BG, Malone TE, Johnson KA, Madson SE, Aceti D, Bingman CA, Blommel PG, Buchan B, Burns B, Cao J, Cornilescu C, Doreleijers J, Ellefson J, Frederick R, Geetha H, Hruby D, Jeon WB, Kimball T, Kunert J, Markley JL, Newman C, Olson A, Peterson FC, Phillips GN Jr, Primm J, Ramirez B, Rosenberg NS, Runnels M, Seder K, Shaw J, Smith DW, Sreenath H, **Song J**, Sussman MR, Thao S, Troestler D, Tyler E, Tyler R, Ulrich E, Vinarov D, Vojtik F, Volkman BF, Wesenberg G, Wrobel RL, Zhang J, Zhao Q, Zolnai Z. X-ray structure of *Arabidopsis* At1g77680, 12-oxophytodienoate reductase isoform 1. *Proteins*. 2005; 61(1):206-8. PMID: 16080145
14. **Song J**, Tyler RC, Lee MS, Tyler EM, Markley JL. Solution structure of isoform 1 of Roadblock/LC7, a light chain in the dynein complex. *Journal of molecular biology*. 2005; 354(5):1043-51. PMID: 16289575
15. Lin IJ, Chen Y, Fee JA, **Song J**, Westler WM, Markley JL. Rieske protein from *Thermus thermophilus*: 15N NMR titration study demonstrates the role of iron-ligated histidines in the pH dependence of the reduction potential. *Journal of the American Chemical Society*. 2006; 128(33):10672-3. PMID:16910649
16. **Song J**, Lee MS, Carlberg I, Vener AV, Markley JL. Micelle-induced folding of spinach thylakoid soluble phosphoprotein of 9 kDa and its functional implications. *Biochemistry*. 2006; 45(51):15633-43. PMID: 17176085, PMCID: PMC2533273
17. **Song J**, Markley JL. Cautionary tail: the presence of an N-terminal tag on dynein light-chain Roadblock/LC7 affects its interaction with a functional partner. *Protein and peptide letters*. 2007; 14(3):265-8. PMID: 17346231
18. **Song J**, Markley JL. Three-dimensional structure determined for a subunit of human tRNA splicing endonuclease (Sen15) reveals a novel dimeric fold. *Journal of molecular biology*. 2007; 366(1):155-64. PMID: 17166513, PMCID: PMC1865571
19. **Song J**, Zhao KQ, Newman CL, Vinarov DA, Markley JL. Solution structure of human sorting nexin 22. *Protein science*. 2007; 16(5):807-14. PMID: 17400918, PMCID: PMC2206652

20. Phillips GN Jr, Fox BG, Markley JL, Volkman BF, Bae E, Bitto E, Bingman CA, Frederick RO, McCoy JG, Lytle BL, Pierce BS, **Song J**, Twigger SN. Structures of proteins of biomedical interest from the Center for Eukaryotic Structural Genomics. *Journal of structural and functional genomics*. 2007; 8(2-3):73-84. PMID: 17786587
21. Frederick RO, Bergeman L, Blommel PG, Bailey LJ, McCoy JG, **Song J**, Meske L, Bingman CA, Ritters M, Dillon NA, Kunert J, Yoon JW, Lim A, Cassidy M, Bunge J, Aceti DJ, Primm JG, Markley JL, Phillips GN Jr, Fox BG. Small-scale, semi-automated purification of eukaryotic proteins for structure determination. *Journal of structural and functional genomics*. 2007; 8(4):153-66. PMID: 17985212, PMCID: PMC2668602
22. **Song J***, Guo LW*, Muradov H, Artemyev NO, Ruoho AE, Markley JL. Intrinsically disordered gamma-subunit of cGMP phosphodiesterase encodes functionally relevant transient secondary and tertiary structure. *Proceedings of the National Academy of Sciences of the United States of America*. 2008; 105(5):1505-10. PMID: 18230733, PMCID: PMC2234174
23. **Song J**, Bettendorff L, Tonelli M, Markley JL. Structural basis for the catalytic mechanism of mammalian 25-kDa thiamine triphosphatase. *The Journal of biological chemistry*. 2008; 283(16):10939-48. PMID: 18276586, PMCID:PMC2447667
24. **Song J***, McGivern JV*, Nichols KW, Markley JL, Sheets MD. Structural basis for RNA recognition by a type II poly(A)-binding protein. *Proceedings of the National Academy of Sciences of the United States of America*. 2008; 105(40):15317-22. PMID: 18824697, PMCID: PMC2563106
25. Wang GG, **Song J**, Wang Z, Dormann HL, Casadio F, Li H, Luo JL, Patel DJ, Allis CD. Haematopoietic malignancies caused by dysregulation of a chromatin-binding PHD finger. *Nature*. 2009; 459(7248):847-51. PMID: 19430464, PMCID: PMC2697266
26. Wang Z*, **Song J***, Milne TA, Wang GG, Li H, Allis CD, Patel DJ. Pro isomerization in MLL1 PHD3-bromo cassette connects H3K4me readout to Cyp33 and HDAC-mediated repression. *Cell*. 2010; 141(7):1183-94. PMID: 20541251, PMCID: PMC4690531
27. Qasim MA, **Song J**, Markley JL, Laskowski M Jr. Cleavage of peptide bonds bearing ionizable amino acids at P(1) by serine proteases with hydrophobic S(1) pocket. *Biochemical and biophysical research communications*. 2010; 400(4):507-10. PMID: 20800580, PMCID: PMC3071031
28. Chu UB, **Song J**, Mavlyutov TA, Guo LW. In vitro interaction of tubulin with the photoreceptor cGMP phosphodiesterase gamma-subunit. *Neuroscience letters*. 2010;482(3):225-9. PMID: 20655363, PMCID: PMC2963155
29. Teplova M, **Song J**, Gaw HY, Teplov A, Patel DJ. Structural insights into RNA recognition by the alternate-splicing regulator CUG-binding protein 1. *Structure* 2010; 18(10):1364-77. PMID: 20947024, PMCID: PMC3381513
30. **Song J**, Rechkoblit O, Bestor TH, Patel DJ. Structure of DNMT1-DNA complex reveals a role for autoinhibition in maintenance DNA methylation. *Science*. 2011; 331(6020):1036-40. PMID: 21163962, PMCID: PMC4689315
31. Teplova M, Malinina L, Darnell JC, **Song J**, Lu M, Abagyan R, Musunuru K, Teplov A, Burley SK, Darnell RB, Patel DJ. Protein-RNA and protein-protein recognition by dual KH1/2 domains of the neuronal splicing factor Nova-1. *Structure* 2011; 19(7):930-44. PMID: 21742260, PMCID: PMC3134789
32. **Song J**, Teplova M, Ishibe-Murakami S, Patel DJ. Structure-based mechanistic insights into DNMT1-mediated maintenance DNA methylation. *Science* 2012; 335(6069):709-12. PMID: 22323818, PMCID: PMC4693633
33. Kuo AJ*, **Song J***, Cheung P, Ishibe-Murakami S, Yamazoe S, Chen JK, Patel DJ, Gozani O. The BAH domain of ORC1 links H4K20me2 to DNA replication licensing and Meier-Gorlin syndrome. *Nature*. 2012; 484(7392):115-9. PMID: 22398447, PMCID: PMC3321094

Assistant professor publications

34. Cai L, Rothbart SB, Lu R, Xu B, Chen WY, Tripathy A, Rockowitz S, Zheng D, Patel DJ, Allis CD, Strahl BD, **Song J***, **Wang GG***. An H3K36 methylation-engaging Tudor motif of polycomb-like proteins mediates PRC2 complex targeting. *Molecular cell*. 2013; 49(3):571-82. PMID: 23273982, PMCID: PMC3570589
35. Jiang S, Yao J, Ma KW, Zhou H, **Song J**, He SY, Ma W. Bacterial effector activates jasmonate signaling by directly targeting JAZ transcriptional repressors. *PLoS pathogens*. 2013; 9(10):e1003715. PMID: 24204266, PMCID: PMC3814404

36. Ji D, Lin K, **Song J**, Wang Y. Effects of Tet-induced oxidation products of 5-methylcytosine on Dnmt1- and DNMT3a-mediated cytosine methylation. *Molecular bioSystems*. 2014; 10(7):1749-52. PMID: 24789765, PMCID: PMC4052722
37. Zhang F, Paramasivam M, Cai Q, Dai X, Wang P, Lin K, **Song J**, Seidman MM, Wang Y. Arsenite binds to the RING finger domains of RNF20-RNF40 histone E3 ubiquitin ligase and inhibits DNA double-strand break repair. *Journal of the American Chemical Society*. 2014; 136(37):12884-7. PMID: 25170678, PMCID: PMC4183597
38. Zhang W, Sankaran S, Gozani O, **Song J**[#]. A Meier-Gorlin syndrome mutation impairs the ORC1-nucleosome association. *ACS chemical biology*. 2015; 10(5):1176-80. PubMed [journal] PMID: 25689043, PMCID: PMC4654454
39. Zhang ZM, Liu S, Lin K, Luo Y, Perry JJ, Wang Y, **Song J**[#]. Crystal Structure of Human DNA Methyltransferase 1. *Journal of molecular biology*. 2015; 427(15):2520-31. PubMed [journal] PMID: 26070743, PMCID: PMC4520738
40. Zhang ZM, Rothbart SB, Allison DF, Cai Q, Harrison JS, Li L, Wang Y, Strahl BD, Wang GG, **Song J**[#]. An Allosteric Interaction Links USP7 to Deubiquitination and Chromatin Targeting of UHRF1. *Cell reports*. 2015; 12(9):1400-6. PMID: 26299963, PMCID: PMC4558366
41. Ma KW, Jiang S, Hawara E, Lee D, Pan S, Coaker G, **Song J**, Ma W. Two serine residues in *Pseudomonas syringae* effector HopZ1a are required for acetyltransferase activity and association with the host co-factor. *The New phytologist*. 2015; 208(4):1157-68. PMID: 26103463, PMCID: PMC4768790
42. Zhang C, Brown MQ, van de Ven W, Zhang ZM, Wu B, Young MC, Synek L, Borchardt D, Harrison R, Pan S, Luo N, Huang YM, Ghang YJ, Ung N, Li R, Isley J, Morikis D, **Song J**, Guo W, Hooley RJ, Chang CE, Yang Z, Zarsky V, Muday GK, Hicks GR, Raikhel NV. Endosidin2 targets conserved exocyst complex subunit EXO70 to inhibit exocytosis. *Proceedings of the National Academy of Sciences of the United States of America*. 2016; 113(1):E41-50. PMID: 26607451, PMCID: PMC4711834
43. Jin SG, Zhang ZM, Dunwell TL, Harter MR, Wu X, Johnson J, Li Z, Liu J, Szabó PE, Lu Q, Xu GL, **Song J**[#], Pfeifer GP[#]. Tet3 Reads 5-Carboxylcytosine through Its CXXC Domain and Is a Potential Guardian against Neurodegeneration. *Cell reports*. 2016; 14(3):493-505. PMID: 26774490, PMCID: PMC4731272
44. Harter MR, Liu CD, Shen CL, Gonzalez-Hurtado E, Zhang ZM, Xu M, Martinez E, Peng CW[#], **Song J**[#]. BS69/ZMYND11 C-Terminal Domains Bind and Inhibit EBNA2. *PLoS pathogens*. 2016; 12(2):e1005414. PMID: 26845565, PMCID: PMC4742278
45. Zhang ZM, Ma KW, Yuan S, Luo Y, Jiang S, Hawara E, Pan S, Ma W[#], **Song J**[#]. Structure of a pathogen effector reveals enzymatic mechanism of a novel acetyltransferase family. *Nature Structural & Molecular Biology*. 2016; In press.
46. **Song J**[#], Pfeifer GP[#]. Are there specific readers of oxidized 5-methylcytosine bases? *BioEssays*. 2016; In press.

C. Research Support

List ongoing and completed research projects (Federal or non-Federally supported). Begin with the projects that are most relevant to the research proposed in the application. Briefly indicate the overall goals of the projects and responsibilities of the key person identified on the Biographical Sketch.

Ongoing Research Support

8/1/2016 – 7/31/2021

1R35GM119721

NIH/MIGMS

Mechanistic Insights into Mammalian DNA Methylation

The major goals of this project are to investigate the mechanistic basis of mammalian DNA methylation.

Role: PI

6/1/2015 – 5/31/2018

#1-FY15-345

Structural insights into the origin recognition complex and Meier-Gorlin syndrome, March of Dimes

Song, Jikui (PI)

The major goals of this project are to investigate how impairment of chromatin loading or molecular assembly of origin recognition complex plays an etiologic role in Meier-Gorlin syndrome pathogenesis.
Role: PI

7/1/2015 – 6/30/2017

Kimmel Scholar Award

Sidney Kimmel Foundation for Cancer Research

Song, Jikui (PI)

Structure and mechanism of mammalian DNA methylation machineries in health and cancer

The major goal of this project is to study the regulatory mechanisms of DNMT1 and DNMT3A.

Role: PI

Completed Research Support

3/1/2013 – 2/28/2015

#1-FY13-29

Structural insights into the origin recognition complex and Meier-Gorlin syndrome, March of Dimes

Song, Jikui (PI)

The major goal of this project is to define structural principles of chromatin association and architectural assembly of Origin Recognition Complex and their functional implications in Meier-Gorlin Syndrome.

Role: PI

7/1/2015 – 6/30/2016

CRC-15-380558

UC Cancer Research Coordinating Committee

Inhibition of the EBNA2-mediated transcription activation by BS69: structure and mechanism

Song, Jikui (PI)

The major goals of this project are to provide the molecular basis for the specific BS69-EBNA2 recognition, and to identify how the BS69-EBNA2 interaction affects the transactivation potential of EBNA2.

Role: PI

Curriculum vitae

Yinsheng Wang

Vital Statistics:

Year of Birth: 1971; Place of Birth: Anhui, China
Married, 1996. Two children, Michael and Michelle.

Business Address:

Department of Chemistry-027, University of California at Riverside, Riverside, CA 92521-0403.
E-mail: Yinsheng.Wang@ucr.edu. Telephone: (951)827-2700. Fax: (951)827-4713.

Home Address:

8371 Manhasset Street, Riverside, CA 92508. Telephone: (951)653-5106.

Education & Positions:

B. S. 1989-1993, Shandong University, China;
M. S. 1993-1996, Dalian Institute of Chemical Physics, Chinese Academy of Sciences (Advisor: Professor Runsheng Zhai);
Ph. D. 1997-2001, Department of Chemistry, Washington University in St. Louis (Advisors: Professors Michael L. Gross and John-Stephen A. Taylor);
Assistant Professor in Chemistry, 2001-2005, University of California Riverside;
Associate Professor in Chemistry, 2005-2008, University of California Riverside;
Professor in Chemistry, 2008-present, University of California Riverside;
Donald T. Sawyer Endowed Founder's Chair in Chemistry, 2016-present, University of California Riverside;
Director, Environmental Toxicology Graduate Program, 2008-present, University of California Riverside

Courses Taught:

CHEM 1A: General Chemistry (2003, 2004)
CHEM 1HB: Honors General Chemistry (2007-2010)
CHEM 5: Quantitative Analysis (2001, 2002, 2003, 2004, 2005, 2011, 2012, 2014-present)
CHEM 221E: Advanced Analytical Chemistry: Mass Spectrometry (2002-2005, 2013)
CHEM 221B: Advanced Analytical Chemistry: Optical Spectroscopy (2005-2013)

Activities with Professional Societies:

American Chemical Society
American Society for Mass Spectrometry
American Association for the Advancement of Sciences
Member, Editorial Board, *Chem. Res. Toxicol.* (01/01/2007-present); *Toxicol. Res.* (01/01/2013-present); *Sci. Rep.* (06/01/2015-present).
Treasurer-Elect, Division of Chemical Toxicology, American Chemical Society (11/2011-10/2013)
Treasurer, Division of Chemical Toxicology, American Chemical Society (11/2013-present)

List of Contract and Grant Support:

Agency	Title	Dates	Amount	PI Status
NIH (completed, R01 CA 96906)	ROS-induced Nucleic Acid Damage	07/01/02-06/30/07	\$894,917	PI
ASMS (Completed, 2005 Research Award)	Pinpointing the Nature of Glycosylation in HMGN2 Protein	07/01/05-06/30/06	\$25,000	PI
Ceres Corporation (Completed)	DNA Damage Induced by Psoralen and its Analogs	07/01/06-06/30/08	\$178,374	PI
JDRF (completed)	Methylglyoxal-modified Hemoglobin as Biomarkers for Diabetic Nephropathy	07/01/07-06/30/08	\$110,000	PI
NIH (completed, R01 CA101864)	Oxidative Crosslink Lesions and CpG Mutagenesis	07/01/04-04/30/09	\$1,169,626	PI
NIH (completed, R56 CA96906-06)	ROS-induced Nucleic Acid Damage	09/30/09-09/29/10	\$181,544	PI
NIH (completed, R01 CA116522)	Post-translational Modifications of High-mobility Group proteins	08/01/07-07/31/10	\$910,066	PI
NIH (completed, R01 DK082779, Diversity Supp.)	Chemistry and Biology of DNA Carboxyalkylation	07/01/09-06/30/11	\$125,758	PI
NIH (completed, R01 DK082779, Equipment Supp.)	Chemistry and Biology of DNA Carboxyalkylation	07/01/09-03/31/11	\$99,505	PI
TRDRP (completed, 18XT-0073)	DNA Adducts Arising from Tobacco-derived <i>N</i> -nitrosamines	07/01/09-06/30/11	\$250,000	PI
NIH (Completed, S10 RR022331)	A TSQ Vantage Mass Spectrometer for the ACIF	05/06/10-05/05/11	\$469,334	PI
NIH (Completed, P01 GM068087)	Functional Analysis and Systems Biology of Filamentous Fungi	04/01/09-03/31/14	\$100,545 (to Wang)	Subcontract (PI, Dunlap)
NIH (Completed, R01 DK082779)	Chemistry and Biology of DNA Carboxyalkylation	07/01/09-06/30/14	\$1,702,660	PI
NIH (Completed, S10 OD010669-01)	An LTQ-Orbitrap Elite with ETD for the Keck Proteomics Facility	06/01/13-05/31/14	\$600,000	PI
NIH (Completed, T32 ES018827)	Research Training in Environmental Toxicology	07/01/10-06/30/15	\$1,091,527	PI
NIH (Completed, R13 ES024658)	Mechanisms and Biomarkers of Environmental Stress	07/01/14-06/30/15	\$6,000	PI
NIH (Active, R01 CA101864)	Oxidative DNA Damage and CpG Mutagenesis	07/01/04-02/29/16	\$1,181,815	PI
NIH (Active, R01 ES019873)	Repair of Radiation-Induced Crosslink Lesions of DNA	05/01/12-01/31/17	\$1,539,000	PI

NIH (Active, R01 ES021007)	Cross-links at Abasic Sites in Duplex DNA	08/15/12-04/30/17	\$1,612,016 (\$646,000 to Wang)	Multi-PI (Gates and Wang)
NIH (Active, P01 AG043376)	Cell Autonomous and Non-Autonomous Mechanisms of Aging	07/01/13-06/30/18	\$10,618,577 (\$731,743 to Wang)	Co-Investigator (PI: Paul Robbins)
NIH (Active, R01 DK082779)	Chemistry and Biology of DNA Carboxyalkylation	07/01/14-06/30/17	\$991,800	PI
NIH (Active, R01 ES025121)	Repair and Biological Consequences of Alkylated Thymidine Lesions	11/01/14-10/31/19	\$1,710,000	PI
NIH (Active, T32 ES018827)	Research Training in Environmental Toxicology	07/01/15-06/30/20	\$1,303,687	PI
NIH (Active, R21 ES025392)	Enzymatic Conversions of Tet-mediated Oxidation Products of 5-Methylcytosine	07/01/15-06/30/17	\$418,000	PI
NIH (Active, R13 ES026043)	New Developments in Assessing Environmental Exposure and Environmental Mutagenesis	07/01/15-06/30/16	\$10,000	PI
NIH (Pending, R01 ES027215-01)	Molecular Mechanisms of Arsenic Carcinogenesis	07/01/16-06/30/21	\$1,941,250	PI
NIH (Pending, R01 CA210445-01)	Occurrence and Biological Consequences of Epimeric 2-Deoxyribose Lesions	07/01/16-06/30/21	\$1,941,250	PI
NIH (Pending, R01 CA210445-01)	Quantitative Adductomics Approaches for Assessing the Occurrence and Repair of DNA Adducts	07/01/16-06/30/21	\$1,941,250	PI

Awards:

- 2013 Biemann Medal, for “innovative application of mass spectrometry in the field of modified nucleic acids”, the American Society for Mass Spectrometry
- 2012 Inaugural *Chemical Research in Toxicology* Young Investigator Award, for “applying innovative chemical technologies to the solution of important toxicological problems”, co-sponsored by the Division of Chemical Toxicology of American Chemical Society and the ACS journal *Chemical Research in Toxicology*
- 2012 Fellow, American Association for the Advancement of Sciences (2012-present), for “distinguished contributions to the field of bioanalytical chemistry, particularly in the development of novel analytical methods enabling understanding of the biological consequences of DNA damage”
- 2005 Research Award, the American Society for Mass Spectrometry
- 1996 President Scholarship of Chinese Academy of Sciences

Campus Services:

Graduate Studies Committee, Department of Chemistry, University of California at Riverside (2002-2007);

Curricula and Student Affairs Committee, Environmental Toxicology Graduate Program, University of California at Riverside (2002-2010)

Seminar Committee: Environmental Toxicology Graduate Program, University of California at Riverside (Chair, 2004-2006; member 2006-present); Cellular, Molecular and Developmental Biology Graduate Program (member, 2008-2009).

Faculty Search Committee: Junior Physical Chemistry (member, 2003); Junior Analytical Chemistry (member, 2004); Junior Analytical Chemistry (chair, 2005 & 2008); Junior Organic Chemistry (member, 2006); Junior Epigenetics (member, 2012, 2013); Junior Analytical Chemistry (chair, 2014); Vice Provost for International Affairs (member, 2014).

Search Committee, Academic Administrator for the UCR Institute of Integrated Genome Biology, 2007.

Committee on Committees, Academic Senate, UC Riverside, 2010-2013.

Director, interdepartmental graduate program in Environmental Toxicology, 2008-present.

Faculty Director, Analytical Chemistry Instrumentation Facility, 2010-2014.

Reviewer of Journals:

Nat. Chem. Biol.; *Nat. Chem.*; *Nat. Sci. Rep.*; *Mol. Cell*; *Proc. Natl. Acad. Sci. USA*; *Nucleic Acids Res.*; *J. Am. Chem. Soc.*; *Anal. Chem.*; *J. Proteome Res.*; *Biochemistry*; *J. Org. Chem.*; *Chem. Res. Toxicol.*; *Angew. Chem., Int. Ed.*; *Chem. Commun.*; *J. Am. Soc. Mass Spectrom.*; *J. Mass Spectrom.*; *Rapid Commun. Mass Spectrom.*; *Eur. J. Mass Spectrom.*; *Int. J. Mass Spectrom.*; *Mol. Cell. Proteomics*; *Appl. Environ. Microbiol.*; *Free Radic. Res.*; *Can. J. Chem.*; *Photochem. Photobiol.*; *Biophys. Chem.*; *Proteins*; *etc.*

Other Advisory Experience:

12/06/02-12/07/02	National Research Program for Genomic Medicine of the National Science Council (Taiwan) and the Program Project on Genomics and Proteomics of Academia Sinica.
3/8/06-3/10/06	NIH Post-doctoral Fellowship Panel on Chemical and Bioanalytical Sciences
11/19/08-11/20/08	NIH Panel on Shared Instrumentation Program
06/08/10-06/09/10	NIH/NIEHS Nanotoxicology Special Emphasis Panel (ZES1 SET-V 03)
06/14/10-06/15/10	NIH Cancer Etiology Study Section
07/22/10	NIH Special Emphasis Panel on Fellowship (ZRG1 F04B-B 20 L)
02/28/11-02/28/11	NIH Cancer Etiology Study Section
11/09/11-11/10/11	NIH Environmental Health Sciences Review Committee
02/28/13-03/01/13	Member, NCI P01 Special Emphasis Panel IV
08/14/14-08/15/14	NIEHS Review Committee for the P30 Centers Program

09/10/14-09/11/14	NIH S10 Shared Instrumentation Grant Panel ZRG1 BMBB-D (30)
11/14/14	NIEHS Special Emphasis Panel on K99 grants
07/11-06/15	Member: NIH Cancer Etiology Study Section
11/09/15-11/10/15	NIEHS Special Emphasis Panel on U01 grants

Symposium Organization:

Organizer, Symposium on “Analytical/Bioanalytical Mass Spectrometry”, 2006 Western Regional ACS Meeting (Jan. 23, 2006), Anaheim, CA.

Organizer, symposium on “Mass Spectrometry for the Analysis of DNA Adducts”, 55th ASMS (June 3-7, 2007), Indianapolis, IN.

Organizer, symposium on “Mass Spectrometry for the Analysis of DNA and Protein Damage”, 234th ACS National Meeting (August 19-23, 2007), Boston, MA.

Organizer, “UCR symposium on Tobacco-related Disease Research” (September 25, 2009), Riverside, CA.

Co-Organizer, “UCR symposium on Tobacco-related Disease Research” (October 28, 2010), Riverside, CA.

Organizer, “Applications of Mass Spectrometry in Environmental Toxicology Research”, Pittcon 2011 (March 13-17, 2011), Atlanta, GA.

Organizer, “Chemical Research in Toxicology Award Symposium”, 244th ACS National Meeting, August 19-23, 2012, Philadelphia, PA.

Co-Organizer, “Genome Instability: Mechanisms of Epigenetic Modification”, 244th ACS National Meeting, August 19-23, 2012, Philadelphia, PA.

Organizer, “Chemistry and Biology of Metal Toxicity”, 246th ACS National Meeting, September 8-12, 2013, Indianapolis, IN.

Organizer, “DNA Polymerases: from Mutagenesis to Biotechnology”, 250th ACS National Meeting, Aug. 15-20, 2015, Boston, MA.

Publications:

Refereed Journals:

Affiliation: Dalian Institute of Chemical Physics, Chinese Academy of Sciences

- (1) Wei, X.; Wang, Y.; Zhai, R.; Zhuang, S.* A HREELS study of adsorption and decomposition of phenol on Pt(111). *Chin. Sci. Bull.* **1996**, *41*, 1797-1801.
- (2) Wang, Y.; Wei, X.; Tian, Z.; Cao, Y.; Zhai, R.*; Ushikubo, T.; Sato, K.; Zhuang, S. An AES, UPS and HREELS study of the oxidation and reaction of Nb(110). *Surf. Sci.* **1997**, *372*, L285-L290.
- (3) Wang, Y.; Wei, X.; Tian, Z.; Zhai, R.*; Ushikubo, T.; Sato, K.; Zhuang, S. A HREELS study of the adsorption of formic acid on slightly oxidized Nb (110) surface. *Sci. China, Ser. B: Chem.* **1997**, *40*, 9-14.
- (4) Wang, Y.; Wei, X.; Tian, Z.; Zhai, R.*; Ushikubo, T.; Sato, K.; Zhuang, S. High resolution electron energy loss spectroscopy study of the oxidation of Nb(110) surface. *Chin. Sci. Bull.* **1997**, *42*, 384-387.

- (5) Zhuang, S.* Wang, X.; Wei, X.; Wang, Y.; Ren, S.; Zhai, R. The adsorption and reaction of cyclohexanone on the Pt(111) surface. *Surf. Sci.* **1997**, 376, L429-L433.

Affiliation: Washington University in St. Louis

- (6) Wang, Y.; Taylor, J.-S.; Gross, M. L.* Differentiation of isomeric photomodified oligodeoxynucleotides by fragmentation of ions produced by matrix-assisted laser desorption ionization and electrospray ionization. *J. Am. Soc. Mass Spectrom.* **1999**, 10, 329-338.
- (7) Wang, Y.; Taylor, J.-S.*; Gross, M. L.* Nuclease P1 digestion combined with tandem mass spectrometry for the structure determination of DNA photoproducts. *Chem. Res. Toxicol.* **1999**, 12, 1077-1082.
- (8) Wang, Y.; Gaspar, P. P.; Taylor, J.-S.* Quantum chemical study of the electron-transfer-catalyzed splitting of oxetane and azetidine intermediates proposed in the photoenzymatic repair of (6-4) photoproducts of DNA. *J. Am. Chem. Soc.* **2000**, 122, 5510-5519.
- (9) Ng, W.-O.; Zentella, R.; Wang, Y.; Taylor, J.-S. A.; Pakrasi, H. B.* phrA, the major photoreactivating factor in the cyanobacterium *Synechocystis* sp. strain PCC 6803 codes for a cyclobutane-pyrimidine-dimer-specific DNA photolyase. *Arch. Microbiol.* **2000**, 173, 412-417.
- (10) Wang, Y.; Taylor, J.-S.; Gross, M. L.* Fragmentation of photomodified oligodeoxynucleotides adducted with metal ions in an electrospray-ionization ion-trap mass spectrometer. *J. Am. Soc. Mass Spectrom.* **2001**, 14, 1174-1179.
- (11) Wang, Y.; Gross, M. L.; Taylor, J.-S.* Use of a combined enzymatic digestion/ESI mass spectrometry assay to study the effect of TATA-binding protein on photoproduct formation in a TATA box. *Biochemistry* **2001**, 40, 11785-11793.
- (12) Wang, Y.; Taylor, J.-S.; Gross, M. L.* Isolation and mass spectrometric characterization of dimeric adenine photoproducts in oligodeoxynucleotides. *Chem. Res. Toxicol.* **2001**, 14, 738-745.
- (13) Wang, Y.; Taylor, J.-S.; Gross, M. L.* The fragmentation of electrospray-produced oligodeoxynucleotides ions adducted with metal ions. *J. Am. Soc. Mass Spectrom.* **2001**, 12, 550-556.
- (14) Wang, Y.; Rempel, D. L.; Taylor, J.-S.; Gross, M. L.* A method for quantification from composite spectra: Application to the determination of isomeric DNA photoproducts by tandem mass spectrometry. *Anal. Chem.* **2001**, 73, 185-191.

Affiliation: University of California at Riverside

- (15) Wang, Y.*. HPLC isolation and mass spectrometric characterization of two isomers of thymine glycols in oligodeoxynucleotides. *Chem. Res. Toxicol.*, **2002**, 15, 671-676.
- (16) Wang, Y.*; Liu, Z., and Dixon, C. Major adenine products from 2-methyl-1,4-naphthoquinone-sensitized photoirradiation at 365 nm. *Biochem. Biophys. Res. Commun.* **2002**, 291, 1252-1257.
- (17) Wang, Y.*; Vivekananda, S, and Zhang, K. ESI-MS/MS for the differentiation of diastereomeric pyrimidine glycols in mononucleosides. *Anal. Chem.* **2002**, 74, 4505-4512.

- (18) Wang, Y.*, Men, L., and Vivekananda, S. Fragmentation of deprotonated ions of oligodeoxynucleotides carrying a 5-formyluracil or 2-aminoimidazolone. *J. Am. Soc. Mass Spectrom.* **2002**, *13*, 1190-1194.
- (19) Wang, Y.* and Liu, Z. Mechanisms for the formation of major oxidation products of adenine upon 365-nm irradiation with 2-methyl-1,4-naphthoquinone as a sensitizer. *J. Org. Chem.*, **2002**, *67*, 8507-8512.
- (20) Liu, Z., Gao, Y. and Wang, Y.* Identification and characterization of a novel crosslink lesion in d(CpC) upon 365 nm-irradiation in the presence of 2-methyl-1,4-naphthoquinone. *Nucleic Acids Res.* **2003**, *31*, 5413-5424.
- (21) Zhang, Q. and Wang, Y.* Independent generation of 5-(2'-deoxycytidiny)methyl radical and the formation of a novel crosslink lesion between 5-methylcytosine and guanine. *J. Am. Chem. Soc.* **2003**, *125*, 12795-12802.
- (22) Wang, Y. and Wang, Y.* Structure elucidation of DNA interstrand crosslink lesions by a combination of nuclease P1 digestion with mass spectrometry. *Anal. Chem.* **2003**, *75*, 6306-6313.
- (23) Wang, Y.*, Vivekananda, S., Men, L., and Zhang, Q. Fragmentation of protonated ions of peptides containing cysteine, cysteine sulfinic acid, and cysteine sulfonic acid. *J. Am. Soc. Mass Spectrom.* **2004**, *15*, 697-702.
- (24) Zou, Y.; Jiang, X.; Wang, Y.* Identification of novel *in vivo* phosphorylation sites in high mobility group N1 protein from the MCF-7 human breast cancer cells. *Biochemistry* **2004**, *43*, 6322-6329.
- (25) Gu, C. and Wang, Y.* LC-MS/MS identification and yeast polymerase η bypass of a novel γ -irradiation-induced intrastrand crosslink lesion G[8-5]C. *Biochemistry* **2004**, *43*, 6745-6750.
- (26) Zeng, Y. and Wang, Y.* Facile formation of an intrastrand crosslink lesion between cytosine and guanine upon Pyrex-filtered UV light irradiation of d(^{Br}CG) and duplex DNA containing 5-bromocytosine. *J. Am. Chem. Soc.* **2004**, *126*, 6552-6553.
- (27) Wang, Y., Zhang, Q. and Wang, Y.* Tandem mass spectrometry for the determination of the sites of DNA interstrand crosslink. *J. Am. Soc. Mass Spectrom.* **2004**, *15*, 1565-1571.
- (28) Zhang, Q. and Wang, Y.* Independent generation of the 5-hydroxy-5,6-dihydrothymidin-6-yl radical and its reactivity in dinucleoside monophosphates. *J. Am. Chem. Soc.* **2004**, *126*, 13287-13297.
- (29) Liu, Z.; Gao, Y.; Zeng, Y.; Fang, F.; Chi, D.; Wang, Y.* Isolation and characterization of a novel crosslink lesion in d(CpC) induced by one-electron photooxidation. *Photochem. Photobiol.* **2004**, *80*, 209-215.
- (30) Jiang, X. and Wang, Y.* β -elimination combined with tandem mass spectrometry for the identification of the *in vivo* and *in vitro* sites of phosphorylation of dehydrin DHN1 protein. *Biochemistry*, **2004**, *43*, 15567-15576.
- (31) Men, L. and Wang, Y.* Further studies on the fragmentation of protonated ions of peptides containing aspartic acid, glutamic acid, cysteine sulfinic acid, and cysteine sulfonic acid. *Rapid Commun. Mass Spectrom.*, **2005**, *19*, 23-30.
- (32) Zhang, Q. and Wang, Y.* Generation of 5-(2'-deoxycytidiny)methyl radical and the formation of intrastrand cross-link lesions in oligodeoxyribonucleotides. *Nucleic Acids Res.*, **2005**, *33*, 1593-1603.

- (33) Zou, Y. and Wang, Y.* Tandem mass spectrometry for the examination of the post-translational modifications of high-mobility group A1 proteins: Symmetric and asymmetric dimethylation of Arg25 in HMGA1a protein. *Biochemistry*, **2005**, *44*, 6293-6301.
- (34) Gu, C. and Wang, Y.* Thermodynamic and *in-vitro* replication studies of an intrastrand crosslink lesion G[8-5]C. *Biochemistry*, **2005**, *44*, 8883-8889.
- (35) Hong, H. and Wang, Y.* Formation of intrastrand crosslink products between cytosine and adenine from UV irradiation of d(^{Br}CA) and duplex DNA containing a 5-bromocytosine. *J. Am. Chem. Soc.*, **2005**, *127*, 13969-13977.
- (36) Zhang, Q. and Wang, Y.* The reactivity of the 5-hydroxy-5,6-dihydrothymidin-6-yl radical in oligodeoxyribonucleotides. *Chem. Res. Toxicol.*, **2005**, *18*, 1897-1906.
- (37) Men, L. and Wang, Y.* Fragmentation of the deprotonated ions of peptides containing cysteine, cysteine sulfinic acid, cysteine sulfonic acid, aspartic acid, and glutamic acid. *Rapid Commun. Mass Spectrom.*, **2006**, *20*, 777-784.
- (38) Gao, Y. and Wang, Y.* The photochemistry of 5-BrdCpdC, dCp5-BrdCpdA, and dCp5-BrdCdT in aqueous solution. *Nucleosides, Nucleotides & Nucleic Acids*, **2006**, *25*, 279-287.
- (39) Hong, H.; Cao, H.; Wang, Y. and Wang, Y.* Identification and quantification of a guanine-thymine intrastrand crosslink lesion induced by Cu(II)/H₂O₂/ascorbate. *Chem. Res. Toxicol.*, **2006**, *19*, 614-621.
- (40) Zeng, Y. and Wang, Y.* Facile photocyclization chemistry of 5-phenylthio-2'-deoxyuridine in duplex DNA. *Org. Lett.*, **2006**, *8*, 2527-2530.
- (41) Zhang, Q. and Wang, Y.* Differentiation of 2'-O- and 3'-O-methylated ribonucleosides by tandem mass spectrometry. *J. Am. Soc. Mass Spectrom.* **2006**, *17*, 1096-1099.
- (42) Jiang, X. and Wang, Y.* Phosphorylation of human high mobility group N1 protein by protein kinase CK2. *Biochem. Biophys. Res. Commun.*, **2006**, *345*, 1497-1503.
- (43) Jiang, X. and Wang, Y.* Acetylation and phosphorylation of high-mobility group A1 proteins in PC-3 human tumor cells. *Biochemistry*, **2006**, *45*, 7194-7201.
- (44) Wang, Y. and Wang, Y.* Synthesis and thermodynamic studies of oligodeoxyribonucleotides containing tandem lesions of thymidine glycol and 8-oxo-2'-deoxyguanosine. *Chem. Res. Toxicol.*, **2006**, *19*, 837-843.
- (45) Cao, H. and Wang, Y.* Collisionally activated dissociation of protonated 2'-deoxycytidine, 2'-deoxyuridine and their oxidatively damaged derivatives. *J. Am. Soc. Mass Spectrom.*, **2006**, *17*, 1335-1341.
- (46) Gu, C.; Zhang, Q.; Yang, Z.; Wang, Y.; Zou, Y. and Wang, Y.* Recognition and incision of oxidative intrastrand cross-link lesions by UvrABC nuclease. *Biochemistry*, **2006**, *45*, 10739-46.
- (47) Sun, W.; Lee, T. S.; Zhu, M.; Gu, C.; Wang, Y.; Zhu, Y. and Shyy, J. Y.* Statins activate AMP-activated protein kinase in vitro and in vivo. *Circulation*, **2006**, *114*, 2655-2662.
- (48) Zeng, Y. and Wang, Y.* Sequence-dependent formation of intrastrand crosslink products from the UVB irradiation of duplex DNA containing a 5-bromo-2'-deoxyuridine or 5-bromo-2'-deoxycytidine. *Nucleic Acids Res.*, **2006**, *34*, 6521-6529.
- (49) Gao, Y. and Wang, Y.* Site-selective modifications of arginine residues in human hemoglobin induced by methylglyoxal. *Biochemistry*, **2006**, *45*, 15654-15660.

- (50) Men, L. and Wang, Y.* The oxidation of yeast alcohol dehydrogenase-1 by hydrogen peroxide in vitro. *J. Proteome Res.*, **2007**, 6, 216-225.
- (51) Hong, H. and Wang, Y.* Derivatization with Girard reagent T combined with LC-MS/MS for the sensitive detection of 5-formyl-2'-deoxyuridine in cellular DNA. *Anal. Chem.*, **2007**, 79, 322-326.
- (52) Zou, Y.; Wang, Y.* Mass spectrometric analysis of high-mobility group proteins and their post-translational modifications in normal and cancerous human breast tissues. *J. Proteome Res.* **2007**, 6, 2304-2314.
- (53) Gu, C.; Wang, Y.* In-vitro replication and thermodynamic studies of methylation and oxidation modifications of 6-thioguanine. *Nucleic Acids Res.*, **2007**, 35, 3693-3704.
- (54) Zou, Y.; Webb, K.; Perna, A. D.; Zhang, Q.; Clarke, S.; and Wang, Y.* A mass spectrometric study on the in-vitro methylation of HMGA1a and HMGA1b proteins by PRMTs: methylation specificity, the effect of binding to AT-rich duplex DNA and the effect of C-terminal phosphorylation. *Biochemistry*, **2007**, 46, 7896-7906.
- (55) Zeng, Y. and Wang, Y.* UVB-induced formation of intrastrand crosslink products of DNA in MCF-7 cells treated with 5-bromo-2'-deoxyuridine. *Biochemistry*, **2007**, 46, 8189-8195.
- (56) Qiu, H. and Wang, Y.* Probing adenosine nucleotide-binding proteins with an affinity labeled-nucleotide probe and mass spectrometry. *Anal. Chem.*, **2007**, 79, 5547-5556.
- (57) Jiang, D.; Men, L.; Wang, J.; Zhang, Y.; Chickenyen, S.; Wang, Y. and Zhou, F.* Redox reactions of copper complexes formed with different β -amyloid peptides and their neuropathological relevance. *Biochemistry*, **2007**, 46, 9270-9282.
- (58) Zhang, Q.; Zhang, K.; Zou, Y.; Perna, A. D. and Wang, Y.* A quantitative study on the in-vitro and in-vivo acetylation of high mobility group A1 proteins. *J. Am. Soc. Mass Spectrom.*, **2007**, 19, 1569-1578.
- (59) Cao, H. and Wang, Y.* Quantification of oxidative single-base and intrastrand cross-link lesions in unmethylated and CpG-methylated DNA induced by Fenton-type reagents. *Nucleic Acids Res.*, **2007**, 35, 4833-4844.
- (60) Men, L.; Roginskaya, M.; Zou, Y. and Wang, Y.* Redox-dependent formation of disulfide bonds in human replication protein A. *Rapid Commun. Mass Spectrom.*, **2007**, 21, 2743-2749.
- (61) Cao, H.; Jiang, Y. and Wang, Y.* Stereospecific synthesis and characterizations of oligodeoxyribonucleotides containing N^2 -(1-carboxyethyl)-2'-deoxyguanosine. *J. Am. Chem. Soc.*, **2007**, 129, 12123-12130.
- (62) Gao, Y. and Wang, Y.* A method to determine the ionization efficiency change of peptides caused by phosphorylation. *J. Am. Soc. Mass Spectrom.*, **2007**, 19, 1973-1976.
- (63) Jiang, Y.; Hong, H.; Cao, H. and Wang, Y.* In-vivo formation and in-vitro replication of a guanine-thymine intrastrand cross-link lesion. *Biochemistry*, **2007**, 46, 12757-12763.
- (64) Hong, H.; Cao, H. and Wang, Y.* Formation and genotoxicity of a guanine-cytosine intrastrand cross-link lesion in vivo. *Nucleic Acids Res.*, **2007**, 35, 7118-7127.
- (65) Zhang, Q. and Wang, Y.* Homeodomain-interacting protein kinase-2 (HIPK2) phosphorylates HMGA1a at Ser-35, Thr-52, and Thr-77 and modulates its DNA binding affinity. *J. Proteome Res.*, **2007**, 6, 4711-4719.

- (66) Wang, Y.* Bulky DNA lesions induced by reactive oxygen species. *Chem. Res. Toxicol.*, **2008**, *21*, 276-281.
- (67) Cao, H.; Hearst, J. E.; Corash, L.; Wang, Y.* LC-MS/MS for the detection of DNA interstrand cross-links formed by 8-methoxypsoralen and UVA irradiation in human cells. *Anal. Chem.*, **2008**, *80*, 2932-2938.
- (68) Qiu, H. and Wang, Y.* Quantitative analysis of surface plasma membrane proteins of primary and metastatic melanoma cells. *J. Proteome Res.*, **2008**, *7*, 1904-1915.
- (69) Yuan, B.; Cao, H.; Jiang, Y.; Hong, H. and Wang, Y.* Efficient and accurate bypass of N^2 -(1-carboxyethyl)-2'-deoxyguanosine by DinB DNA polymerase *in vitro* and *in vivo*. *Proc. Natl. Acad. Sci. USA.*, **2008**, *105*, 8679-8684.
- (70) Zhang, Q. and Wang, Y.* High mobility group proteins and their post-translational modifications. *Biochim. Biophys. Acta*, **2008**, *1784*, 1159-1166.
- (71) Yuan, B. and Wang, Y.* Mutagenic and cytotoxic properties of 6-thioguanine, S^6 -methylthioguanine and guanine- S^6 -sulfonic acid. *J. Biol. Chem.*, **2008**, *283*, 23665-23670.
- (72) Rempel, M. A.; Wang, Y.; Armstrong, J.; Schlenk, D.* Uptake of estradiol from sediment by hornyhead turbot (*Pleuronichthys verticalis*) and effects on oxidative DNA damage in male gonads. *Mar. Environ. Res.* **2008**, *66*, 111-112.
- (73) Lai, C.; Cao, H.; Hearst, J.; Corash, L.; Luo, H. and Wang, Y.* Quantitative analysis of DNA interstrand cross-links and monoadducts formed in human cells induced by psoralens and UVA irradiation. *Anal. Chem.*, **2008**, *80*, 8790-8798.
- (74) Wang, J. and Wang, Y.* Chemical synthesis of oligodeoxynucleotides containing N^3 - and O^4 -carboxymethylthymidine and their formation in DNA. *Nucleic Acids Res.*, **2009**, *37*, 336-345.
- (75) Cao, H. and Wang, Y.* Fragmentation of isomeric intrastrand cross-link lesions of DNA in an ion-trap mass spectrometer. *J. Am. Soc. Mass Spectrom.*, **2009**, *20*, 611-617.
- (76) Jiang, Y.; Wang, Y. and Wang, Y.* *In-vitro* replication and repair studies of tandem lesions containing neighboring thymidine glycol and 8-oxo-7,8-dihydro-2'-deoxyguanosine. *Chem. Res. Toxicol.*, **2009**, *22*, 574-583.
- (77) Rempel, M. A.; Hester, B.; DeHaro, H.; Hong, H.; Wang, Y. and Schlenk, D.* Effects of 17β -estradiol, and its metabolite, 4-hydroxyestradiol on the spermatozoa of the sand dollar (*Dendraster excentricus*): Effects on fertilization, embryo development and oxidative DNA damage. *Sci. Tot. Environ.*, **2009**, *407*, 2209-15.
- (78) Wang, H. and Wang, Y.* 6-Thioguanine perturbs cytosine methylation at CpG dinucleotide site by DNA methyltransferases *in vitro* and acts as a DNA demethylating agent *in vivo*. *Biochemistry*, **2009**, *48*, 2290-2299.
- (79) Qiu, H. and Wang, Y.* Exploring DNA-binding proteins with *in vivo* chemical cross-linking and mass spectrometry. *J. Proteome Res.*, **2009**, *8*, 1983-1991.
- (80) Rempel-Hester, M. A.; Hong, H.; Wang, Y.; Deng, X.; Armstrong, J.; Gully, J. and Schlenk, D.* Site-specific effects of 17β -estradiol in hornyhead turbot (*Pleuronichthys verticalis*) collected from a wastewater outfall and reference location. *Environ. Res.*, **2009**, *109*, 552-558.
- (81) Xiong, L.; Ping, L.; Yuan, B. and Wang, Y.* Methyl group migration during the fragmentation of singly charged ions of trimethyllysine-containing peptides: Precaution of

- using MS/MS of singly charged ions for interrogating peptide methylation. *J. Am. Soc. Mass Spectrom.*, **2009**, *20*, 1172-1181.
- (82) Cao, H., Jiang, Y. and Wang, Y.* Kinetics of deamination and Cu(II)/H₂O₂/ascorbate-induced formation of 5-methylcytosine glycol at CpG sites in duplex DNA. *Nucleic Acids Res.*, **2009**, *37*, 6635-6643.
- (83) Zhang, Q. and Wang, Y.* HMG modifications and nuclear function. *Biochim. Biophys. Acta*, **2010**, 1799, 28-36.
- (84) Jiang, D.; Li, X.; Williams, R.T.; Patel, S.; Men, L.; Wang, Y. and Zhou, F.* Fe(III)- and Fe(II)-nitrilotriacetic acid complexes of amyloid- β (1-16): Binding affinities, redox properties, and relevance to iron-induced oxidative stress in Alzheimer's disease, *Biochemistry*, **2009**, *48*, 7939-7947.
- (85) Wang, H.; Cao, H. and Wang, Y.* Quantification of *N*²-carboxymethyl-2'-deoxyguanosine in calf-thymus DNA and cultured human kidney epithelial cells by capillary LC tandem mass spectrometry coupled with stable isotope-dilution method. *Chem. Res. Toxicol.*, **2010**, *23*, 74-81.
- (86) Yuan, B.; Jiang, Y.; Wang, Y. and Wang, Y.* Mutagenic and cytotoxic properties of tandem lesions containing neighboring thymidine glycol and 8-oxo-7,8-dihydro-2'-deoxyguanosine. *Chem. Res. Toxicol.*, **2010**, *23*, 11-19.
- (87) Xiong, L. and Wang, Y.* Quantitative proteomic analysis reveals the perturbation of multiple cellular pathways in HL-60 cells induced by arsenite treatment. *J. Proteome Res.*, **2010**, *9*, 1129-1137.
- (88) Li, P.; Wang, D.; Yao, H.; Doret, P.; Hao, G.; Shen, Q.; Qiu, H.; Zhang, X.; Wang, Y.; Chen, G. and Wang, Y.* Coordination of PAD4 and HDAC2 in the regulation of p53 target gene expression. *Oncogene*, **2010**, *29*, 3153-3162.
- (89) Lin, G.; Zhang, J.; Luo, H.* and Wang, Y.* Conformation-dependent formation of the G[8-5]U intrastrand cross-link in 5-bromouracil-containing G-quadruplex DNA induced by UVA irradiation. *Biochemistry*, **2010**, *49*, 2346-2350.
- (90) Xiong, L.; Adhvaryu, K. K.; Selker, E. U. and Wang, Y.* Mapping of lysine methylation and acetylation in core histones of *Neurospora crassa*. *Biochemistry*, **2010**, *49*, 5236-5243.
- (91) Wang, J. and Wang, Y.* Synthesis and characterization of oligodeoxyribonucleotides containing a site-specifically incorporated *N*⁶-carboxymethyl-2'-deoxyadenosine or *N*⁴-carboxymethyl-2'-deoxycytidine. *Nucleic Acids Res.*, **2010**, *38*, 6774-6784.
- (92) Wang, H. and Wang, Y.* LC-MS/MS coupled with stable isotope dilution method for the quantification of 6-thioguanine and *S*⁶-methylthioguanine in genomic DNA of human cancer cells treated with 6-thioguanine. *Anal. Chem.*, **2010**, *82*, 5797-5803.
- (93) Dong, X.; Cheng, J.; Li, J.* and Wang, Y.* Graphene as a novel matrix for the analysis of small molecules by MALDI-TOF MS. *Anal. Chem.*, **2010**, *82*, 6208-6214.
- (94) Weng, M.; Zheng, Y.; Jasti, V.; Champeil, E.; Tomasz, M.; Wang, Y.; Basu, A. and Tang, M.* Repair of mitomycin C mono- and interstrand cross-linked DNA adducts by UvrABC: a new model. *Nucleic Acids Res.*, **2010**, *38*, 6976-84.
- (95) Dong, X.; Xiong, L.; Jiang, X. and Wang, Y.* Quantitative proteomic analysis reveals the perturbation of multiple cellular pathways in Jurkat-T cells induced by doxorubicin. *J. Proteome Res.*, **2010**, *9*, 5943-5951.

- (96) Yuan, B.; O'Connor, T. R. and Wang, Y.* 6-Thioguanine and *S*⁶-methylthioguanine are mutagenic in human cells. *ACS Chem. Biol.*, **2010**, 5, 1021-1027.
- (97) Wang, P.; Jiang, Y.; Wang, Y.; Shyy, J. Y. and DeFea, K.A.* β -Arrestin inhibits CAMKK β -dependent AMPK activation downstream of protease-activated-receptor-2. *BMC Biochemistry*, **2010**, 11:36.
- (98) Xiong, L.; Zhang, J.; Yuan, B.; Dong, X.; Jiang, X. and Wang, Y.* Global proteome quantification for discovering imatinib-induced perturbation of multiple biological pathways in K562 human chronic myeloid leukemia cells. *J. Proteome Res.*, **2010**, 9, 6007-6015.
- (99) Yuan, B.; Zhang, J.; Wang, H.; Xiong, L.; Cai, Q.; Wang, T.; Jacobsen, S.; Pradhane, S. and Wang, Y.* 6-Thioguanine reactivates epigenetically silenced genes in acute lymphoblastic leukemia cells by facilitating proteasome-mediated degradation of DNMT1, *Cancer Res.*, **2011**, 71, 1904-1911.
- (100) Wang, J.; Yuan, B.; Guerrero, C.; Bahde, R.; Gupta, S.; Wang, Y.* Quantification of oxidative DNA lesions in tissues of Long-Evans Cinnamon rats by capillary high-performance liquid chromatography-tandem mass spectrometry coupled with stable isotope-dilution method. *Anal. Chem.*, **2011**, 83, 2201-2209.
- (101) Xiong, L. and Wang, Y.* Mapping Post-translational Modifications of Histones H2A, H2B and H4 in *Schizosaccharomyces pombe*. *Int. J. Mass Spectrom.*, **2011**, 301, 159-165.
- (102) Xiong, L.; Darwanto, A.; Sharma, S.; Herring, J.; Hu, S.; Filippova, M.; Filippov, V.; Wang, Y.; Chen, C.; Duerksen-Hughes, P.; Sowers, L.C. and Zhang, K.* Mass spectrometric studies on epigenetic interaction networks in cell differentiation. *J. Biol. Chem.* **2011**, 286, 13657-13668.
- (103) Yuan, B.; Wang, J.; Cao, H.; Sun, R. and Wang, Y.* High-throughput analysis of the mutagenic and cytotoxic properties of DNA lesions by next-generation sequencing, *Nucleic Acids Res.*, **2011**, 39, 5945-5954.
- (104) Yuan, B.; You, C.; Andersen, N.; Jiang, Y.; Moriya, M.; O'Connor, T. R. and Wang, Y.* The roles of DNA polymerases κ and ι in the error-free bypass of *N*²-carboxyalkyl-dG lesions in mammalian cells. *J. Biol. Chem.*, **2011**, 286, 17503-17511.
- (105) Zhang, J.; Dong, X.; Cheng, J.; Li, J.*; and Wang, Y.* Efficient analysis of non-polar environmental contaminants by MALDI-TOF MS with graphene as matrix. *J. Am. Soc. Mass Spectrom.*, **2011**, 22, 1294-1298.
- (106) Matt, G. E.*; Quintana, P. J. E.; Destailats, H.; Gundel, L. A.; Sleiman, M.; Singer, B. C. III; Jacob, P.; Benowitz, N.; Winickoff, J. P.; Rehan, V.; Talbot, P.; Schick, S.; Samet, J.; Wang, Y.; Hang, B.; Martins-Green, M.; Pankow, J. F.; Hovell, M. F. Thirdhand tobacco smoke: Emerging evidence and arguments for a multidisciplinary research agenda. *Environ. Health. Perspect.*, **2011**, 119, 1218-1226.
- (107) Swanson, A; Wang, J.; Wang, Y.* *In-vitro* replication studies of carboxymethylated DNA lesions with *Saccharomyces cerevisiae* polymerase η . *Biochemistry*, **2011**, 50, 7666-7673.
- (108) Dong, X; Xiao, Y.; Jiang, X.; Wang, Y.* Quantitative proteomic analysis revealed lovastatin-induced perturbation of cellular pathways in HL-60 cells. *J. Proteome Res.*, **2011**, 10, 5463-5471.

- (109) Zhang, J.; Yuan, B.; Zhang, F.; Xiong, L.; Wu, J.; Pradhan, S. and Wang, Y.* Cyclophosphamide perturbs cytosine methylation in Jurkat-T cells through LSD1-mediated stabilization of DNMT1 protein. *Chem. Res. Toxicol.*, **2011**, *24*, 2040-2043.
- (110) Jin, J.G.; Jiang, Y.; Qiu, R.; Rauch, T.A.; Wang, Y.; Schackert, G.; Krex, D.; Lu, Q. and Pfeifer, G.P.* 5-Hydroxymethylcytosine is strongly depleted in human cancers but its levels do not correlate with IDH1 mutations. *Cancer Res.* **2011**, *71*, 7360-7365.
- (111) Shimada, K.; Crother, T. R.; Karlin, K.; Dagvadorj, J.; Chiba, N.; Chen, S.; Ramanujan, V. K.; Wolf, A. J.; Vergnes, L.; Ojcius, D. M.; Rentsendorj, A.; Vargas, M.; Guerrero, C.; Wang, Y.; Fitzgerald, K. A.; Underhill, D. M.; Town, T.; Arditi, M.* Oxidized mitochondrial DNA activates the NLRP3 inflammasome during apoptosis. *Immunity*, **2012**, *36*, 401-414.
- (112) Prins, J.; Wang, Y.* Quantitative proteomic analysis revealed 4-(methylnitrosamino)-1-(3-pyridinyl)-1-butanone-induced up-regulation of 20S proteasome in cultured human fibroblast cells. *J. Proteome Res.* **2012**, *11*, 2347-2354.
- (113) Cliffe, L.; Hirsch, G.; Wang, J.; Ekanayake, D.; Bullard, W.; Hu, M.; Wang, Y. and Sabatini, R.* JBP1 and 2 are Fe²⁺/2-OG dependent dioxygenases and oxygen sensors regulating the hydroxylation of thymine residues in trypanosome Pol II promoters. *J. Biol. Chem.*, **2012**, *287*, 19886-19895.
- (114) Zhang, F.; Dai, X. and Wang, Y.* 5-Aza-2'-deoxycytidine induced growth inhibition of leukemia cells through modulating endogenous cholesterol biosynthesis. *Mol. Cell. Proteomics* **2012**, *11*, M111.016915.
- (115) Wang, J.; Clauson, C. L.; Robbins, P. D.; Niedernhofer, L. J. and Wang, Y.* Accumulation of DNA damage with aging is tissue-specific. *Aging Cell*, **2012**, *11*, 714-716.
- (116) Wang, J.; Cao, H.; You, C.; Yuan, B.; Gupta, S.; Nishigori, C.; Niedernhofer, L. J.; Brooks, P. J.; and Wang, Y.* Endogenous formation and repair of oxidatively induced G[8-5m]T intrastrand cross-link lesion. *Nucleic Acids Res.*, **2012**, *40*, 7368-7374.
- (117) Tilstra, J. S.; Robinson, A. R.; Wang, J.; Gregg, S. Q.; Clauson, C. L.; Reay, D. P.; Nasto, L. A.; St Croix, C. M.; Usas, A.; Vo, N.; Huard, J.; Clemens, P. R.; Stolz, D. B.; Guttridge, D. C.; Watkins, S. C.; Garinis, G. A.; Wang, Y.; Niedernhofer, L. J.*; Robbins, P. D.* Inhibition of IKK/NF- κ B delays the onset of senescence and aging-related degenerative diseases caused by DNA damage. *J. Clin. Invest.*, **2012**, *122*, 2601-2612.
- (118) Spindler, S. R.*; Li, R.; Dhahbi, J. M.; Yamakawa, A.; Mote, P.; Bodmer, R.; Ocorr, K.; Williams, R. T.; Wang, Y. and Ablao, K. P. Statin treatment increases lifespan and improves cardiac health in *Drosophila*. *PLoS ONE*, **2012**, *7*, e39581.
- (119) You, C.; Dai, X.; Yuan, B.; Wang, J.; Wang, J.S.; Brooks, P. J.; Niedernhofer, L. J.; Wang, Y.* A quantitative assay for assessing the effects of DNA lesions on transcription. *Nat. Chem. Biol.*, **2012**, *8*, 817-822.
- (120) Swanson, A.; Wang, J.; Wang, Y.* The evolutionarily conserved role of DNA polymerase η in the accurate and efficient bypass of cyclopurine lesions. *Chem. Res. Toxicol.*, **2012**, *25*, 1682-1691.
- (121) Williams, R. T. and Wang, Y.* A density functional theory study on glycosidic bond cleavage in 5-substituted 2'-deoxycytidines: Implications in active cytosine demethylation. *Biochemistry*, **2012**, *51*, 6458-6462.

- (122) Tang, Y.; Gao, X.-D.; Wang, Y.; Yuan, B.-F.*; Feng, Y.-Q.* The widespread existence of cytosine methylation in yeast DNA measured by gas chromatography-mass spectrometry. *Anal. Chem.*, **2012**, *84*, 7249-7255.
- (123) Shaked, H.; Hofseth, L. J.; Chumanevich, A. P.; Chumanevich, A. A.; Wang, J.; Wang, Y.; Taniguchi, K.; Guma, M.; Shenouda, S.; Clevers, H.; Harris, C. C.; Karin, M.* Chronic epithelial NF- κ B activation accelerates APC loss and intestinal tumor initiation through iNOS upregulation. *Proc. Natl. Acad. Sci. USA*, **2012**, *109*, 14007-14012.
- (124) Mitra, D.; Luo, X.; Morgan, A.; Wang, J.; Hoang, M.P.; Lo, J.; Guerrero, C. R.; Lennerz, J. K.; Mihm, M. C.; Wargo, J. A.; Robinson, K. C.; Devi, S. P.; Vanover, J. C.; D'Orazio, J. A.; McMahon, M.; Bosenberg, M. W.; Haigis, K. M.; Haber, D.A.; Wang, Y.; Fisher, D. E.* Redheads and melanoma risk: pheomelanin synthesis is carcinogenic by a UV-independent mechanism. *Nature*, **2012**, *491*, 449-453.
- (125) You, C.; Dai, X.; Yuan, B.; Wang, Y. Effects of 6-thioguanine and S^6 -methylthioguanine on transcription *in vitro* and in human cells. *J. Biol. Chem.*, **2012**, *287*, 40915-40923.
- (126) Andersen, N.; Wang, J.; Wang, P.; Jiang, Y.; and Wang, Y.* Bypass of O^2 -methylthymidine and O^4 -methylthymidine by purified DNA polymerases *in vitro*. *Chem. Res. Toxicol.*, **2012**, *25*, 2523-2531.
- (127) Johnson, K.; Price, N.; Wang, J.; Fekry, M.; Dutta, S.; Seiner, D.; Wang, Y.; Gates, K. S.* On the formation and properties of interstrand DNA-DNA cross-links forged by reaction of an abasic site with the opposing guanine residue of 5'-CAp sequences in duplex DNA. *J. Am. Chem. Soc.*, **2013**, *135*, 1015-1025.
- (128) Williams, R.T.; Nalbandian, J.; Tu, A.; Wang, Y.* Nuclease digestion and mass spectrometric characterization of oligodeoxyribonucleotides containing 1,2-GpG, 1,2-ApG, and 1,3-GpXpG cisplatin intrastrand cross-links. *Clin. Chim. Acta*, **2013**, *420*, 160-170.
- (129) Prins, J.M. and Wang, Y.* Quantitative proteomic analysis revealed N' -nitrosonornicotine-induced down-regulation of non-muscle myosin II and reduced cell migration in cultured human skin fibroblast cells. *J. Proteome Res.*, **2013**, *12*, 1282-1288.
- (130) Xiao, Y.; Guo, L.; Jiang, X.; Wang, Y.* Proteome-wide discovery and characterizations of nucleotide-binding proteins with affinity-labeled chemical probes. *Anal. Chem.*, **2013**, *85*, 3198-3206.
- (131) Chen, M.-L.; Shen, F.; Huang, W.; Qi-J.-H.; Wang, Y.; Feng, Y.-Q.*; Liu, S.-M.* and Yuan, B.-F.* Quantification of 5-methylcytosine and 5-hydroxymethylcytosine in genomic DNA from hepatocellular carcinoma tissues by capillary hydrophilic-interaction liquid chromatography/quadrupole TOF mass spectrometry. *Clin. Chem.*, **2013**, *59*, 824-832.
- (132) Liu, S.; Wang, J.; Su, Y.; Guerrero, C.; Zeng, Y.; Mitra, D.; Brooks, P.J.; Fisher, D.E.; Song, H. and Wang, Y.* Quantitative assessment of Tet-induced oxidation products of 5-methylcytosine in cellular and tissue DNA. *Nucleic Acids Res.*, **2013**, *41*, 6421-6429.
- (133) Ghang, Y.J.; Schramm, M.P.; Zhang, F.; Acey, R.; David, C.; Wilson, E.; Wang, Y.; Cheng, Q. and Hooley, R. J.* Selective cavitand-mediated endocytosis of imaging agents. *J. Am. Chem. Soc.*, **2013**, *135*, 7090-7093.
- (134) Guo, L.; Xiao, Y. and Wang, Y.* Hexavalent chromium-induced alteration of proteomic landscape in human skin fibroblast cells. *J. Proteome Res.*, **2013**, *12*, 3511-3518.

- (135) Wen, L.; Chen, Z.; Zhang, F.; Cui, X.; Sun, W.; Geary, G.G.; Wang, Y.; Johnson, D.A.; Chien, S.*; Zhu, Y.* and Shyy, J. Y-J.* CaMKK β phosphorylation of SIRT1 in endothelium is athero-protective. *Proc. Natl. Acad. Sci. USA*, **2013**, *110*, E2420-E2427.
- (136) Liu, S. and Wang, Y.* A Quantitative mass spectrometry-based approach for assessing the repair of 8-methoxypsoralen-induced DNA interstrand crosslink and monoadducts in mammalian cells. *Anal. Chem.*, **2013**, *85*, 6732-6739.
- (137) Xiao, Y.; Guo, L. and Wang, Y.* Isotope-coded ATP probe for quantitative affinity profiling of ATP-binding proteins. *Anal. Chem.*, **2013**, *82*, 7478-7486.
- (138) Dai, X.; Otake, K.; You, C.; Cai, Q.; Wang, Z.; Masumoto, H. and Wang, Y.* Identification and functional characterization of α -N-methylation of CENP-B. *J. Proteome Res.*, **2013**, *12*, 4167-4175.
- (139) You, C.; Swanson, A. L.; Dai, X.; Yuan, B.; Wang, J. and Wang, Y.* Translesion synthesis of 8,5'-cyclopurine-2'-deoxynucleosides *in vitro* and in human cells. *J. Biol. Chem.*, **2013**, *288*, 28548-28556.
- (140) Guerrero, C. R.; Wang, J. and Wang, Y.* Induction of 8,5'-cyclopurine-2'-deoxynucleosides in isolated DNA by Fenton-type reagents. *Chem. Res. Toxicol.*, **2013**, *26*, 1361-1366.
- (141) Xing, X.-W.; Liu, Y.-L.; Vargas, M.; Wang, Y.; Feng, Y.-Q.; Zhou, X.*; Yuan, B.-F.* Mutagenic and cytotoxic properties of oxidized products of 5-methylcytosine revealed by next-generation sequencing. *PLoS ONE*, **2013**, *8*, e72993.
- (142) Zhang, F.; Fu, L. and Wang, Y.* 6-Thioguanine induces mitochondrial dysfunction and oxidative DNA damage in acute lymphoblastic leukemia cells. *Mol. Cell. Proteomics*, **2013**, *12*, 3803-3811.
- (143) Huang, J.; Liu, S.; Bellani, M.; Thazhuthaveetil, A.K.; Ling, C.; de Winter, J.; Wang, Y.; Wang, W. and Seidman, M.M.* Fanci anemia protein M mediates replication traverse of DNA interstrand crosslinks. *Mol. Cell*, **2013**, *52*, 434-446.
- (144) Ponts, N.; Fu, L.; Harris, E. Y.; Zhang, J.; Chung, D.-W. D.; Cervantes, M.C.; Prudhomme, J.; Atanasova-Penichon, V.; Zehraoui, E.; Bunnik, E.; Rodrigues, E.M.; Lonardi, S.; Hicks, G.R.; Wang, Y.; Le Roch, K.G.* Genome-scale discovery of DNA methylations in the human malaria parasite. *Cell Host Microbe*, **2013**, *14*, 696-706.
- (145) Andersen, N.; Wang, P. and Wang, Y.* Replication across regioisomeric ethylated thymidine lesions by purified DNA polymerases. *Chem. Res. Toxicol.*, **2013**, *26*, 1730-1738.
- (146) Liu, S.; Dunwell, T.L.; Pfeifer, G.P.; Dunwell, J.D. and Wang, Y.* Detection of oxidation products of 5-methyl-2'-deoxycytidine in Arabidopsis DNA. *PLoS ONE*, **2013**, *8*, e84620.
- (147) Liang, Q.; Dexheimer, T.S.; Zhang, P.; Rosenthal, A.S.; Villamil, M.A.; You, C.; Zhang, Q.; Chen, J.; Sun, H.; Luci, D.K.; Yuan, B.; Simeonov, A.; Jadhav, A.; Xiao, H.; Wang, Y.; Maloney, D.J.*; Zhuang, Z. A selective USP1/UAF1 inhibitor links deubiquitination to DNA damage responses. *Nat. Chem. Biol.*, **2014**, *10*, 298-304.
- (148) Xiao, Y.; Guo, L.; Wang, Y.* A targeted quantitative proteomics strategy for global kinome profiling of cancer cells and tissues. *Mol. Cell. Proteomics*, **2014**, *13*, 1065-1075.
- (149) Wang, P.; Williams, R.T.; Guerrero, C.R.; Ji, D.; Wang, Y.* Fragmentation of electrospray-produced deprotonated ions of oligodeoxyribonucleotides containing an alkylated or oxidized thymidine. *J. Am. Soc. Mass Spectrom.*, **2014**, *25*, 1067-1076.

- (150) Price, N.E.; Johnson, K.M.; Wang, J.; Fekry, M.I.; Wang, Y. and Gates, K.S.* Interstrand DNA-DNA cross-link formation between adenine residues and abasic sites in duplex DNA. *J. Am. Chem. Soc.* **2014**, *136*, 3483-3490.
- (151) Guo, L.; Xiao, Y. and Wang, Y.* Monomethylarsonous acid inhibited endogenous cholesterol biosynthesis in human skin fibroblast cells. *Toxicol. Appl. Pharmacol.*, **2014**, *277*, 21-29.
- (152) Amato, N.; Wang, Y.* Epimeric DNA lesions: Products from the improper chemical repair of 2-deoxyribose radicals. *Chem. Res. Toxicol.* **2014**, *27*, 470-479.
- (153) Haque, M. M.; Sun, H.; Liu, S.; Wang, Y. and Peng, X.* Photo-switchable DNA interstrand cross-Link formation by a coumarin-modified nucleotide. *Angew. Chem. Int. Ed.*, **2014**, *53*, 7001-7005.
- (154) Prins, J.M.; Fu, L.; Guo, L. and Wang, Y.* Cd²⁺-induced alteration of global proteome of human skin fibroblast cells. *J. Proteome Res.*, **2014**, *13*, 1677-1687.
- (155) Zhai, Q.; Wang, P. and Wang, Y.* Cytotoxic and mutagenic properties of regioisomeric O²-, N³- and O⁴-ethylthymidines in bacterial cells. *Carcinogenesis*, **2014**, *35*, 2002-2006.
- (156) Xiao, Y.; Guo, L. and Wang, Y.* Comprehensive characterization of ³²P-GTP-binding proteins by orthogonal quantitative ³²P-GTP-affinity profiling and ³²P-GTP/GTP competition assays. *Anal. Chem.*, **2014**, *86*, 4550-4558.
- (157) Ji, D.; Lin, K.; Song, J. and Wang, Y.* Effects of Tet-induced oxidation products of 5-methylcytosine on Dnmt1- and DNMT3a-mediated cytosine methylation. *Mol. Biosyst.*, **2014**, *10*, 1749-1752.
- (158) Cai, Q.; Fu, L.; Wang, Z.; Gan, N.; Dai, X. and Wang, Y.* α -N-methylation of damaged DNA-binding protein 2 (DDB2) and its function in nucleotide excision repair. *J. Biol. Chem.*, **2014**, *289*, 16046-16056.
- (159) Bullard, W.; da Rosa-Spiegler, J.L.; Liu, S.; Wang, Y. and Sabatini, R.* Identification of the glucosyltransferase that converts hydroxymethyluracil to base J in the trypanosomatid genome. *J. Biol. Chem.*, **2014**, *289*, 20273-20282.
- (160) Fu, L.; Guerrero, C.R.; Zhong, N.; Amato, N.J.; Liu, Y.; Liu, S.; Cai, Q.; Ji, D.; Jin, S.G.; Niedernhofer, L.J.; Pfeifer, G.P.; Xu, G.L.; Wang Y.* Tet-mediated formation of 5-hydroxymethylcytosine in RNA. *J. Am. Chem. Soc.*, **2014**, *136*, 11582-11585.
- (161) Ji, D. and Wang, Y.* Facile enzymatic synthesis of base J-containing oligodeoxyribonucleotides and an analysis of the impact of base J on DNA replication in cells. *PLoS One*, **2014**, *9*, e103335.
- (162) Liu, S.; Ji, D.; Cliffe, L.; Sabatini, R. and Wang, Y.* Quantitative mass spectrometry-based analysis of β -D-glucosyl-5-hydroxymethyluracil in genomic DNA of *Trypanosoma brucei*. *J. Am. Soc. Mass Spectrom.*, **2014**, *25*, 1763-1770.
- (163) Ji, D.; You, C.; Wang, P. and Wang, Y.* Effects of Tet-induced oxidation products of 5-methylcytosine on DNA replication in mammalian cells. *Chem. Res. Toxicol.*, **2014**, *27*, 1304-1309.
- (164) Zhang, F.; Paramasivam, M.; Cai, Q.; Dai, X.; Wang, P.; Lin, K.; S, J.; Seidman, M.M. and Wang, Y.* Arsenite binds to the RING finger domains of RNF20-RNF40 histone E3 ubiquitin ligase and inhibits DNA double-strand break repair. *J. Am. Chem. Soc.*, **2014**, *136*, 12884-12887.

- (165) Zhai, Q.; Wang, P.; Cai, Q. and Wang, Y.* Syntheses and characterizations of the *in-vivo* replicative bypass and mutagenic properties of the minor-groove O^2 -alkylthymidine lesions. *Nucleic Acids Res.*, **2014**, *42*, 10529-10537.
- (166) Yu, Q.-W.; Li, X.-S.; Xiao, Y.; Guo, L.; Zhang, F.; Cai, Q.; Feng, Y.-Q.; Yuan, B.-F. and Wang, Y.* Sequential enrichment with titania-coated magnetic mesoporous hollow silica microspheres and zirconium arsenate-modified magnetic nanoparticles for the study of phosphoproteome of HL60 cells. *J. Chromatogr. A*, **2014**, *1365*, 54-60.
- (167) Guo, L.; Xiao, Y. and Wang, Y.* The application of ATP affinity probe and scheduled MRM analysis for profiling global kinome in human cells in response to arsenite treatment. *Anal. Chem.*, **2014**, *86*, 10700-7.
- (168) You, C.; Ji, D.; Dai, X. and Wang, Y.* Effects of Tet-mediated oxidation products of 5-methylcytosine on DNA transcription *in vitro* and in mammalian cells. *Sci. Rep.*, **2014**, *4*, 7052.
- (169) Chavez, L.; Huang, Y.; Luong, K.; Agarwal, S.; Iyer, L.M.; Pastor, W.A.; Hench, V.K.; Frazier-Bowers, S.A.; Korol, E.; Liu, S.; Tahiliani, M.; Wang, Y.; Clark, T.A.; Korlach, J.; Pukkila, P.J.; Aravind, L.; and Rao, A.* Simultaneous sequencing of oxidized methylcytosines produced by TET/JBP proteins in *Coprinopsis cinerea*. *Proc. Natl. Acad. Sci. USA*, **2014**, *111*, E5149-58.
- (170) You, C.; Dai, X. and Wang, Y.* Transcriptional bypass of regioisomeric ethylated thymidine lesions by T7 RNA polymerase and human RNA polymerase II. *Nucleic Acids Res.*, **2014**, *42*, 13706-13713.
- (171) Xiao, Y. and Wang, Y.* Global discovery of protein kinases and other nucleotide-binding proteins by mass spectrometry. *Mass Spectrom. Rev.*, **2014**, DOI: 10.1002/mas.21447.
- (172) Guo, L.; Xiao, Y.; Fan, M.; J. J. Li and Wang, Y.* Profiling global kinome signatures of the radioresistant MCF-7/C6 breast cancer cells using MRM-based targeted proteomics. *J. Proteome Res.*, **2015**, *14*, 193-201.
- (173) You, C.; Wang, J.; Dai, X. and Wang, Y.* Transcriptional inhibition and mutagenesis induced by *N*-nitroso compounds-derived carboxymethylated thymidine adducts in DNA. *Nucleic Acids Res.*, **2015**, *43*, 1012-1018.
- (174) Price, N. E.; Catalano, M.; Liu, S.; Wang, Y.; Gates, K. S.* Chemical and structural characterization of interstrand cross-links formed between abasic sites and adenine residues in duplex DNA. *Nucleic Acids Res.*, **2015**, *43*, 3434-3441.
- (175) Catalano, M.; Liu, S.; Andersen, N.; Yang, Z.; Johnson, K. M.; Price, N.E.; Wang, Y. and Gates, K.S.* Chemical structure and properties of the interstrand cross-link formed by the reaction of abasic sites with guanine residues in duplex DNA. *J. Am. Chem. Soc.*, **2015**, *137*, 3933-45.
- (176) Dai, X.; Rulten, S.; You, C.; Caldecott, K. and Wang, Y.* Identification and functional characterizations of N-terminal α -N-methylation and phosphorylation of serine 461 in human poly(ADP-ribose) polymerase 3. *J. Proteome Res.*, **2015**, *14*, 2575-2582.
- (177) Zhang, Z.-M.; Liu, S.; Lin, K.; Perry, J.J.; Wang, Y. and Song, J.* Crystal structure of human DNA methyltransferase 1, *J. Mol. Biol.*, **2015**, *427*, 2520-2531.
- (178) You, C. and Wang, Y.* Quantitative measurement of transcriptional inhibition and mutagenesis induced by site-specifically incorporated DNA lesions *in vitro* and *in vivo*. *Nat. Protocols*, **2015**, *10*, 1389-1406.

- (179) Fu, L.; Amato, N. J.; Wang, P.; McGowen, S.; Niedernhofer, L. J. and Wang, Y.* Simultaneous quantification of methylated cytidine and adenosine in cellular and tissue RNA by nano-flow liquid chromatography-tandem mass spectrometry coupled with the stable isotope-dilution method. *Anal. Chem.* **2015**, *87*, 7653-7659.
- (180) Amato, N. J.; Zhai, Q.; Navarro, D. C.; Niedernhofer, L. J. and Wang, Y.* *In vivo* detection and replication studies of α -anomeric lesions of 2'-deoxyribonucleosides. *Nucleic Acids Res.*, **2015**, *43*, 8314-8324.
- (181) Wang, X.; Song, S.*; Wu, Y.; Li, Y.; Chen, T.; Huang, Z.; Liu, S.; Dunwell, T.L.; Pfeifer, G.P.; Dunwell, J.M.; Wamaedeesa, R.; Ullah, I.; Wang, Y.; Hu, S.* Selective chemical labeling reveals the genome-wide distribution of 5-hydroxymethylcytosine in rice. *J. Exp. Bot.*, **2015**, *66*, 6651-6663.
- (182) Zhang, Z.-M.; Rothbart, S.B.; Allison, D.F.; Cai, Q.; Harrison, J.S.; Lin, L.; Wang, Y.; Strahl, B.D.; Wang, G.G. and Song, J.* An allosteric interaction links USP7 to deubiquitination and chromatin targeting of UHRF1. *Cell Rep.*, **2015**, *12*, 1400-1406.
- (183) Liu, S. and Wang, Y.* Mass spectrometry for the assessment of the occurrence and biological consequences of DNA adducts. *Chem. Soc. Rev.*, **2015**, *44*, 7829-7854.
- (184) Bing, T.; Shangguan, D.* and Wang, Y.* Facile discovery of cell-surface protein targets of cancer cell aptamers. *Mol. Cell. Proteomics*, **2015**, *14*, 2692-2700.
- (185) Wang, P.; Amato, N.J.; Zhai, Q. and Wang, Y.* Cytotoxic and mutagenic properties of O^4 -alkylthymidine lesions in *Escherichia coli* cells. *Nucleic Acids Res.*, **2015**, *43*, 10795-10803.
- (186) Hu, L.; Lu, J.; Cheng, J.; Rao, Q.; Li, Z.; Hou, H.; Lou, Z.; Zhang, L.; Li, W.; Gong, W.; Liu, M.; Sun, C.; Yin, X.; Li, J.; Tan, X.; Wang, P.; Wang, Y.; Fang, D.; Cui, Q.; Yang, P.; He, C.; Jiang, H.; Luo, C.* and Xu, Y.* Structural insight into substrate preference for TET-mediated oxidation. *Nature*, **2015**, *527*, 118-122.
- (187) Liu, S.; Jiang, J.; Li, L.; Amato, N.J.; Wang, Z. and Wang, Y.* Arsenite targets the zinc finger domains of Tet proteins and inhibits Tet-mediated oxidation of 5-methylcytosine. *Env. Sci. Technol.*, **2015**, *49*, 11923-11931.
- (188) McIntyre, J.; McLenigan, M.P.; Frank, E.G.; Dai, X.; Yang, W.; Wang, Y. and Woodgate, R.* Posttranslational regulation of human DNA polymerase ϵ . *J. Biol. Chem.*, **2015**, *290*, 27332-27344.
- (189) Perez, L.; Ghang, Y.-J.; Williams, P.; Wang, Y.; Cheng, Q.; Hooley, R.* Cell and protein recognition at a supported bilayer interface via in situ cavitand-mediated functional polymer growth. *Langmuir*, **2015**, *31*, 11152-11159.
- (190) Yu, Y.; Guerrero, C.R.; Liu, S.; Sharma, Y.; Gupta, S. and Wang, Y.* Comprehensive assessment of oxidatively induced modifications of DNA in a rat model of human Wilson's disease. *Mol. Cell. Proteomics*, **2015**, *15*, 810-817.
- (191) Bullard, W.; Cliff, L.; Wang, P.; Wang, Y. and Sabatini, R.* Base J glucosyltransferase does not regulate the sequence specificity of J synthesis in Trypanosomatid telomeric DNA. *Mol. Biochem. Parasitol.*, **2016**, *204*, 77-80.
- (192) You, C. and Wang, Y.* Mass spectrometry-based quantitative strategies for assessing the biological consequences and repair of DNA adducts. *Acc. Chem. Res.* **2016**, *49*, 205-213.

- (193) Lichinchi, G.; Gao, Y.; Saletore, Y.; Gonzalez, G.M.; Bansal, V.; Wang, Y.; Mason, C. and Rana, T.M.* Dynamics of the human and viral m⁶A RNA methylomes during HIV-1 infection of T cells. *Nat. Microbiol.*, **2016**, in press.
- (194) You, C.; Wang, P.; Nay, S.L.; Wang, J.; Dai, X.; O'Connor, T.R. and Wang, Y.* Roles of Aag, Alkbh2, and Alkbh3 in the repair of carboxymethylated and ethylated thymidine lesions. *ACS Chem. Biol.*, **2016**, *11*, 1332-1338.
- (194) Williams, N.; Wang, P.; Wu, J. and Wang, Y.* *In vitro* lesion bypass studies of O⁴-alkylthymidines with human DNA polymerase η . *Chem. Res. Toxicol.*, **2016**, *29*, 669-675.
- (195) Dai, X.; You, C. and Wang, Y.* Phosphorylation of human DNA polymerase η at Ser687 is required for UV damage tolerance. *Mol. Cell. Proteomics*, **2016**, *15*, 1913-1920.
- (196) Wang Y.; Liu, S.; Lin, Z.; Fan, Y.; Wang, Y.; Peng, X.* Photochemical generation of benzyl cations that selectively cross-link guanine and cytosine in DNA. *Org. Lett.* **2016**, *18*, 2544-2547.
- (197) Wu, J.; Li, L.; Wang, P.; You, C.; Williams, N. and Wang, Y.* Translesion synthesis of O⁴-alkylthymidine lesions in human cells. *Nucleic Acids Res.*, **2016**, *44*, in press.
- (198) Yu, Y.; Wang, J.; Wang, P. and Wang, Y.* Quantification of azaserine-induced carboxymethylated and methylated DNA lesions in cells by nanoflow liquid chromatography-nanoelectrospray ionization tandem mass spectrometry coupled with the stable isotope-dilution method. *Anal. Chem.*, **2016**, *88*, 8036-8042.
- (199) Volz, D.*; Leet, J. K.; Chen, A.; Stapleton, H.; Katiyar, N.; Kaundal, R.; Yu, Y. and Wang, Y. Tris(1,3-dichloro-2-propyl) phosphate induces genome-wide hypomethylation within early zebrafish embryos. *Environ. Sci. Technol.*, **2016**, in press.
- (200) Miao, W.; Xiao, Y.; Guo, L.; Jiang, X.; Huang, M. and Wang, Y.* A high-throughput targeted proteomic approach for comprehensive profiling of methylglyoxal-induced perturbations of the human kinome. *Anal. Chem.*, **2016**, in press.
- (201) Williams, N.L.; Wang, P. and Wang, Y.* Replicative bypass of O²-alkylthymidine lesions in Vitro. *Chem. Res. Toxicol.*, **2016**, revision pending.
- (202) Shentu, T.P.; He, M.; Sun, X.; Zhang, J.; Zhang, F.; Gongo, B.; Marin, T.L.; Zhang, J.; Wen, L.; Wang, Y.; Geary, G.G.; Zhu, Y.; Johnson, D.A. and Shyy, J. Y.-J.* AMPK and SIRT1 coregulation of cortactin contributes to endothelial function. *Arterioscler. Thromb. Vasc. Biol.* **2016**, revision pending.
- (203) Dai, X.; Li, L.; Li, J.; You, C., Gonzalez, G.; Miao, W.; Hu, J.; Fu, L.; Xu, Y.; Gu, W.* and Wang, Y.* Identification of YTHDF2 as a reader for 5-methylcytosine in RNA. *Nat. Chem. Biol.*, **2016**, submitted.

Non-peer-reviewed Book Chapters:

Affiliation: Washington University in St. Louis

- (1) Wang, Y.; Gross, M. L. Application of hydrogen exchange and electrospray-ionization mass spectrometry in studies of protein structure and dynamics; in: *Applied Electrospray Mass Spectrometry*. pp. 389-410. Ganguly, A. K., Pramanik, B. N. and Gross, M. L., Eds.; Marcel Dekker, Inc. New York, 2002. **Invited.**

Affiliation: University of California at Riverside:

- (2) Wang, Y.* Interactions between alkali metal ions and nucleic acid bases. *Encyclopedia of Mass Spectrometry*, Volume 4: Fundamentals of and Applications to Organic (and Organometallic) Compounds. pp. 577-84. Elsevier Ltd., 2005. **Invited.**
- (3) Hong, H. and Wang, Y.* Natural Products. *Encyclopedia of Mass Spectrometry*, Volume 6: Ionization Methods. pp. 848-856. Elsevier Ltd., 2007. **Invited.**
- (4) Gu, C.; Hong, H.; Wang, Y. LC-MS/MS for the examination of the cytotoxic and mutagenic properties of DNA lesions *in vitro* and *in vivo*. *Mass Spectrometry of Nucleosides and Nucleic Acids*, pp. 431-443. Editor(s): Joseph H Banoub and Patrick A. Limbach. CRC Press, Boca Raton, FL.
- (5) Wang, J.; Wang, Y. Carboxymethylation of DNA induced by N-nitroso compounds and its biological implications. *Advances in Molecular Toxicology*, Volume 5, 219-243. Editor: James Fishbein. Elsevier Ltd., 2011.

Seminars Given at Universities:

- 1) "Mass spectrometry for the study of oxidative DNA damage", Department of Chemistry and Biochemistry, California State University, Fullerton, Sep. 19, 2002.
- 2) "DNA damage induced by oxidative stress or UV irradiation --- A mass spectrometry approach", The City of Hope, Sep. 23, 2002.
- 3) "Top-down and bottom-up approaches for the study of oxidative DNA damage by mass spectrometry", Department of Chemistry, California State University, San Bernardino, Oct. 31, 2002.
- 4) "Discovery of novel oxidative DNA lesions by mass spectrometry", Department of Chemistry, San Diego State University, San Diego, Mar. 20, 2003.
- 5) "Searching for novel oxidative crosslink lesions", Department of Nuclear Medicine and Radiobiology, University of Sherbrooke, Canada, Sep. 12, 2003.
- 6) "Hunting for novel oxidative crosslink lesions of DNA", Department of Public Health Science, University of Alberta, Canada, Sep. 15, 2003.
- 7) "Identification of novel intrastrand crosslink lesions of DNA induced by ionizing radiation and oxidative stress", Division of Basic Sciences, School of Medicine, Loma Linda University, Oct. 16, 2003.
- 8) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, March 19, 2004.
- 9) "Mass spectrometry for the discovery of novel oxidative crosslink lesions of DNA", Dalian Institute of Chemical Physics, Chinese Academy of Sciences, March 30, 2004.
- 10) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry, University of Cincinnati, May 14, 2004.
- 11) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry, University of Missouri, Columbia, May 17, 2004.
- 12) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry, Washington University in St. Louis, May 18, 2004.

- 13) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry and Biochemistry, University of Maryland in Baltimore County, Sep. 14, 2004.
- 14) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry and Biochemistry, California State University Los Angeles, Nov. 09, 2004.
- 15) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry and Chemical Biology, Northeastern University, Jan. 31, 2005.
- 16) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry and Biochemistry, the University of Oklahoma, Apr. 5, 2005.
- 17) "Chemistry and biology of novel oxidative crosslink lesions of DNA", Department of Chemistry, Vanderbilt University, Apr. 25, 2005.
- 18) "Chemistry and biology of novel oxidative intrastrand crosslink lesions of DNA", Department of Chemistry, Graduate School of Science, Kyoto University, Japan, Oct. 20, 2006.
- 19) "Mass spectrometry for the study of oxidative DNA damage", Center for Eco-Environmental Sciences, Chinese Academy of Sciences, China, Oct. 22, 2006.
- 20) "Chemistry and biology of novel oxidative intrastrand crosslink lesions of DNA", Department of Chemistry, Peking University, China, Oct. 23, 2006.
- 21) "Chemistry and biology of novel oxidative intrastrand crosslink lesions of DNA", Department of Chemistry, Tsinghua University, China, Oct. 25, 2006.
- 22) "Chemistry and biology of novel oxidative intrastrand crosslink lesions of DNA", Department of Chemistry, Texas A&M University, May 1, 2007.
- 23) "Chemistry and biology of novel oxidative intrastrand crosslink lesions of DNA", Department of Chemistry and Biochemistry, University of Texas at Austin, May 3, 2007.
- 24) "Oxidative Intrastrand Crosslink Lesions: Formation, Replication, and Repair", Beckman Research Institute, The City of Hope, May 24, 2007.
- 25) "Oxidative Intrastrand Crosslink Lesions: From Speculation to Reality", Department of Chemistry, Boston University, August 17, 2007.
- 26) "Oxidative Intrastrand Crosslink Lesions: Formation, Replication, and Repair", Department of Chemistry, University of Missouri at Rolla, December 3, 2007.
- 27) "Post-translational Modifications of Acid-soluble Proteins", Department of Chemistry, St. Louis University, December 4, 2007.
- 28) "Oxidative Intrastrand Crosslink Lesions: From Speculation to Reality", Department of Chemistry and Biochemistry, University of Missouri, St. Louis, December 5, 2007.
- 29) "Oxidative Intrastrand Crosslink Lesions: From Speculation to Reality", Department of Chemistry, University of Kansas, December 7, 2007.
- 30) "Mass Spectrometry for the Study of the Post-translational Modifications of Chromosomal Proteins", Department of Chemistry and Biochemistry, University of California, Los Angeles, April 25, 2008.
- 31) "Chemistry and Biology of DNA Damage Induced by Reactive Oxygen and Reactive Carbonyl Species", Department of Chemistry, Johns Hopkins University, April 29, 2008.
- 32) "Chemistry and Biology of DNA Damage Induced by Reactive Oxygen and Reactive Carbonyl Species", Distinguished Lecture Series, Department of Chemistry, Hong Kong Baptist University, May 20, 2008.

- 33) "Mass Spectrometry for Assessing the Post-translational Modifications of Proteins", Distinguished Lecture Series, Department of Chemistry, Hong Kong Baptist University, May 22, 2008.
- 34) "Chemistry and Biology of DNA Damage Induced by Reactive Oxygen and Reactive Carbonyl Species", Department of Chemistry, University of Connecticut, October 08, 2008.
- 35) "Chemistry and Biology of DNA Damage Induced by Reactive Oxygen and Reactive Carbonyl Species", Department of Chemistry and Biochemistry, University of Ohio, November 10, 2008.
- 36) "Mass Spectrometry for the Examination of Oxidative Intrastrand Crosslink Lesions of DNA: Structure Elucidation, Quantification and Replication Studies", Department of Chemistry, Wuhan University, China, August 02, 2010.
- 37) "Mass Spectrometry for Unraveling the Molecular Mechanisms of Action of Anti-cancer Drugs", Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian, China, August 4, 2010.
- 38) "LC-MS/MS for Assessing the Replication of Hyperglycemia-induced DNA Lesions in Cells", College of Chemistry and Molecular Engineering, Peking University, China, August 12, 2010.
- 39) "Unraveling Novel Molecular Mechanisms of Action of Anti-cancer Drugs", Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, China, August 12, 2010.
- 40) "Formation, Replication, and Repair of Oxidatively Generated DNA Lesions", The City of Hope Cancer Center, October 11, 2010.
- 41) "Chemistry and Biology of Oxidatively Induced DNA Lesions", Department of Chemistry and Biochemistry, University of Delaware, November 1, 2010.
- 42) "Chemistry and Biology of Oxidatively Induced DNA Lesions", Department of Chemistry, New York University, November 2, 2010.
- 43) "Chemistry and Biology of Oxidatively Induced DNA Lesions", Department of Chemistry, North Carolina State University, November 4, 2010.
- 44) "Mass spectrometry for the quantification, replication, transcription, and repair studies of bulky DNA lesions induced by reactive oxygen species", Department of Chemistry, University of California Davis, March 29, 2011.
- 45) "Detection and in-vivo replication and repair studies of bulky DNA lesions induced by reactive oxygen species", Department of Chemistry, University of the Pacific, March 30, 2011.
- 46) "Chemistry and Biology of DNA Carboxyalkylation", Department of Chemistry, Zhejiang University, China, April 14, 2011.
- 47) "Post-translational modifications of acid-soluble proteins", Department of Chemistry, Nanjing University, China, April 18, 2011.
- 48) "Chemistry and Biology of Ionizing Radiation-induced Bulky DNA Lesions", Institute of Technological Biology and Agricultural Engineering, Chinese Academy of Sciences, October 10, 2011.
- 49) "Mass Spectrometry for the Study of Repair and Transcription Mutagenesis of DNA Lesions", Wuhan University, China, October 13, 2011.

- 50) "Mass Spectrometry for the Study of Protein Methylation", Midwest Mass Spectrometry Discussion Group, Washington University, St. Louis, October 26, 2011.
- 51) "Chemistry and Biology of DNA Damage Induced by Reactive Oxygen and Carbonyl Species", Department of Chemistry, Washington University, St. Louis, October 27, 2011.
- 52) "Mass Spectrometry for the Assessment of the Formation, Replication, Repair and Transcription Mutagenesis of DNA Lesions", Center for Molecular Toxicology, Vanderbilt University, Nashville, TN, October 28, 2011.
- 53) "Chemistry and Biology of DNA Damage Induced by Reactive Oxygen Species", Cedars Sinai Medical Center, Los Angeles, February 16, 2012.
- 54) "Quantitative Proteomics for Unraveling the Mechanisms of Action of Antitumor Agents", School of Pharmacy, University of New Mexico, Albuquerque, April 9, 2012.
- 55) "Chemistry and Biology of Oxidatively Induced Bulky DNA Lesions", Elkin Lecture, Winship Cancer Institute, Emory University, Atlanta, April 27, 2012.
- 56) "Chemical Biology of Oxidatively Induced Bulky DNA Lesions", Department of Biochemistry and Molecular Biology, University of Louisville, Louisville, April 30, 2012.
- 57) "Quantitative Proteomics for Unraveling the Mechanisms of Action of Antitumor Drugs and Environmental Toxicants", State Key Laboratory of Marine Environmental Science, Xiamen University, China, June 26, 2012.
- 58) "Chemical Biology of Oxidatively Induced DNA Lesions", Department of Biochemistry and Molecular Biology, George Washington University, July 17, 2012.
- 59) "Chemical Biology of Oxidatively Induced DNA Lesions", Department of Chemistry, Purdue University, September 4, 2012.
- 60) "Chemical Biology of Oxidatively Induced Bulky DNA Lesions", Department of Chemistry and Biochemistry, University of Wisconsin-Milwaukee, September 14, 2012.
- 61) "Chemical Biology of Oxidatively Induced Bulky DNA Lesions", Shanghai Institute of Biochemistry and Cell Biology, Chinese Academy of Sciences, October 24, 2012.
- 62) "Chemistry and Biology of Oxidatively Induced Bulky DNA Lesions", Department of Chemistry and Biochemistry, University of California, San Diego, March 11, 2013.
- 63) Curing cancer: How do anticancer drugs work? *2013 Science Lecture Series*, University of California Riverside, May 16, 2013.
- 64) "Quantitative Proteomics for Unraveling Novel Mechanisms of Action of Anti-cancer Drugs and Environmental Toxicants", Department of Chemistry, Wuhan University, China, July 11, 2013.
- 65) "Quantitative Proteomics for Unraveling Novel Mechanisms of Action of Anti-cancer Drugs and Environmental Toxicants", Department of Chemistry, Shaanxi Normal University, China, July 22, 2013.
- 66) "Quantitative Proteomics for Unraveling Novel Mechanisms of Action of Anti-cancer Drugs and Environmental Toxicants", Department of Chemistry, University of Redlands, October 1, 2013.
- 67) "Post-translational Regulation of DNA Repair", Institute of Chemistry, Academic Sinica, Taiwan, October 31, 2013.
- 68) "Chemical Biology of Oxidatively Induced Bulky DNA Lesions", Genome Research Center, Academic Sinica, Taiwan, October 31, 2013.

- 69) “Quantitative Proteomics for the Discovery of Targets for Anti-cancer Therapy”, University of California Davis Cancer Center, November 21, 2013.
- 70) “Quantitative Proteomics for the Unraveling the Molecular Mechanisms of Action of Anticancer Drugs and Environmental Toxicants”, Department of Chemistry and Biochemistry, University of California Los Angeles, January 17, 2014.
- 71) “Chemistry and Biology of DNA Repair”, Biochemistry and Molecular Biophysics Graduate Program, University of Pennsylvania, January 24, 2014.
- 72) “Quantitative Proteomics for the Unraveling the Molecular Mechanisms of Action of Anticancer Drugs and Environmental Toxicants”, High Magnetic Field Laboratory, Chinese Academy of Sciences, April 15, 2014.
- 73) “Quantitative Proteomics for the Unraveling the Molecular Mechanisms of Action of Anticancer Drugs and Environmental Toxicants”, School of Life Sciences, University of Science and Technology of China, April 16, 2014.
- 74) “Quantitative Proteomics for the Unraveling the Molecular Mechanisms of Action of Anticancer Drugs and Environmental Toxicants”, School of Medicine, Loma Linda University, May 29, 2014.
- 75) “Quantitative Proteomics for Research in Cancer Biology and Environmental Toxicology”, Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, China, June 25, 2014.
- 76) “Quantitative Proteomics for Proteome-wide Studies of Nucleotide-binding Proteins”, High Magnetic Field Laboratory, Chinese Academy of Sciences, Hefei, China, June 27, 2014.
- 77) “Quantitative Proteomics for Research in Cancer Biology and Environmental Toxicology”, Department of Biochemistry, University at Buffalo, August 26, 2014.
- 78) “Chemistry and Biology of DNA Repair”, Medical Research Council Laboratory of Molecular Biology, Cambridge, United Kingdom, September 4, 2014.
- 79) “Chemistry and Biology of DNA Repair”, Department of Chemistry, York University, Toronto, Canada, September 25, 2014.
- 80) “Chemistry and Biology of DNA Repair”, Scripps Florida, November 5, 2014.
- 81) “Chemistry and Biology of DNA Repair”, Department of Pharmacology and Toxicology, University of Texas Medical Branch at Galveston, November 6, 2014.
- 82) “Quantitative Proteomics for Research in Cancer Biology and Environmental Toxicology”, Department of Chemistry and Biochemistry, University of Texas Arlington, November 7, 2014.
- 83) “Chemistry and Biology of DNA Repair”, Department of Environmental Medicine, New York University, December 15, 2014.
- 84) “Cyclopurine Lesions as Robust Biomarkers of Oxidative Stress”, Department of Medicine, Albert Einstein College of Medicine, December 16, 2014.
- 85) “Chemistry and Biology of Tet-mediated Oxidation of 5-Methylcytosine”, Department of Chemistry, Wuhan University, China, June 8, 2015.
- 86) “Chemistry and Biology of DNA Repair”, Department of Chemistry, University of Science and Technology of China, June 9, 2015.

- 87) "Chemistry and Biology of Oxidatively Induced Bulky DNA Lesions", Department of Chemistry, Hong Kong University of Science and Technology, June 11, 2015.
- 88) "Quantitative Proteomics for Assessing the Molecular Mechanisms of Action of Anti-cancer Drugs and Environmental Toxicants", Department of Applied Biology and Chemical Technology, Hong Kong Polytechnic University, June 12, 2015.
- 89) "Chemistry and Biology of DNA Repair", MGH/Harvard Cutaneous Biology Research Center, Massachusetts General Hospital and Harvard School of Medicine, August 17, 2015.
- 90) "Chemistry and Biology of Oxidatively Induced DNA Lesions", Beijing Institute of Chemistry, Chinese Academy of Sciences, September 23, 2015.
- 91) "Occurrence, Repair and Biological Consequences of Oxidatively Induced DNA Lesions", Department of Medicinal Chemistry, University of Toledo, October 1, 2015.
- 92) "Chemistry and Biology of the Occurrence and Biological Consequences of DNA Damage", Department of Chemistry and Biochemistry, Wayne State University, October 2, 2015.
- 93) "Chemistry and Biology of DNA Damage and Repair", Institute of Biomedical Sciences, Fudan University, October 30, 2015.
- 94) "Chemistry and Biology of DNA Damage and Repair", Department of Chemistry, Brown University, November 13, 2015.
- 95) "Chemistry and Biology of DNA Repair", School of Pharmacy, University of Arizona, December 15, 2015.
- 96) "Chemistry and Biology of DNA Repair", Department of Chemistry and Biochemistry, University of Texas, El Paso, January 29, 2016.
- 97) "Occurrence, Biological Consequences and Repair of DNA Lesions", Department of Chemistry, University of South Florida, March 31, 2016.
- 98) "Novel Shuttle Vector Methods for Assessing the Repair and Biological Consequences of DNA Lesions in Cells", Department of Medicinal Chemistry, University of Minnesota, May 3, 2016.
- 99) "Occurrence, Repair and Biological Consequences of DNA Damage", Department of Chemistry, Nanjing University, China, May 23, 2016.
- 100) "Chemistry and Biological Consequences of DNA Modifications", Department of Chemistry, Wuhan University, China, May 24, 2016.
- 101) "Chemistry and Biology of Nucleotide- and Nucleic Acid-binding Proteins", Department of Chemistry, Nankai University, China, May 25, 2016.
- 102) "Chemistry and Biology of DNA Repair", Department of Chemistry, Shandong University, China, May 26, 2016.

Invited Oral Presentations Made at Conferences:

Affiliation: University of California at Riverside:

- (1) Wang, Y. Toward the understanding of fragmentation of modified oligodeoxynucleotides. *2002 Lake Arrowhead conference on ion chemistry and mass spectrometry*, Jan. 25-27, 2002, Lake Arrowhead, CA.
- (2) Wang, Y.; Liu, Z.; and Zhang, Q. "Top-down" and "bottom-up" approaches for the study of oxidative DNA damage by mass spectrometry. *LabAutomation 2003*, Feb 1-5, 2003, Palm Springs, CA.
- (3) Wang, Y.; Liu, Z.; and Zhang, Q. Identification and characterization of a novel crosslink lesion in d(CpC). *51th ASMS conference on mass spectrometry and allied topics*, Jun. 8-13, 2003, Montreal, CA.
- (4) Wang, Y.; Zhang, Q.; and Zeng, Y. Mass spectrometry as a major technique for the discovery of novel oxidative crosslink lesions of DNA *2004 Lake Arrowhead conference on ion chemistry and mass spectrometry*, Jan. 16-18, 2004, Lake Arrowhead, CA.
- (5) Wang, Y.; Zhang, Q.; Gu, C.; Zeng, Y. Identification, structure elucidation, and in vitro replication studies of novel oxidative crosslink lesions of DNA, *227th ACS National Meeting*, Philadelphia, PA, August 22-26, 2004.
- (6) Wang, Y. Mass spectrometry for the discovery of novel oxidative crosslink lesions of DNA, *228th ACS National Meeting*, San Diego, CA, March 13-17, 2005.
- (7) Wang, Y. Photocaged radicals for the studies of oxidative DNA damage, *11th Congress of the European Society for Photobiology*, Aix-les-Bains, France, September 3-9, 2005.
- (8) Wang, Y.; Hong, H.; Zeng, Y.; Gu, C. Identification and quantifications of novel intrastrand crosslink lesions of DNA by mass spectrometry. *40th Western Regional Meeting of the American Chemical Society*, Anaheim, CA, United States, January 22-25, 2006.
- (9) Wang, Y.; Hong, H.; Gu, C.. New developments on the study of oxidative intrastrand crosslink lesions. *232nd ACS National Meeting*, San Francisco, CA, Sept. 10-14, 2006.
- (10) Wang, Y. Chemistry and biology of novel oxidative intrastrand crosslink lesions of DNA. *3rd International Symposium on Persistent Toxic Substances*, Beijing, China, Oct. 22-25, 2006.
- (11) Wang, Y.; Hong, H.; Gu, C. Mass spectrometry for the identification and quantification of new types of oxidative DNA lesions. *234th ACS National Meeting*, Boston, MA, Aug. 19-23, 2007.
- (12) Wang, Y. Mass spectrometry for the structure elucidation, quantification, and replication studies of oxidative intrastrand crosslink lesions of DNA. *2007 Shanghai Symposium on Biomedical Sciences*, Shanghai, China, Oct. 25, 2007.
- (13) Wang, Y. Post-translational modifications of acid-soluble proteins. *XIVth DICP Symposium on Microscale Bioseparation*, Dalian, China, Oct. 28-29, 2007.
- (14) Wang, Y. Mass spectrometry for DNA and RNA adduct analysis: An overview. *56th ASMS Conference on Mass Spectrometry and Allied Topics*, Jun. 1-5, 2008, Denver, CO.
- (15) Wang, Y. Efficient and accurate bypass of a minor-groove DNA adduct by DinB DNA polymerase *in vitro* and *in vivo*. *236th ACS National Meeting*, Philadelphia, PA, August 17-21, 2008.
- (16) Wang, Y. Chemistry and biology of complex lesions induced by reactive oxygen species. *8th Winter Research Conferences on Oxidative DNA Damage: From Chemical Aspects to Biological Consequences*, Les Houches, France, January 18-23, 2009.

- (17) Wang, Y. SILAC and mass spectrometry for the assessment of effects of arsenite on the global protein expression in the human HL-60 cells. *57th ASMS Conference on Mass Spectrometry and Allied Topics*, May 31-June 4, 2009, Philadelphia, PA.
- (18) Wang, Y. LC-MS/MS for studying DNA replication in cells. *The 2nd Canada-China Symposium on Bioanalytical Chemistry*, October 15-16, 2009, Beijing, China.
- (19) Wang, Y. LC-MS/MS for studying DNA replication in cells. *The 24th International Symposium on MicroScale Bioseparations*, October 19-22, 2009, Dalian, China.
- (20) Wang, Y. Pharmacoproteomic profiling for unraveling the molecular mechanisms of anticancer drugs. *International Conference on Frontiers in Prevention, Diagnosis, and Therapy of Cancer*, November 21-22, 2009, Allahabad, India.
- (21) Wang, Y. Novel molecular mechanism of action of thiopurine drugs. *58th ASMS Conference on Mass Spectrometry and Allied Topics*, May 23-27, 2010, Salt Lake City, UT.
- (22) Wang, Y. Formation and in-vivo replication studies of bulky DNA lesions induced by reactive oxygen species. *240th ACS National Meeting*, Boston, MA, August 22-26, 2010.
- (23) Wang, Y. Novel LC-MS method for assessing the formation, replication, repair and transcription mutagenesis of bulky DNA lesions induced by reactive oxygen species. *2011 Pittcon*, Atlanta, GA, March 13-17, 2011.
- (24) Wang, Y. Chemical biology for functional proteomics studies. *7th CNHUPO Annual Congress and 3rd International Forum of Proteomics*, Hangzhou, China, April 15-18, 2011.
- (25) Wang, Y. LC-MS/MS for assessing the repair of purine cyclonucleosides in human cells. *59th ASMS Conference*, Denver, Colorado, June 5 - 9, 2011.
- (26) Wang, Y. LC-MS/MS for assessing the formation, repair, and transcription mutagenesis of purine cyclonucleosides. *242nd ACS National Meeting & Exposition*, Denver, CO, August 28-September 1, 2011.
- (27) Wang, Y. Novel molecular mechanism of action of thiopurine drugs. *Wisconsin Human Proteomics Symposium: Proteomics Technologies and Applications to Human Disease*, Madison, WI, August 4-6, 2011.
- (28) Wang, Y. Chemistry and biology of oxidatively induced purine cyclonucleosides. *8th Beijing Conference and Exhibition for Instrumental Analysis*, Beijing, China, October 13-16, 2011.
- (29) Wang, Y. Chemistry and biology of oxidatively induced bulky DNA lesions. *3rd World Chinese Conference of Mass Spectrometry*, Tainan, Taiwan, June 28-30, 2012.
- (30) Wang, Y. Chemistry and biology of endogenous oxidatively induced DNA lesions. *244th ACS National Meeting & Exposition*, Philadelphia, PA, United States, August 19-23, 2012.
- (31) Wang, Y. Chemistry and biology of oxidatively induced bulky DNA lesions. *58th Annual Meeting of the Radiation Research Society*, Puerto Rico, United States, September 30-October 3, 2012.
- (32) Wang, Y. Quantitative proteomics for unraveling novel mechanisms of action of anti-tumor drugs and environmental toxicants. *28th International Symposium on MicroScale Bioseparations and Analyses*, Shanghai China, October 21-24, 2012.
- (33) Wang, Y. Mass spectrometry for the structure elucidation, quantification and assessing the biological consequences of DNA damage, Plenary Lecture for the Biemann Medal, *60th ASMS Conference*, Minneapolis, Minnesota, June 9 - 13, 2013.

- (34) Wang, Y. Chemistry and biology of oxidatively induced bulky DNA lesions. *The 9th SINO - US Chemistry Professors Conference*, Chengdu, Sichuan, China, July 12-14, 2013.
- (35) Wang, Y. Arsenite induces genomic instability by targeting RING finger histone E3 ubiquitin ligases. *The 14th SCBA International Symposium*, Xi'an, Shaanxi, China, July 18-22, 2013.
- (36) Wang, Y. Arsenite induces compromised DNA double-strand break repair through direct binding to histone E3 ubiquitin ligases. *The 10th International Symposium on Persistent Toxic Substances*, Edmonton, Alberta, Canada, August 13-17, 2013.
- (37) Wang, Y. Arsenite induces compromised DNA double-strand break repair through direct binding to histone E3 ubiquitin ligases. *246th ACS National Meeting & Exposition*, Indianapolis, Indiana, United States, September 8-12, 2013.
- (38) Wang, Y. Arsenite induces compromised DNA double-strand break repair through direct binding to histone E3 ubiquitin ligases. *29th Asilomar Conference: Mass Spectrometry in Environmental Chemistry, Toxicology, and Health*, Pacific Grove, CA, October 18 - 22, 2013.
- (39) Wang, Y. Mass spectrometry for the study of the biological consequences of DNA damage. *Mass Spectrometry for Clinical Diagnosis and Related Research Symposium*, Kaohsiung, Republic of China, November 2-3, 2013.
- (40) Wang, Y. Mass spectrometry for assessing the occurrence and biological consequences of oxidatively induced tandem DNA lesions. *Eastern Analytical Symposium & Exposition*, Somerset, NJ, November 18-20, 2013.
- (41) Wang, Y. Cyclopurine lesions as biomarkers for oxidative stress. *248th ACS National Meeting & Exposition*, San Francisco, CA, August 10-14, 2014.
- (42) Wang, Y. Translesion synthesis of minor-groove DNA lesions. *Zing Conference on DNA Polymerases*, Cambridge, United Kingdom, August 31-September 4, 2014.
- (43) Wang, Y. Mass spectrometry for investigating the occurrence, biological consequences and repair of oxidatively induced bulky DNA lesions. Plenary Lecture, The 17th Annual General Meeting of the Hong Kong Society of Mass Spectrometry, Hong Kong, China, June 13, 2015.
- (44) Wang, Y. Occurrence, Biological Consequences and Repair of Oxidatively Induced 8,5'-Cyclopurine Lesions, Zing Conference on Genomic Integrity, Cairns, Australia, August 1-5, 2015.
- (45) Wang, Y. Novel Shuttle Vector Methods for Assessing the Repair and Biological Consequences of DNA Lesion in Cells. *250th ACS National Meeting & Exposition*, Boston, MA, August 16-20, 2015.
- (46) Wang, Y. LC-MRM for Interrogating the Human Kinome. *HPLC 2015*, Beijing, China, September 22-24, 2015.
- (47) Wang, Y. LC-MS/MS-based Shuttle Vector Methods for Assessing the Biological Consequences of DNA Lesions. *16th Beijing Conference and Exhibition on Instrumental Analysis*, Beijing, China, October 27-29, 2015.
- (48) Wang, Y. Occurrence, Biological Consequences and Repair of Oxidatively Induced Cyclopurine Lesions. *The 6th International Conference on Nucleic Acid-Protein Chemical and Structural Biology for Drug Discovery*, Chengdu, China, May 26-28, 2016.

- (49) Wang, Y. Occurrence, Occurrence, Biological Consequences and Repair of Oxidatively Induced Cyclopurine Lesions. *The 7th International Symposium on Bioanalysis, Biomedical Engineering and Nanotechnology*, Changsha, May 27-29, 2016.
- (50) Wang, Y. Novel Shuttle Vector Methods for Assessing the Repair and Biological Consequences of DNA Lesions in Cells. *DNA Metabolism, Genomic Stability and Diseases*, Suzhou, China. June 13-17, 2016.
- (51) Wang, Y. Occurrence, Repair, and Biological Consequences of Oxidatively Induced Cyclopurine Lesions. *HPLC 2016*, San Francisco, CA, June 19-24, 2016.
- (52) Wang, Y. Novel Shuttle Vector Methods for Assessing the Repair and Biological Consequences of DNA Lesions in Cells. *2016 Telluride Workshop on Nucleic Acid Chemistry*, Telluride, CO. July 25-29, 2016.

Trainees:

Graduate Students

Name	Ph. D.	Time	Current Position
Xinzhao Jiang	X	09/01-04/06	Senior Manager, Amgen Inc.
Qibin Zhang	X	03/02-05/05	Associate Professor, UNC Greensboro
Yuesong Wang	X	09/01-06/06	Chemist, Food and Drug Administration
Yan Zou	X	08/02-03/07	Manager, Collaboration Projects, iCMC-NPP, Sanofi US
Yu Zeng	X	08/02-03/07	Scientist, Alnylam Pharmaceuticals
Chunang Gu	X	08/02-03/07	Scientist, Genentech Inc.
Lijie Men	X	08/02-03/07	Scientist, Johnson & Johnson
Yuan Gao	X	05/03-02/08	Scientist, Novo Nordisk, Beijing
Haizheng Hong	X	08/03-12/07	Associate Professor, Xiamen University
Qingchun Zhang	X	08/03-02/08	Scientist, Amgen Inc.
Haibo Qiu	X	08/04-03/09	Scientist, Regeneron Pharmaceuticals Inc.
Yong Jiang	X	08/04-11/09	Post-doc, Emory University
Mario Vargas	X	08/05-03/12	
Hongxia Wang	X	08/05-08/10	Application Chemist, Thermo Fisher Scientific
Lei Xiong	X	08/06-02/11	Applied Biosystems
Jianshuang Wang	X	01/08-03/11	Associate Scientist, Genentech Inc.
Nisana Andersen	X	09/07-09/13	Associate Scientist, Genentech Inc.
Renee Williams	X	09/07-12/12	Johnson & Johnson
Fan Zhang	X	09/08-09/13	Scientist, Amgen Inc.
Candace Guerrero	X	09/08-06/14	Postdoc, University of Minnesota
Yongsheng Xiao	X	07/09-03/14	Scientist, Biogen

Name	Ph. D.	Time	Current Position
Ashley Swanson	X	08/09-06/14	Postdoc, NIH
Qian Cai	X	08/09-12/14	Genentech Inc.
Lijuan Fu	X	08/09-05/15	Covance, Inc.
Shuo Liu	X	08/10-11/15	Postdoc at Stanford Univ.
Lei Guo	X	08/10-03/15	Biochemistry and Bioanalytics Group, Translational Science, Sanofi US
Preston Williams	X	08/11-present	
Zi Wang	MS	08/11-08/16	
Pengcheng Wang	X	08/11-present	
Yang Yu	X	08/12-present	
Ji Jiang	X	09/12-present	
Ming Huang	X	09/13-present	
Nicole Williams	X	08/13-present	
Yuxiang Cui	X	08/14-present	
Jiabin Wu	X	08/14-present	
Weili Miao	X	08/14-present	
Lok Ming Tam	X	08/14-present	
Gwendolyn Gonzalez	X	06/15-present	
David Bade	X	07/15-present	

Post-doctoral Fellows

Name	Time in Group	Current Position

Name	Time in Group	Current Position
Shetty Vivekananda	08/01-09/02	Assistant Professor, Baylor College of Medicine
Zhenjiu Liu	12/01-06/03	Scientist, Pfizer
Liyan Ping	09/07-02/08	Junior Group Leader at Max Plank Institute of Chemical Ecology
Huachuan Cao	02/04-12/08	Scientist, Eli Lilly
Bifeng Yuan	07/07-02/11	Professor of Chemistry, Wuhan University, China
Jiang Wu	09/09-08/10	Assistant Professor, Nanjing University, China
Xiaoli Dong	08/09-07/11	Agilent
Jin Wang	08/09-07/12	Postdoc at National University of Singapore
Changjun You	10/09-present	
John Prins	08/10-09/13	Analytical Chemist, Tyco International
Xiaoxia Dai	03/11-present	
Debin Ji	06/12-05/14	Postdoc, Stanford University
Qianqian Zhai	07/12-09/14	Lecturer, Huazhong Agricultural University, China
Nicholas Amato	07/13-12/15	Scientist, Moderna Therapeutics
Tao Bing	03/14-02/15	Associate Professor, Institute of Chemistry, Chinese Academy of Sciences
Jun Wu	07/14-present	
Xiaogang Jiang	12/14-11/15	Associate Professor, Suzhou University
Nathan Price	01/15-present	
Lin Li	01/15-present	
Lijuan Fu	06/15-08/15	Covans, Inc.
Jiapeng Leng	02/16-present	
Tianlu Wang	04/16-present	
Rong Cai	07/16-present	

Undergraduate Students

	Time
Judith Padilla	08/01-12/01
Erica Winter	09/01-06/02
Dahn Chi	09/02-06/03
Kaleb Dixon	09/02-06/03
Dena Witthaus	03/02-06/03
Jina Wang	06/03-03/04
Kieu Nguyen	09/03-12/03
Chelsea Gustafson	06/05-09/05
Avi Perma	06/05-08/06
Tan-li Hsu	02/07-06/10
Andrew Lin	02/07-12/08
Felicia Pranata	02/07-06/09
Karen Zhong	09/11-06/12
Audrey Tu	09/11-06/12
Stephen Torres	03/11-12/11

Min Xue, Ph.D.

Assistant Professor of Chemistry
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Educational Background

University of California, Los Angeles 2008-2013

Ph.D. in Chemistry, Advisor: Prof. Jeffrey I. Zink

California Institute of Technology 2013-2015

Postdoctoral Scholar, Advisor: Prof. James R. Heath

Personal Statement

My research experience covers a broad spectrum of fields, including supramolecular chemistry, nanoparticle engineering, applied spectroscopy, bioanalytical chemistry, systems biology and nanomedicine. Currently, the premise of my research is to study the supramolecular properties of peptides, and to explore their biomedical applications. Specific research interests are: 1) Designing supramolecular peptides that are capable of binding to specific proteins. The goal is to seek inhibitors for previously undruggable protein targets and establish new therapeutics; 2) Develop functional peptides as the basis of novel bioanalytical methods, and implement these methods to map the dynamics of cell signaling pathways. This will help us to decode the mechanisms behind disease progression and drug resistance; and 3) Constructing nanoparticles for biological applications. This includes, and is not limited to, developing nanoparticles for cancer immunotherapy, cardiovascular disease therapies and bio-imaging probes.

Contributions to Science and Selected Publications

1. Supramolecular Nanovalves for Controlled Release and Chemical Sensing

Upon stimulation, many supramolecular structures undergo large-amplitude motions, such as isomerization, structural reorganization, and components disassociation. When these supramolecular complex are grafted at the opening of nanopores, they are able to control the access to the pore, and therefore control the release of cargo molecules from the pore. This type of structure is termed nanovalve. I have developed several types of stimuli-responsive nanovalves. These nanovalves are shown to be useful building blocks for smart drug delivery systems as well as chemical sensors.

- a. **M. Xue**, X. Zhong, S. Zory, Y. Qu, F. Tamanoi, X. Duan, and J. I. Zink, "pH-Operated Mechanized Porous Silicon Nanoparticles," *Journal of the American Chemical Society*, vol. 133, 8798-8801, **2011**. PMID: 21595466, PMCID: PMC3431915.
- b. **M. Xue**, D. Cao, J. F. Stoddart, and J. I. Zink, "Size-Selective pH-Operated Megagates on Mesoporous Silica Materials," *Nanoscale*, vol. 4, 7569-7574, **2012**. PMID: 23108219, PMCID: PMC3884833.
- c. **M. Xue** and J. I. Zink, "An Enzymatic Chemical Amplifier Based on Mechanized Nanoparticles," *Journal of the American Chemical Society*, vol. 135, 17659-17662, **2013**. PMID: 24224766, PMCID: PMC3898706.
- d. M. D. Yilmaz, **M. Xue** (co-first author), M. W. Ambrogio, O. Buyukcakil, Y. Wu, M. Frasconi, X. Chen, M. S. Nassar, J. F. Stoddart, and J. I. Zink, "Sugar and pH Dual-Responsive Mesoporous Silica Nanocontainers Based on Competitive Binding Mechanisms," *Nanoscale*, vol. 7, 1067-1072, **2015**. PMID: 25475070.

2. Silica-Based Versatile Drug Delivery Platforms

A key challenge for improving the efficacy of passive drug delivery to tumor sites by a nanocarrier is to limit reticuloendothelial system uptake and to maximize the enhanced permeability and retention effect. Traditional silica-based nanoparticles have a size around 120 nm, which often times is too large for effective in vivo drug delivery. With my expertise in nanoparticle synthesis and surface chemical modification, I have developed much smaller silica nanoparticles (30-50 nm) that lead to greatly improved biodistribution profiles and better therapeutic outcome. Meanwhile, my efforts in combining supramolecular nanovalves with silica nanoparticles have yielded in many different types of stimuli-responsive drug delivery systems that have demonstrated unprecedented efficacies in treating various diseases, including cancer, infectious disease and respiratory system diseases.

- a. H. Meng, **M. Xue** (co-first author), T. Xia, Z. Ji, D. Y. Tarn, J. I. Zink, and A. E. Nel, "Use of Size and a Copolymer Design Feature To Improve the Biodistribution and the Enhanced Permeability and Retention Effect of Doxorubicin-Loaded Mesoporous Silica Nanoparticles in a Murine Xenograft Tumor Model," *ACS Nano*, vol. 5, 4131-4144, **2011**. PMID: 21524062, PMCID: PMC3905975.
- b. D. L. Clemens, B.-Y. Lee, **M. Xue**, C. R. Thomas, H. Meng, D. P. Ferris, A. E. Nel, J. I. Zink, and H. A. Marcus, "Targeted Intracellular Delivery of Anti-tuberculosis Drugs to Mycobacterium Tuberculosis-Infected Macrophages via Functionalized Mesoporous Silica Nanoparticles," *Antimicrobial Agents and Chemotherapy*, vol. 56, 2535-2545, **2012**. PMID: 22354311, PMCID: PMC3346638.
- c. X. Li, **M. Xue**, O. G. Raabe, H. L. Aaron, E. A. Eisen, J. E. Evans, F. A. Hayes, S. Inaga, A. Tagmout, M. Takeuchi, C. Vulpe, J. I. Zink, S. H. Risbud, and K. E. Pinkerton, "Aerosol Droplet Delivery of Mesoporous Silica Nanoparticles: A strategy for Respiratory-Based Therapeutics," *Nanomedicine*, vol. 11, 1377-1385, **2015**. PMID: 25819886, PMC4494876.

3. Spectroscopic Methods for Probing Microenvironment at Nanoscale

Aside from the control release applications, supramolecular nanovalves also provide unique opportunities to probe nanoscale microenvironments. On this basis, I have employed spectroscopic methods that when combined with the nanovalves, are capable of providing detailed information on the molecular mobility as well as local environment rigidity inside a nanopore. This technology provides the basis of kinetically studying protein properties, which is one of my current research directions.

- a. **M. Xue** and J. I. Zink, "Probing the Microenvironment in the Confined Pores of Mesoporous Silica Nanoparticles," *The Journal of Physical Chemistry Letters*, vol. 5, 839-842, **2014**. PMID: 24803992, PMCID: PMC3985790.

4. Chemical Methods for Integrated Single Cell Analysis

One of the challenges for single cell studies is to simultaneously quantify analytes of different categories, for instance, proteins and metabolites. To overcome this challenge, I have devoted into developing integrated single cell assays using surface chemistry and supramolecular chemistry. I have established several orthogonal chemical probes that can quantify different metabolites. Combined with BioMEMS platforms for protein measurements, these probes lead to integrated single cell metabolic/proteomic assays that provide unprecedentedly rich information on cellular heterogeneity.

- a. **M. Xue**, W. Wei, Y. Su, D. Johnson and J. R. Heath "Supramolecular Probes for Assessing Glutamine Uptake Enable Semi-Quantitative Metabolic Models in Single Cells," *Journal of the American Chemical Society*, vol. 138, 3085-3093, **2016**.

- b. J. Yu, J. Zhou, A. Sutherland, W. Wei, Y.S. Shin, **M. Xue** and J.R. Heath " Microfluidics-Based Single-Cell Functional Proteomics for Fundamental and Applied Biomedical Applications." *Annual Review of Analytical Chemistry*, **7**, 17.1–17.21, **2014**. PMID 24896308.
- c. **M. Xue**, W. Wei, Y. Su, J. Kim, Y. S. Shin, W. X. Mai, D. A. Nathanson, and J. R. Heath, "Chemical Methods for the Simultaneous Quantitation of Metabolites and Proteins from Single Cells," *Journal of the American Chemical Society*, vol. 137, 4066-4069, **2015**. PMID: 25789560
- d. W. Wei, Y.S. Shin, **M. Xue**, T. Matsutani, K. Masui, H. Yang, Y. Gu, H. Ken, X. Ding, K. Hwang, J. Kim, J. Zhou, X. Li, B. Bonetti, R. Chopra, C.D. James, W.K. Cavenee, T.F. Cloughesy, P.S. Mischel, J.R. Heath and B. Gini "Single cell phosphoproteomics resolves adaptive signaling dynamics and informs targeted combination therapy in glioblastoma." *Cancer Cell*, in press.

5. Contribution to Other Nanotechnology Fields

In addition to biomedical-oriented research, I have also made significant contributions to other nanotechnology fields, especially in nanomaterial fabrication and photocatalysis. I have developed novel nanocomposites that exhibit great photocatalytic properties under visible light. These studies have led to 2 patents, on which I am the main inventor. I have also contributed in the development of inorganic/organic hybrid nanomaterials for chemical sensing and environmental detoxing purposes.

- a. **M. Xue**, L. Huang, J. Q. Wang, Y. Wang, L. Gao, J. H. Zhu, and Z. G. Zou, "The Direct Synthesis of Mesoporous Structured MnO₂/TiO₂ Nanocomposite: a Novel Visible Light Active Photocatalyst with Large Pore Size," *Nanotechnology*, vol. 19, 185604-185604, **2008**. PMID: 21825692.
- b. J. Q. Wang, L. Huang, **M. Xue**, L. Liu, Y. Wang, L. Gao, J. H. Zhu, and Z. G. Zou, "Developing a Novel Fluorescence Chemosensor by Self-assembly of Bis-Schiff Base within the Channel of Mesoporous SBA-15 for Sensitive Detecting of Hg²⁺ Ions," *Applied Surface Science*, vol. 254, 5329-5335, **2008**.
- c. J. Q. Wang, L. Huang, **M. Xue**, Y. Wang, L. Gao, J. H. Zhu, and Z. G. Zou, "Architecture of a Hybrid Mesoporous Chemosensor for Fe³⁺ by Covalent Coupling Bis-Schiff Base PMBA onto the CPTES-Functionalized SBA-15," *The Journal of Physical Chemistry C*, vol. 112, 5014-5022, **2008**.
- d. S. Chu, H. Y. Zhu, **M. Xue**, L. L. Luo, F. Kong, Y. Wang, and Z. G. Zou, "Synthesis of Mn and Se-Doping TiO₂ Mesoporous Materials and their Antibacterial Efficacy Under Visible Light Irradiation," *Advanced Materials Research*, vol. 287, 1852-1855, **2011**.

Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/myncbi/browse/collection/49408204/?sort=date&direction=ascending>

Biographical Sketches

Roya Zandi

Professional Preparation:

Ph. D. Physics, December 2001
University of California, Los Angeles (UCLA).

B.S. Physics, *summa cum laude*, December 1992
California State University, Northridge (CSUN).

Appointments:

July 2014 – present
Professor of Physics, University of California, Riverside.

July 2010 – June 2014
Associate Professor of Physics, University of California, Riverside.

July 2005 – June 2010
Assistant Professor of Physics, University of California, Riverside.

January 2002-September 2005
Postdoctoral scholar, Department of Chemistry and Biochemistry, (UCLA).

September 2002 – July 2005
Postdoctoral visitor, Department of Physics, Massachusetts Institute of Technology (MIT).

Summer 1997
Research Assistant in developing the UCLA physics department web site on “Contributions of 20th Century Women to Physics,”

Publications:

Five publications most relevant to proposed project:

1. Michael Hagan and Roya Zandi, "Recent advances in coarse-grained modeling of virus assembly," *Curr. Opin. Virol.* **18**, 36-43 (2016).
2. V. Sivanandam, D. Mathwes, R. Garmann, G. Erdemci- Tandogan, R. Zandi, and A. Rao, *Scientific Reports* **6**, 26328, (2016).
3. Jef Wagner and Roya Zandi, “The Robust Assembly of Small Symmetric Nanoshells,” *Biophys. J.* **109**, 956 (2015).
4. R. Kusters, H.-K Lin, R. Zandi, I. Tsvetkova, B. Dragnea, P. van der Schoot, “Role of Charge Regulation and Size Polydispersity in Nanoparticle Encapsulation by Viral Coat Proteins,” *Journal of Physical Chemistry B* **119** (5), 1869-1880 (2015).
5. Z. Yu, M. J. Dobro, A. Levandovsky, Cindy M. Danielson, V. Sandrin, J. Shi, C. Aiken, R. Zandi, T. J. Hope, G. J. Jensen ,“Unclosed HIV-1 Capsids Suggest a Curled Sheet Model of Assembly”, *JMB* **425**, 112-23 (2013).

Five other significant publications:

1. Dong Gui, Sharad Gupta, Jun Xu, Roya Zandi, Sarjeet Gill, I-Chueh Huang, A.L.N. Rao,

- and Umar Mohideen, “A novel minimal in vitro system for analyzing HIV-1 Gag mediated budding”, *Journal of Biological Physics* **41**, 135-149 (2014).
2. Antoni Luque, Roya Zandi and David Reguera, “Optimal architectures of elongated viruses”, *PNAS* **107**, 5323-8 (2010).
 3. Roya Zandi and Paul van der Schoot, “Size Regulation of ss RNA Viruses”, *Biophys. J.* **96**, 9-20 (2009).
 4. Artem Levandovsky and Roya Zandi, “Nonequilibrium assembly, retroviruses and conical shape,” *Phys. Rev. Lett.* **102**, 198102 (2009)
 5. Yufang Hu, Roya Zandi, Adriana Anavitarte, Charles M. Knobler, and William M. Gelbart, “Packaging of a Polymer by a Viral Capsid: The Interplay Between Polymer Length and Capsid Size”, *Biophys. J.* **94**, 1428-1436 (2008).

Awards and Honors:

- NSF Career Award 2007-2014.
- UC Regents’ Faculty Fellowship Award 2013-2014.
- UC President’s Postdoctoral Fellowship 2002-2004.
- UC Regents’ Faculty Fellowship Award 2008-2009.
- Dissertation Year Fellowship, UCLA 2000-2001.
- Research Mentorship Fellowship, UCLA 1999-2000.
- Outstanding Teaching Award, Physics Department, UCLA 1997-1998.
- Outstanding Scholarly and Research Work Award, Physics Department, UCLA Fall 1996-1997.
- Physics Department Fellowship, UCLA 1995-1996.
- Graduate Opportunity Fellowship, UCLA 1995-1996.
- Outstanding Senior Award, Physics Department, CSUN FALL 1992.
- Outstanding Junior Award, School of Science and Mathematics, CSUN, Spring 1991.

Synergistic Activities:

- Co-organizer of the workshop on “The Theory and Practice of Fluctuation-Induced Interactions” at the Kavli Institute for Theoretical Physics at the University of California, Santa Barbara, in the period 18 August - 21 November, 2008
- Co-organizer of “An Interdisciplinary Workshop on Physical Aspects of Viral Assembly and Infectivity” to be held at UCLA, in May 7-9 2009.
- Co-organizer of the topical session “Self-assembly at the Nanoscale” at the 87th ACS Colloid and Surface Science Symposium held at UCR, June 24-26 2013.
- Co-organizer of the workshop on “Physics and Mathematics of Viral Assembly,” held in Aspen Center for Physics, June 14-July 5 2014.
- Reviewer for: National Science Foundation, Physical Review E, Physical Review Letters, PNAS, EPJE, Physica A, Physical Biology, Royal Society: Phil Trans A, Chemical Physics Letters, Europhysics Letters, EPJD, Journal of Chemical Physics, Biophysical J., JMB, JOMB.
- Creation of the first graduate level biological physics course at UCR, Phys. 246.
- Creation of a series of undergraduate biological physics courses at UCR, Phys. 145A, 145B and 145C.

Research Support:

- “Physics of Virus Assembly: Energetics and Dynamics,” NSF–DMR, \$270,000, 09/15/2013-09/14/2017.
- “High Precision Casimir Force Measurements”, Co-PI, NSF–PHY, \$380,000.

Wenwan Zhong, Ph.D.

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Group Homepage: <http://faculty.ucr.edu/~wenwanz>

A. Education/Training

INSTITUTION AND LOCATION	DEGREE /TRAINING	MM/YY	FIELD OF STUDY
University of Science & Technology of China	B.S.	07/98	Chemistry
Iowa State University	Ph.D.	07/03	Analytical Chemistry
Los Alamos National Laboratory	Postdoctoral	06/06	Bioanalytical Chemistry

B. Positions and Honors

Positions and Employment

2003-2006	Post-doctoral Research Associate, Chemistry Division, Los Alamos National Lab
2006-2012	Assistant Professor, Department of Chemistry, University of California, Riverside
2012-2016	Associate Professor, Department of Chemistry, University of California, Riverside
2016-present	Professor, Department of Chemistry, University of California, Riverside

Honors and Awards

2005	Los Alamos Achievement Award
2011	National Science Foundation CAREER Award

C. Peer-Reviewed Publications

Brief Summary of Research Areas

Our work focuses on two main research topics: 1) Discovery of valuable biomarkers and **development of new techniques and devices for rapid, on-site detection of target molecules**; and 2) Study of nano-bio interface to guide better design and applications of biofunctional nanomaterials. The biomarkers we are interested in include post-translationally

modified proteins and peptides, non-coding RNAs, extracellular vesicles, as well as **environmental contaminants**. Separation-enabled sensing is the main theme for our research work. Diverse separation techniques, like nanomaterial-based solid-phase extraction, flow-field flow fractionation, and capillary electrophoresis, are used and modified to improve marker detection and to discover new markers. Moreover, we **develop diverse signal amplification strategies** for enhancement of biomarker detection, taking advantage of nanomaterials and isothermal nucleic acid amplification.

At the University of California, Riverside (*Corresponding Author)

- C-1. Y. Liu, L. Perez, M. Mettry, A. D. Gill, G. J. O. Beran, R. J. Hooley*, and **W. Zhong***. Site-Selective Sensing of Histone Demethylase Activity with an Arrayed Deep Cavitand Fluorescence Displacement Assay. *Manuscript in preparation*.
- C-2. X. Fang, **W. Zhong***. Enrichment and Multiplexed Detection of Toxic Metals Enabled by Porous Graphene Forms. *Manuscript in preparation*.
- C-3. K. Flack, L. Jimenez, G. B. Adkins, J. Y. Lee, G. Somlo, C. Tian, S. E. Wang, X. Cui, **W. Zhong***. Distribution Profiling of Circulating microRNAs among Carriers by a Differential Isolation Platform (DIP) Exhibited Distinct Patterns in Cancer Patients. Submitted.
- C-4. Y. Wang, J. Liu, J.-H. Jiang,* and **W. Zhong***. Cobalt Oxyhydroxide Nanoflakes with Intrinsic Peroxidase Catalytic Activity and Its Application to Blood Glucose Detection. *Analytical and Bioanalytical Chemistry, in press*.
- C-5. Y. Liu, L. Perez, M. Mettry, A. D. Gill, S. R. Byers, C. J. Easley, C. J. Bardeen, **W. Zhong***, and R. J. Hooley*. Site Selective Reading of Epigenetic Markers by a Dual-Mode Synthetic Receptor Array. *Chemical Sciences*, 2017, 8, 3960-3970.
- C-6. Ju Yong Lee, **W. Zhong***. Analysis of proteins and enzymes by Field Flow Fractionation (FFF). *Field-Flow Fractionation: Principles and Applications*. Editors: Céline Guéguen, Mohammed Baalousha, S. Kim R. Williams. Springer, New York, USA. 2017, In press.
- C-7. Y. Liu, L. Perez, M. Mettry, C. J. Easley, R. J. Hooley* and **W. Zhong***. A Self-Aggregating Deep Cavitand Acts as a Fluorescence Displacement Sensor for Lysine Methylation. *Journal of American Chemical Society*, 2016, 138, 10746-9.
- C-8. K. Flack, L. Jimenez, **W. Zhong***. Analysis of the distribution profiles of circulating microRNAs by Asymmetrical Flow Field Flow Fractionation. *Micro RNA Profiling: Methods and Protocols*. Editor: Sweta Rani. Springer, New York, USA. 2016, pp 161-168.
- C-9. H. Wang, Y. Duan, **W. Zhong***. ZrO₂ Nanofiber as a Versatile Tool for Protein Analysis. *ACS Applied Materials & Interfaces*, 2015, 7, 26414-26420.
- C-10. Q. Tang, M. Liu, F. Zhou, N. Wang, T. Deng, J. Li, R. Yang, **W. Zhong**, W. Tan. A novel AgNPs/DNA/TPdye Conjugate-based Two-photon Nanoprobe for GSH Imaging in Cell Apoptosis of Cancer Tissue. *Chemical Communications*, 2015, 51, 16810-16812.
- C-11. S. Fang, Y. Liu, K. Yan, **W. Zhong***. Mitochondrion Targeting Fluorescent Probe for Imaging of Intracellular Superoxide Radical. *Chemical Communications*, 2015, 51, 7931 - 7934.
- C-12. J. Ashby, Y. Duan, E. Ligans, M. Tamsi, **W. Zhong***. High-Throughput Profiling of Nanoparticle-Protein Interactions by Fluorescamine Labeling. *Analytical Chemistry*, 2015, 87, 2213-2219.

- C-13. M. Y. Fong, W. Zhou, L. Liu, A. Y. Alontaga, M. Chandra, J. Ashby, A. Chow, S. T. O'Connor, S. Li, A. R. Chin, G. Somlo, M. Palomares, Z. Li, J. R. Tremblay, A. Tsuyada, G. Sun, M. A. Reid, X. Wu, P. Swiderski, X. Ren, Y. Shi, M. Kong, **W. Zhong**, Y. Chen, S. E. Wang. Breast-cancer-secreted miR-122 reprograms glucose metabolism in premetastatic niche to promote metastasis. *Nature Cell Biology*, 2015, 17, 183-194.
- C-14. Y. Ghang, L. Perez, M. A. Morgan, F. Si, O. M. Hamdy, C. N. Beecher, C. K. Larive, R. R. Julian, **W. Zhong**, Q. Cheng, R. J. Hooley. Anionic deep cavitands enable the adhesion of unmodified proteins at a membrane bilayer. *Soft Matter*, 2014, 10, 9651-9656.
- C-15. J. Ashby, K. Flack, L. Jimenez, Y. Duan, A.-K. Khatib, G. Somlo, S. E. Wang, X. Cui, **W. Zhong***. Distribution Profiling of Circulating MicroRNAs in Serum. *Analytical Chemistry*, 2014, 86, 9343-9349.
- C-16. Y. Liu, D. Yan, **W. Zhong***. Mechanistic Study on the Reduction of SWCNT-induced Cytotoxicity by Albumin Coating ([Invited Research Article; Inside Cover](#)). *Particle & Particle Systems Characterization*, 2014, 31, 1244–1251.
- C-17. Y. Mei, S. Yang, Z. Peng, C. Liu, J. Li*, **W. Zhong**, R. Yang, W. Tan. Two-Photon Graphene Oxide/Aptamer Nanosensing Conjugate for In Vitro or In Vivo Molecular Probing. *Analytical Chemistry*, 2014, 86, 3548-3554.
- C-18. J. Ashby, S. Pan, **W. Zhong***. Size and Surface Functionalization of Iron Oxide Nanoparticles Influence the Composition and Dynamic Nature of Their Protein Corona. *ACS Applied Materials & Interfaces*, 2014, 6, 15412-15419.
- C-19. J. Ashby, S. Schachermeyer, Y. Duan, L. Jimenez, **W. Zhong***. Probing and Quantifying DNA-protein Interactions with Asymmetrical Flow Field-Flow Fractionation. *Journal of Chromatography, A*, 2014, 1358, 217-224.
- C-20. S. Zeng, M. Huang, Chia-en A. Chang*, **W. Zhong***. Protein Binding for Detection of Small Changes on Nanoparticle Surface ([Back Cover](#)). *Analyst*, 2014, 139, 1364 - 1371.
- C-21. C. Shi, Q. Liu, C. Ma*, **W. Zhong***. Exponential Strand-Displacement Amplification for Detection of MicroRNAs. *Analytical Chemistry*, 2014, 86, 336–339.
- C-22. J. Li, Y. Jia, J. Zheng, **W. Zhong**, G. Shen, R. Yang, W. Tan. Aptamer degradation inhibition combined with DNAzyme cascade-based signal amplification for colorimetric detection of proteins. *Chemical Communications*, 2013, 49, 6137-6139.
- C-23. J. Ashby, S. Schachermeyer, **W. Zhong***. Dissociation-Based Screening of Nanoparticle-Protein Interaction via Flow Field-Flow Fractionation. *Analytical Chemistry*, 2013, 85, 7494-7501.
- C-24. S. Schachermeyer, J. Ashby, **W. Zhong***. Analysis of Aptamer-Protein Interaction by Asymmetrical Flow Field Flow Fractionation. *Journal of Chromatography A*, 2013, 1295, 107-113.
- C-25. J. Yao, K. Flack, L. Ding, **W. Zhong***. Tagging the rolling circle products with nanocrystals clusters for cascade signal increase in the detection of miRNA. *Analyst*, 2013, 138, 3121-3125.
- C-26. R. Zhong, K. Flack, **W. Zhong***. Automatic Small RNA Extraction and Processing by a Multichannel/Multiwell Chip. *Analyst*, 2013, 137, 5546-5552.

- C-27. L. Ren, D. Yan, **W. Zhong***. Electron-Transfer via Single-Walled Carbon Nanotube in Enzymatic Redox Reaction. *Carbon*, 2012, 50, 1303-1310.
- C-28. J. Yao, X. Han, S. Zeng, **W. Zhong***. Detection of Femtomolar Proteins by Nonfluorescent ZnS Nanocrystal Clusters. *Analytical Chemistry*, 2012, 84, 1645–1652.
- C-29. S. Schachermeyer, J. Ashby, M. Kwon, **W. Zhong***. Impact of Carrier Fluid Composition on Recovery of Nanoparticles and Proteins in Flow Field Flow Fractionation. *Journal of Chromatography A*, 2012, 1264, 72-79.
- C-30. S. Schachermeyer, J. Ashby, **W. Zhong***. Advancements in Field Flow Fractionation for the Analysis of Biomolecules: Instrument Design, Miniaturization, and Hyphenation ([Invited Trend Article](#)). *Analytical and Bioanalytical Chemistry*, 2012, 404, 1151-1158.
- C-31. S. Schachermeyer, **W. Zhong***. Chapter 9: Flow Field Flow Fractionation: Analysis of Biomolecules and Their Complexes. *Field-Flow Fractionation in Biopolymer Analysis*. (Editors: Karin D. Caldwell & Kim R. Williams) Springer, New York, USA, 2012, 127-138.
- C-32. K. Parvatiyar, Z. Zhang, R. M. Teles, S. Ouyang, Y. Jiang, Z.-J. Liu, S. Slyer, S. Zeng, **W. Zhong**, R. L. Modlin, Y. Liu, G. Cheng*. DDX41 Recognizes Bacterial Secondary Messengers Cyclic di-GMP and Cyclic di-AMP to Activate a Type I Interferon Immune Response. *Nature Immunology*, 2012, 13, 1155-1161.
- C-33. N. Li, S. Zeng, L. He, **W. Zhong***. Exploration of the Possible Binding Sites of Nanoparticles on Protein. *Analytical Chemistry*, 2011, 83, 6929-6934.
- C-34. H. Zhou, J. Lin, A. Johnson, R. L. Morgan, **W. Zhong**, W. Ma*. *Pseudomonas Syringae* Type III Effector HopZ1 Targets a Host Enzyme to Suppress Isoflavone Biosynthesis and Promote Infection in Soybean. *Cell Host & Microbe*, 2011, 9, 177-186.
- C-35. J. Yao, J. Li, J. Owens, **W. Zhong***. Combining DNase with Single-walled Carbon Nanotubes for Detection of Pb(II) in Water. *Analyst*, 2011, 136, 764-768.
- C-36. N. Li, Z. Shang, L. He, **W. Zhong***. Probing Nanoparticle-Protein Interaction by Capillary Electrophoresis. *Analytical Chemistry*, 2010, 82(17), 7460-7466. ([Featured on SeparationsNow.com as leading new development in electrophoresis](#))
- C-37. N. Li, **W. Zhong***. Chapter 5: Capillary Electrophoresis of Nucleic Acids at the Single-Cell Level. *Chemical Cytometry: Ultrasensitive analysis of single cells*. (Editor: Chang Lu) Wiley-VCH, Weinheim, Germany, 2010, 75-91.
- C-38. L. N. Cella, P. Sanchez, **W. Zhong**, N. V. Myung, W. Chen, A. Mulchandani*. Nano Aptasensor for Protective Antigen Toxin of Anthrax. *Analytical Chemistry*, 2010, 82, 2042-2047.
- C-39. J. Yao, S. Schachermeyer, Y. Yin, **W. Zhong***. Cation Exchange in ZnSe Nanocrystals for Signal Amplification in Bioassays. *Analytical Chemistry*, 2010, 83, 402-408.
- C-40. Z. Lu, M. Ye, N. Li, **W. Zhong**, Y. Yin*. Self-Assembled TiO₂ Nanocrystal Clusters for Selective Enrichment of Intact Phosphorylated Proteins. *Angewandte Chemie, International Edition*, 2010, 49, 1862-1866.
- C-41. L. Ren, **W. Zhong***. Oxidation Reactions Mediated by Single-walled Carbon Nanotubes in Aqueous Solution. *Environmental Science & Technology*, 2010, 44(18), 6954-6958.

- C-42. J. Li, S. Schachermeyer, Y. Wang, Y. Yin, **W. Zhong***. Detection of MicroRNA by Fluorescence Amplification Based on Cation-Exchange in Nanocrystals. *Analytical Chemistry*, 2009, 81, 9723-9729.
- C-43. J. Li, J. Yao, **W. Zhong***. Membrane Blotting for Rapid Detection of Mercury (II) in Water. *Chemical Communications*, 2009, 33, 4962-4964.
- C-44. J. Li, T. Zhang, J. Ge, Y. Yin, **W. Zhong***. Fluorescence Amplification by Cation Exchange in Ionic Nanocrystals. *Angewandte Chemie, International Edition*, 2009, 48, 1588-1591.
- C-45. N. Li, C. Jablonowski, **W. Zhong***. Stand-Alone Rolling Circle Amplification Combined with Capillary Electrophoresis for Specific Detection of Small RNA. *Analytical Chemistry*, 2009, 81, 4906-4913.
- C-46. L. Ren, H. K. Kim, **W. Zhong***. Capillary Electrophoresis-Assisted Identification of Peroxyl Radical Generated by Single-Walled Carbon Nanotubes in a Cell-Free System. *Analytical Chemistry*, 2009, 81, 5510-5516.
- C-47. (Review) **W. Zhong***. Nanomaterials in Fluorescence-based Biosensing. *Analytical and Bioanalytical Chemistry*, 2009, 394, 47-59. ([Invited paper for the special issue of "Young Investigator in Analytical and Bioanalytical Science"; listed among the 2009 Top 10 most viewed articles published in this journal](#))
- C-48. N. Li, A. Nguyen, J. Diedrich, **W. Zhong***. Separation of miRNA and Its Methylation Products by Capillary Electrophoresis. *Journal of Chromatography A*, 2008, 1202, 220-223.
- C-49. J. Li, J. Ge, Y. Yin, **W. Zhong***. Multiplexed Affinity-Based Protein Complexes Purification. *Analytical Chemistry*, 2008, 80, 7068-7074.
- C-50. N. Li, J. Li, **W. Zhong***. CE Combined with Rolling Circle Amplification for Sensitive DNA Detection. *Electrophoresis*, 2008, 29, 424-432.
- C-51. J. Li, **W. Zhong***. A Two-dimensional Suspension Array System by Coupling Field Flow Fractionation to Flow Cytometry. *Journal of Chromatography A*, 2008, 1183, 143-149.
- C-52. J. Li, **W. Zhong***. Typing of Multiple Single-Nucleotide Polymorphisms Using a Microsphere-based Rolling Circle Amplification Assay. *Analytical Chemistry*, 2007, 79, 9030-9038.

Before Coming to the University of California, Riverside

- C-53. **W. Zhong**, Y. Shou, T. Yoshida, B. Marrone*. *Bacillus anthracis*, *B. cereus* and *B. thuringiensis* Differentiation Using Pulsed Field Gel Electrophoresis. *Applied and Environmental Microbiology*, 2007, 73 (10), 3446-3449.
- C-54. J. He, **W. Zhong**, A. Tang, X. Yan, C. Lewis, V. Majidi, W. Hang*. A Fluorescence Detection Scheme for Ultra Large Molecules after Gas Phase Separation. *Talanta*, 2007, 71(5), 2126-2128.
- C-55. J. He, **W. Zhong**, M. Cynthia, W. Hang*. Laser Ablation and Ionization Time-of-flight Mass Spectrometer with Orthogonal Sample Introduction and Axial Field rf-only

- Quadrupole Cooling. *Spectrochimica Acta, Part B: Atomic Spectroscopy*, 2006, 61B (2), 220-224.
- C-56. X.Yan*, **W. Zhong**, A. Tang, W. Hang. J. Nolan, Multiplexed Microsphere-based Flow Cytometric Immunoassay for Detection and Differentiation of Influenza Viruses. *Analytical Chemistry*, 2005, 77 (23), 7673-7678.
- C-57. W. Hang*, L. Zhu, **W. Zhong**, and C. Mahan. Determination of Ultra-trace Level of Actinides from Urine Matrix Using Extraction Chromatography Coupled to ICP-Q-MS. *Journal of Analytical Atomic Spectrometry*, 2004, 19, 1-8.
- C-58. **W. Zhong**, and E.S. Yeung*. Study of Total RNA Expression Profile among Human Tissues by Capillary Gel Electrophoresis and Multivariate Analysis. *Analytical Chemistry*, 2003, 75(17), 4415-4422.
- C-59. **W. Zhong**, and E.S. Yeung*. Combinatorial Enantiomeric Separation of Diverse Compounds Using Capillary Array Electrophoresis. *Electrophoresis*, 2002, 23(17), 2996-3005.
- C-60. Y. Markouchine, **W. Zhong**, G.J. Small, E.L. Cavalieri, and R. Jankowiak*. Identification of Catechol Estrogen Quinones Derived DNA Adducts and Conjugates in Human Tissue Extracts. *Chemical Research in Toxicology*, 2003, 16(9), 1107-1117.
- C-61. Y. He, **W. Zhong**, and E.S. Yeung*. Multiplexed On-column Protein Digestion and Capillary Electrophoresis for Comprehensive Peptide Mapping. *Journal of Chromatography B*, 2002, 782 (1-2), 331-341.
- C-62. **W. Zhong**, and E.S. Yeung*. Multiplexed Capillary Electrophoresis for DNA Sequencing with Ultra Violet Absorption Detection. *Journal of Chromatography A*, 2002, 960(1-2), 229-239.

D. Patents and Invention Disclosures

- D-1. **W. Zhong** and Y. Yin (UCR colleague). "Signal Amplification Through the Gentle Release of Zn²⁺ from ZnSe Nanocrystals for Detection of Biomolecules." UC Disclosure case No. 2011-246-1, Oct. 2010.
- D-2. **W. Zhong** and R. Zhong (postdoc). "Valveless Microfluidic Device." UC Disclosure case No. 2012-301-1. USSN 61/558,851. Patent Issued, 01/2017.
- D-3. **W. Zhong**, J. Ashby (graduate student), and K. Flack (graduate student). "Methods to Determine the Distribution Profiles of Circulating MicroRNAs." UC Disclosure case No. 2015-080-1. Provisional Patent filed on Sept. 03, 2014; Non-provisional filing done on Sept. 03, 2015, PCT/US2015/048341; entered National Phase 03/2017, elected the US and China as the entry nations.

E. Research Support

Project Title (Role)	Agency	Period Covered	Amount	Status

Synthetic Receptor-Based Arrays for Sensing Post-Translationally Modified Proteins and Peptides (PI)	NSF	07/01/2017-06/30/2020	\$495,000	Recommended for funding
Nano-response: Immune stimulation, microbiome perturbation and impacts from protein corona (PI)	NIH/NIEHS	09/31/16 – 08/31/21	\$750,000	Ongoing
3-Dimensional profile of circulating miRNA for early cancer detection (PI)	National Institutes of Health (NCI)	04/23/15 – 03/31/19	\$1,250,000	Ongoing
Development of the prototype of the microRNA Differential Isolation Platform (PI)	UC Riverside	07/01/16-06/30/17	\$35,000	Ongoing
CAREER: Signal Amplification by Cation Exchange in Ionic Nanocrystals (PI)	National Science Foundation	02/01/11 - 01/31/16	\$550,000	Completed
Discovery of virus-binding aptamers (PI)	UC Riverside	07/01/15-06/20/16	\$11,000	Completed
Direct Recruitment of Ribosomes by RNA Polymerase might guide the Evolution of Bacterial Pathogens (Co-I)	UC Riverside	07/01/14-06/30/15	\$70,000	Completed
Nanomaterials coated with antigenic proteins as immunostimulatory complexes (PI)	UC Riverside	07/01/14-06/30/15	\$50,000	Completed
Impact of Protein Corona on Nanotube-Conjugated CpG Immunotherapy for Glioma (Co-PI)	City of Hope and UC Riverside	02/01/13-01/31/15	\$100,000	Completed
Discovery of Virus-Binding Aptamers (PI)	UCR IIGB Core Instrument Facility	12/14-05/15	\$5,000	Completed
Study Protein-Nanomaterial Interactions and Their Impacts on Protein Activity (PI)	National Institutes of Health	09/01/10 -08/30/12	\$415,775	Completed

One-step miRNA Analysis for Study of Cancer Development (PI)	Cancer Research Coordinating Committee, UC	07/01/11-06/30/12	\$50,000	Completed
High-Throughput Screening of siRNA Expression Using Rolling Circle Amplification (PI)	The Institute for Integrative Genome Biology (IIGB) of UCR	11/01/07-10/30/08	\$50,000	Completed
Separation of Protein Complex by Micro-Asymmetrical Flow-Field Flow Fractionation (PI)	The Academic Senate Committee on Research of UCR	07/01/07-06/30/08	\$4,000	Completed

F. Professional Services

Service on Professional Board

Analytical Chemistry Feature Panel, 2015-2018

Analytical and Bioanalytical Chemistry, International Advisory Board, 2017-present

Teaching and service at UCR

Graduate advisor for Environmental Toxicology Program, 2012-present

Undergraduate advisor for Chemistry, 2016-present

Instructor for Advanced Analytical Separation, Advanced Bioanalytical Chemistry, Quantitative Analysis, Instrumental Methods and Analysis, General Chemistry

Organized Symposia at Conferences

- F-1. 253rd ACS National Meeting & Exhibition, San Francisco, April 2017, ACS-DAC, *Advanced Materials, Discovery, Characterization & Safety*.
- F-2. The Pittsburgh Conference 2017. ACS-DAC, *Analytical Advances in Sustainable and Safe Nanotechnology*.
- F-3. 251st ACS National Meeting & Exhibition, San Diego, March 2016. *Sampling and Processing of Biological Particles Enabled by Micro- or Nano-fluidics*.
- F-4. 2016 Annual Meeting for the Society of Western Analytical Professors (SWAP). Organizer. Riverside, CA, January 2016.
- F-5. Pacifichem 2015, Honolulu, HI, December 2015. Organized two symposia: "New Tools and Methodologies for the Characterization of Biomolecular Interactions"; and

“Innovation in Chemical Sensing and Separation Systems toward Advanced Chemical Analysis”.

- F-6. 17th International Symposium on Field and Flow-based Fractionation. Organization Committee. Salt Lake City, UT, October 2014.
- F-7. The Pittsburgh Conference 2014, Conferee Networking Session: Analytical Chemistry at the Nano-Bio Interface. Chicago, IL, March 2014.
- F-8. ACS 87th Colloid & Surface Science Symposium. Riverside, CA. June 2013. *Sensing for Biomedical and Environmental Applications*.
- F-9. (Co-Chair; lead organization of all four electrophoresis symposia) Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (SCIX 2012), Kansas City, Missouri, October 2012.
- F-10. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (FACSS XXXVII), Reno, Nevada, October 2011. *Bioparticle Analysis Employing Electrokinetic Techniques*.
- F-11. 241st ACS National Meeting & Exhibition, Anaheim, California, March 2011. *Separation Sciences and Supramolecular Assembly: Analysis and Applications*.
- F-12. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (FACSS XXXVI), Raleigh, North Carolina, October 2010. *Probing Interactions Between Biomolecules and Nanomaterials*.
- F-13. The Pittsburgh Conference (PittCon), Orlando, Florida, March 2010. *Analytical Chemistry for the Study of Nanotoxicity*. ([Accepted symposium proposal, and reported as a cover story in Chemical & Engineering News](#))
- F-14. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (FACSS XXXV), Louisville, Kentucky, October 2009. *Multifunctional Nanostructure: Fabrication and Applications*.

Reviewed Proposals

National Science Foundation: Ad-hoc reviewer, 2008-2012; Panelist for CBET and Chemistry Division, 2011-2015.

National Institute of Health: Ad-hoc reviewer, 2012-2014; Panelist, study section EBIT, 2012, 2015, 2016, 2017; Small Business: Biological Chemistry, Biophysics and Drug Discovery Study Section 2013, 2014, 2016.

NASA, Panelist, 2016.

Ad-hoc reviewer for Hongkong research council 2012-2017; Korean National Science Foundation 2015; Deutsche Forschungsgemeinschaft (DFG) 2016.

Reviewed Journal Articles

ACS Applied Materials & Interfaces
Analyst

Analytical and Bioanalytical Chemistry
Analytical Biochemistry
Analytical Chemistry
Analytical Method
Angewandte Chemie, International Edition
Bioanalysis
Biomedical Chromatography
Chemical Communications
Chemical Science
Chemistry & Biology
Colloids and Surfaces A: Physicochemical and Engineering Aspects
Electrophoresis
Environmental Chemistry
European Journal of Cancer
Journal of American Chemical Society
Journal of Chromatography A
Journal of Chromatography B
Journal of Material Science
Journal of Separation Science
Langmuir
Nanoscale
Nature Protocol
Patents in Nanomedicine
Particle & Particle Systems Characterization
PLOS One
RSC Advances
Scientific Report
Sensors
Sensors & Actuators B. Chemica
Talanta

G. Invited Presentations

At Conferences

- G-1. 253rd ACS National Meeting & Exhibition, San Francisco, April 2017. *Separation and Fluorescence – Analytical Tools for Study of Protein-Nanoparticle Interaction.*
- G-2. The Pittsburgh Conference 2017. *Separation and Fluorescence – Analytical Tools for Study of Protein-Nanoparticle Interaction.*
- G-3. ACS Publications Symposium. Innovation in Molecular Science. Beijing, China, October, 2016. *Deep Cavitand Acts as a Fluorescence Displacement Sensor for Lysine Methylation.*
- G-4. 251st ACS National Meeting & Exhibition, San Diego, March 2016. *On Chip Extraction of Circulating MicroRNA from Various Carriers.*

- G-5. 2016 Annual Meeting for the Society of Western Analytical Professors (SWAP). Riverside, CA, January 2016. *A Synthetic Receptor-based Sensor for Detection of Lysine Methylation in Proteins.*
- G-6. 43rd International Symposium on High Performance Liquid Phase Separations and Related Techniques (HPLC2015). *On-Chip Separation of Circulating microRNAs Bound to Various Carriers.*
- G-7. Revolutionizing Biology and Medicine with Advances in Nanotechnology. Work Shop, Changsha, Hunan, China, June 2015. *Integration of Bioanalytical Chemistry and Nanotechnology.*
- G-8. 31st International Symposium on MicroScale Bioseparations (MSB2015). Shanghai, China, May 2015. *Open-Channel Separation Hyphenated with Nanofiber-based Molecular Extraction for Analysis of Biological Complexes.*
- G-9. ACS 248th National Meeting. San Francisco, CA, August 2014. *Dissociation-Based Screening of Nanoparticle (NP)-Protein Interaction via Flow Field-Flow Fractionation (F4).*
- G-10. 2014 6th International Symposium on Bioanalysis, Biomedical Engineering and Nanotechnology (ISBBN 2014). Hunan, China, June 2014. *Potential Contribution of Protein Corona to the Efficacy of Nanomedicines.*
- G-11. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (SCIX 2012), Kansas City, Missouri, October 2012. *Free-solution Separation for Study of Molecular Interaction.*
- G-12. Spring 2012 ACS National Meeting, San Diego, CA, March 2012. *Capillary Electrophoresis in the Study of Nanoparticle-Protein Interaction.*
- G-13. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (FACSS XXXVII), Reno, Nevada, October 2011. *Capillary Electrophoresis for Study of Nanoparticle-Protein Interaction.*
- G-14. Joint conference of the 57th International Conference on Analytical Sciences and Spectroscopy (ICASS) and the 3rd Canada-China Analytical Chemistry Conference (CCACC), Canada, August 2011. *Sensing by Cation Exchange in Ionic Nanocrystals.*
- G-15. The International Symposium on Field- and Flow-based Separation (FFF), May 2011. *Study Nanoparticles and Their Interaction with Proteins Using Open-Column Separation Technologies.*
- G-16. Sino-US Symposium on Separation Science, San Diego, CA, May 2011. *Analytical Tools for the Study of Nanoparticle-Protein Interaction.*
- G-17. 241st ACS National Meeting & Exhibition, Anaheim, California, March 2011. *Study Nanoparticle-Protein Interaction with Capillary Electrophoresis and Beyond.*
- G-18. Pacifichem 2010, Honolulu, Hawaii, December 2010. *Open-Column Separation Techniques in Characterization of the Protein-Nanoparticle Complexes.*

- G-19. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (FACSS XXXVI), Raleigh, North Carolina, October 2010. *Measuring Affinity Between Proteins and Nanoparticles Using Capillary Electrophoresis.*
- G-20. The Pittsburgh Conference, Orlando, Florida, March 2010. *Study of Protein-Nanoparticle Interaction Using Free Solution-Based Separation Techniques.*
- G-21. Federation of Analytical Chemistry and Spectroscopy Societies Annual Conference (FACSS XXXV), Louisville, Kentucky, October 2009. *Applications of Ionic Nanocrystals in Biosensing.*

At Universities

- G-22. West Virginia University, WV, August 2017.
- G-23. University of Iowa, Iowa City, IA, December 2017.
- G-24. Iowa State University, Ames, IA, December 2017.
- G-25. Sun Yat-Sen University, Guangzhou, China, October 2016.
- G-26. Macquarie University, Sydney, Australia, June 2015.
- G-27. University of Science and Technology of China, Hefei, China. May 2015.
- G-28. Nanjing University, Nanjing, China. May 2015.
- G-29. HongKong University of Science and Technology, HongKong, China. August 2014.
- G-30. HongKong Baptist University, HongKong, China. August 2014.
- G-31. Hunan Normal University, Changsha, China. May 2014. *Separation Science for Analysis of Molecular Interaction.*
- G-32. Old Dominion University, Northfolk, VA. March 2014. *The Biological Signatures of Nanoparticles.*
- G-33. Shandong University, Jinan, China. July 2013. *Analytical Chemistry at the Nano-Bio Interface.*
- G-34. Xiamen University, Xiamen, China. August 2013. *Analytical Chemistry at the Nano-Bio Interface.*
- G-35. University of California, Irvine, Department of Chemistry and Biochemistry. October 18th, 2011. *Analytical Chemistry at the Nano-Bio Interface.*
- G-36. University of Minnesota, Department of Chemistry. September 22nd, 2011. *Understanding the Nano-Bio Interface with Analytical Technologies.*
- G-37. University of Kansas, Department of Chemistry. September 19th, 2011. *Understanding the Nano-Bio Interface with Analytical Technologies.*
- G-38. Brigham Young University, Department of Chemistry and Biochemistry. September 2nd, 2011. *Probing Protein-Nanoparticle Interaction with Analytical Technologies.*
- G-39. University of Utah, Department of Chemistry. September 1st, 2011. *Probing protein-nanoparticle Interaction with Analytical Technologies.*

- G-40. University of Alberta, Department of Chemistry. August 28th, 2011. *Understanding the Nano-Bio Interface with Analytical Technologies*.
- G-41. University of California, Davis, Department of Chemistry. June 1st, 2011. *Analytical Chemistry at the Nano-Bio Interface*.
- G-42. University of Arizona, Department of Chemistry and Biochemistry. May 11th, 2011. *Gaining Better Understanding of the Nano-Bio Interface with Analytical Technologies*.
- G-43. California State University, Long Beach, Department of Chemistry and Biochemistry. March 11th, 2011. *Study Nanoparticle-Protein Interaction with Analytical Tools*.
- G-44. San Diego State University, Department of Chemistry and Biochemistry. February 4th, 2011. *Analytical Chemistry at the Nano-Bio Interface*.
- G-45. California State University, Los Angeles, Department of Chemistry and Biochemistry. January 25th, 2011. *Analytical Chemistry at the Nano-Bio Interface*.
- G-46. North Carolina State University, Department of Chemistry. October 22nd, 2010. *Understanding the Nano-Bio Interface with Analytical Tools*.
- G-47. California State University, San Bernardino, Department of Chemistry and Biochemistry. October 7th, 2010. *Analytical Chemistry at the Nano-Bio Interface*.
- G-48. California State University, Fullerton, Department of Chemistry and Biochemistry. May 7th, 2009. *What Analytical Chemists Can Do with Nanomaterials?*

H. Advisees

Graduate Students

Ni Li, Ph.D.	Research Scientist, Abbott Laboratories 09/2006-06/2011, Chemistry
Lei Ren, Ph.D.	Research Scientist, Bokai Pharma 09/2007-08/2012, Environmental Toxicology Program 2011-2012 Dissertation Year Program Fellowship
Jingjing Yao, Ph.D.	Biopharma, Inc. 09/2007-08/2013, Chemistry
Samantha Schachermeyer, Ph.D.	Chlorox, Inc. 01/2008-12/2013, Chemistry
Shang Zeng, Ph.D.	Amgen, Inc. 09/2009-08/2014, Chemistry
Jonathan Ashby, Ph.D.	Postdoctoral researcher, UC Davis 01/2010-08/2014, Chemistry NSF Graduate Research Fellowship, 06/11-05/14
Kenneth Flack	Hewlett Packard, Inc.

	01/2011-12/2015, Chemistry
Yang Liu	09/2012-present, Environmental Toxicology Program
Luis Jimenez	09/2012-present, Program of Biomedical Sciences
Yaokai Duan	09/2013-present, Chemistry
Song Zhe	09/2014-present, Environmental Toxicology Program
Jiwon Lee	09/2014-present, Chemistry
Gary Brent Adkins	07/2015-present, Chemistry
Michael Trihn	07/2015-present, Chemistry
Kaizhu Guo	07/2016-present, Chemistry
Roxana Coreas	07/2016-present, Environmental Toxicology Program

Postdocs

Jishan Li	12/2006-02/2010; Professor, College of Chemistry and Chemical Engineering, Hunan University, China
Xiaogang Han	09/2010-08/2011; Postdoc, University of Maryland, College Park
Runtao Zhong	07/2010-02/2012
Hui Wang	05/2012-08/2013
Ju-Yong Lee	08/2015-present
Wen Shen	01/2016-present
Xiaoni Fang	07/2016-present

Visiting Scholars/Students

Liang Ding	08/2011-02/2012; Professor, School of Medicine, Hebei University
Chao Shi	05/2012-02/2013; Professor, Qingdao University of Science and Technology
Zhigang Wang	08/2012-04/2013; Professor, Yang Zhou University
Xiaofeng Chen	09/2014-02/2015; Professor, Yang Zhou University
Fang Chen	09/2014-08/2015; Professor, Hua Zhong University of Science & Technology
Ting Deng	03/2015-present; Associate Professor, Hunan University
Fang Si	12/2013-02/2015; Visiting Student, Dong Hua University
Yumin Wang	09/2016-09/2017; Visiting Student, Hunan University
Hua Wang	10/2016-10/2017; Professor, Yansheng University

Undergraduate Students

Long-term Participants in Group Research:

Anh Nguyen	07/2007-06/2009; co-author in C-18
Hong Kim	07/2007-06/2009; co-author in C-17
Sonja Kress	NSF International REU Program, summer 2007
Carolyn Jablonowski	NSF REU Program, summer 2008; co-author in C-14
Jimmy Vo	Analytical Assistant Chemist, Mitsui Chemical Group 07/2009-08/2012 Kuwana-Sawyer award for undergraduate research in Analytical Chemistry, 2011 Undergraduate Research Grant of UCR, 07/2010-05/2011
Michael Pham	07/2011-06/2013 (Honor student thesis program)
Erik Ligans	04/2013-12/2014 (Honor student thesis program)
Merissa Gonzales	08/2013-present (MARC*U program)
Michael Tamsi	08/2013-07/2014
Abdel-Kareem Khatib	05/2014-09/2014
Nancy Ortega	05/2014-05/2015
Joshua Berlarde	05/2014-present
Sabrina Sedano	05/2015-present
Yomara Mendez	05/2015-present
Erica Sun	04/2017-present

I. Professional Affiliations

American Chemical Society; American Association for the Advancement of Science

Appendix II. Faculty letters of intent to participate

Huiwang Ai (Assistant Professor, Chemistry, Ph.D.)
Mark Alber (Distinguished Professor, Physics, Ph.D.)
John Barton (Assistant Professor, Ph.D., Physics, arriving 1/1/18)
Gregor Blaha (Assistant Professor, Biochemistry, Ph.D.)
Chia-en Chang (Associate Professor, Chemistry, Ph.D.)
Richard Cardullo (Professor, Biology, Ph.D.)
Richard Debus (Professor, Biochemistry, Ph.D.)
Li Fan (Associate Professor, Ph.D.)
Theodore Garland (Distinguished Professor, Biology, Ph.D.)
Joseph Genereux (Assistant Professor, Chemistry, Ph.D.)
Russ Hille (Distinguished Professor, Biochemistry, Ph.D.)
Richard Hooley (Associate Professor, Chemistry, Ph.D.)
Darrel Jenerette (Associate Professor, Botany and Plant Sciences, Ph.D.)
Ryan Julian (Professor, Chemistry, Ph.D.)
Umar Mohideen (Professor, Physics, Ph.D.)
Len Mueller (Professor, Chemistry, Ph.D.)
Dawn Nagel (Assistant Professor, Botany and Plant Sciences, Ph.D.)
Seán O'Leary (Assistant Professor, Biochemistry, Ph.D.)
Jeff Perry (Assistant Professor, Biochemistry, Ph.D.)
Nicole Rafferty (assistant Professor, Biology, Ph.D.)
Carolyn Rasmussen (Assistant Professor, Botany and Plant Sciences, Ph.D.)
Louis Santiago (Associate Professor, Botany and Plant Sciences, Ph.D.)
Jikui Song (Assistant Professor, Biochemistry, Ph.D.)
Yinsheng Wang (Professor, Chemistry, Ph.D.)
Min Xue (Assistant Professor, Chemistry, Ph.D.)
Wenwang Zhong (Professor, Chemistry, Ph.D.)
Roya Zandi (Professor, Physics, Ph.D.)



DEPARTMENT OF CHEMISTRY

RIVERSIDE, CALIFORNIA 92521-0122

June 15, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of protein engineering and chemical biology. In particular, my research group is engineering novel molecular probes to peer into cells and brains to understand their communications. We use a collection of innovative techniques, such as protein engineering, fluorescence and bioluminescence imaging, synthetic chemistry and mass spectrometry, to dissect signaling pathways involving redox-active molecules, neurotransmitters, and protein post-translational modifications (PTMs). Our research direction is well aligned with the proposed graduate program in Biophysics. I will enthusiastically support the Program.

Sincerely,

A handwritten signature in cursive script, appearing to read "Huiwang Ai".

Huiwang Ai
Assistant Professor of Chemistry

Professor Russ Hille
Department of Biochemistry
University of California, Riverside
CAMPUS

August 31, 2016

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of computational biophysics and mathematical and computational biology.

Sincerely,



Mark Alber
Distinguished Professor
Department of Mathematics
Office: Surge 246
University of California, Riverside
Tel: (951) 827-3113
Fax: (951) 827-7314
e-mail: malber@ucr.edu

Fellow of the American Association for the
Advancement of Science (AAAS)
Deputy Editor, PLoS Computational Biology
Associate Editor
Bulletin of Mathematical Biology (Springer)

Professor Emeritus (Early retirement)
University of Notre Dame
Adjunct Professor of Medicine
Indiana University School of Medicine

May 21, 2017

Russ Hille
Distinguished Professor of Biochemistry
1643 Boyce Hall
University of California
Riverside, CA 92521

Dear Prof. Hille,

Following your invitation, I am writing to indicate my interest in participating in the interdepartmental graduate program in Biophysics at the University of California, Riverside. I would be excited to take part in this interdisciplinary program.

Together with this letter I am including a copy of my CV. Please do not hesitate to contact me for any further information that may be helpful.

Sincerely,



John P Barton



August 19, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. I believe that my expertise in X-ray crystallography and my interest in biophysical methods for characterizing of protein ribonucleic acid particles matches well with the stated goals the proposed program.

Sincerely,



Gregor Blaha
Assistant Professor
Department of Biochemistry

16, August 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of membrane biophysics, advanced imaging technologies, and modeling dynamic signaling events in living cells. Our recent research involves looking at the molecular mechanisms for sperm activation and relating it to changes in flagellar behavior in insects, especially mosquitoes. Although mainly cellular in focus, our work bridges many disciplines including biochemistry, bioengineering, developmental biology, and molecular genetics.

I am truly excited about this program and feel that the time is right for a biophysics program at UCR. I look forward to moving ahead with this initiative and will actively participate in all aspects of the program.

Sincerely,



Richard A. Cardullo, PhD
Howard H Hays Jr. Chair, University Honors
Professor of Biology

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PROFESSOR CHIA-EN A. CHANG
DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CA 92521-0403

PHONE: (951) 827-7263
e-mail: chiaenc@ucr.edu
<http://www.chem.ucr.edu/chang>

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of molecular recognition. My group is particularly interested in understanding non-covalent protein-ligand binding kinetics and thermodynamics using molecular mechanics methods such as molecular dynamics simulations, Brownian dynamics simulations, and molecular docking, just to name a few.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Chia-en A. Chang".

Chia-en A. Chang, Ph.D.
Association Professor of Chemistry
University of California, Riverside

RICHARD J. DEBUS
PROFESSOR AND CHAIR OF BIOCHEMISTRY
DEPARTMENT OF BIOCHEMISTRY
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CA 92521-0129

Phone: 951-827-3483
FAX: 951-827-4294
Email: richard.debus@ucr.edu

August 19, 2016

Russ Hille, Distinguished Professor of Biochemistry
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm at participating in the graduate program in Biophysics that is being proposed. My own expertise is in the area of spectroscopic analysis of the oxygen-evolving process in photosynthesis, particularly vibrational spectroscopy. Specifically, my laboratory employs FTIR difference spectroscopy to characterize mutant core complexes of Photosystem II containing single amino acid substitutions of residues identified crystallographically or computationally as potentially participating in networks of hydrogen bonds near the catalytic Mn_4CaO_5 cluster. Identifying these residues will improve our understanding of the dynamic mechanism of O_2 production by the Mn_4CaO_5 cluster and will provide insight into the design of new generations of synthetic catalysts that convert sunlight into useful forms of storable energy. Attached please find a current cv.

Sincerely,

A handwritten signature in blue ink that reads "Richard J. Debus".

Richard J. Debus

Richard J. Debus



DEPARTMENT OF BIOCHEMISTRY

RIVERSIDE, CALIFORNIA 92521-0122

July 10, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of protein X-ray crystallography, protein chemistry and DNA repair.

Sincerely,

A handwritten signature in blue ink, appearing to read "Li Fan". The signature is fluid and cursive.

Li Fan
Associate Professor &
Director of Macromolecular X-ray Crystallography Core Facility



DEPARTMENT OF BIOLOGY

RIVERSIDE, CALIFORNIA 92521-0122

September 14, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own relevant expertise is in the systems biology of locomotor behavior and exercise physiology, approached from both genetic and modeling perspectives. I also have a great deal of experience in statistical analyses of complex systems and experimental designs. In addition, as Director of UCR's Institute for the Development of Educational Applications (IDEA), I would be interested in developing online curricula for the program, should that seem appropriate.

Please let me know if you need any further information, and best luck with the proposal.

Sincerely,

Theodore Garland, Jr., Distinguished Professor

Office Phone: [\(951\) 827-3524](tel:9518273524)

Facsimile: [\(951\) 827-4286](tel:9518274286) (not confidential)

Email: tgarland@ucr.edu

<http://www.biology.ucr.edu/people/faculty/Garland.html>

<http://scholar.google.com/citations?hl=en&user=iSSbrhwAAAAJ>

Director, UCR [Institute for the Development of Educational Applications](http://www.idea.ucr.edu/)

Editor in Chief, [Physiological and Biochemical Zoology](http://www.physiology.org/)

Fail Lab: Episode One

<http://testtube.com/faillab/zoochosis-episode-one-evolution>

<http://www.youtube.com/watch?v=c0msBWYTzU0>

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DEPARTMENT OF CHEMISTRY

RIVERSIDE, CALIFORNIA 92521-0122

September 5, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of protein homeostasis, the balance between protein conformation and fate. Specifically, my group develops tools to determine the molecular consequences of cellular networks that regulate protein homeostasis. The physical and chemical underpinnings of these biological processes are poorly understood, and cross-disciplinary students who understand both biological systems, and the physical basis for the methods that we are developing to probe them, will be a natural fit for my research program. A biophysics graduate program would be an ideal source to attract these graduate students, while at the same time offering them an educational program that is tailored to the interdisciplinary background necessary to tackle these research projects.

As a participant, I commit to recruit students into the program, to serve on related committees, and to contribute to the associated seminar series.

Sincerely,

A handwritten signature in black ink, reading "Joseph Genereux". The signature is fluid and cursive, with a long horizontal stroke at the end.

Joseph Genereux

Department of Chemistry

951-827-3759



RUSS HILLE
DISTINGUISHED PROFESSOR OF BIOCHEMISTRY
1463 BOYCE HALL
Phone: (951) 827-6354
e-mail: russ.hille@ucr.edu
Fax : (951) 827-2364

RIVERSIDE, CALIFORNIA 92521-0122

August 4, 2016

To Whom It may Concern:

I write to convey my strong interest in creating and participating in a new graduate program in Biophysics at UC Riverside, as reflected in my involvement in the preparation of the present proposal.

With best regards,

A handwritten signature in black ink that reads "Russ Hille". The signature is written in a cursive style.

Russ Hille, Ph.D.
Distinguished Professor of Biochemistry

UNIVERSITY OF CALIFORNIA, RIVERSIDE

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**RICHARD HOOLEY
ASSOCIATE PROFESSOR
DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CA 92521**

**PHONE: (951) 827-4924
e-mail: richard.hooley@ucr.edu**

August 4th, 2016

Dear Russ:

This letter is to confirm my intent to participate in the UC Riverside Biophysics program. I believe this is an important new direction for the UCR science faculty, and will be a valuable addition for the campus as it seeks to expand and improve.

If you require any more information, please feel free to contact me.

A handwritten signature in black ink, appearing to read "R. Hooley".

Richard Hooley



DEPARTMENT OF BOTANY AND PLANT SCIENCES
CALIFORNIA 92521-0122

RIVERSIDE,

June 15, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of landscape patterns of ecosystem functioning. Much of this work depends strongly on an understanding of biophysics and frequently such understanding is a limiting reagent for my students research. My research depends on biophysical concepts related to energy balance, light absorption, and fluid transport. These processes all rely at the biophysics interface. For example, energy balance dynamics are affected by many leaf structural and evaporative characteristics. These plant-based dynamics strongly interact with energy availability and transport between the vegetation and atmosphere. These dynamics are only understandable only in the context of biological processes interaction with physics based dynamics.

Sincerely,

A handwritten signature in dark ink, appearing to read "Darrel Jenerette".

Darrel Jenerette
Associate Professor
Department of Botany and Plant Sciences

UNIVERSITY OF CALIFORNIA, RIVERSIDE

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Ryan R. Julian
Department of Chemistry
University of California, Riverside
Riverside, CA 92521-0403

PHONE: (951) 827-3958
FAX: (951) 827-2435
e-mail: ryan.julian@ucr.edu

August 19, 2016

Russ Hille
Department of Biochemistry
UCR

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of biomolecular structure determination, noncovalent interactions, spectroscopy, and mass spectrometry.

Sincerely,

A handwritten signature in black ink that reads "Ryan Julian".

Department of Chemistry



DEPARTMENT OF PHYSICS & ASTRONOMY

RIVERSIDE, CALIFORNIA 92521-0122

Umar Mohideen
Professor
Department of Physics & Astronomy
University of California
Riverside, CA 92521

August 22, 2016

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of single molecule force spectroscopy, nanoscale imaging of cells and mechanical elasticity of cell parts. The realization of the Biophysics program at UCR would be valuable to the whole campus by providing a pool of talented students who can interact with the ongoing multidisciplinary biophysics research.

Sincerely,

A handwritten signature in black ink, appearing to read "Umar Mohideen", with a stylized, wavy flourish extending to the right.

Umar Mohideen



DEPARTMENT OF CHEMISTRY

RIVERSIDE, CALIFORNIA 92521

June 15, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of solid-state NMR spectroscopy and biological chemistry. The major goal of my research is to understand the transformation of substrate to product in enzyme active sites at the atomic level – that is to define the position of all atoms, including protons. To accomplish this, we are pioneering the development and application of NMR-assisted crystallography – the synergistic combination of solid-state NMR, X-ray crystallography, first-principles (ab initio) and molecular dynamics computational approaches, and synthetic organic chemistry – to enzyme systems. Specifically, my group is establishing the atomic-level details in the enzymatic transformation of substrate to product in pyridoxal-5'-phosphate-requiring enzymes. By doing so, we are advancing an understanding of the relationship between chemical structure, conformational dynamics, and enzyme mechanism.

I look forward to being a strong, contributing member of the Biophysics graduate program at UCR.

Sincerely,

Leonard J. Mueller
Professor and Vice-Chair
Department of Chemistry

May 22, 2017

RE: Biophysics Graduate Program at UCR

Dear Russ,

I am writing this letter to inform you of my interest in participating in the Biophysics Graduate Program if created. My CV is attached, and please let me know if you have any questions.

Sincerely,



--

Dawn Nagel, Ph.D.
Assistant Professor
Department of Botany and Plant Sciences
1129 Batchelor Hall
University of California
Riverside, CA 92507
dawnn@ucr.edu
Office: (951) 827-4425



SEÁN O'LEARY
ASSISTANT PROFESSOR

DEPARTMENT OF BIOCHEMISTRY
3488B BOYCE HALL
RIVERSIDE, CALIFORNIA 92521-0122

August 5th, 2016

Russ Hille,
Distinguished Professor of Biochemistry,
University of California, Riverside,
2404 Boyce Hall,
Riverside, CA 92521-0122.

Re: Interdepartmental Graduate Program in Biophysics

Dear Russ,

I would like to express my enthusiastic support for the proposed Interdepartmental Graduate Program in Biophysics at the University of California, Riverside.

During my past six years as a postdoctoral researcher at Stanford University School of Medicine, I was involved both in performing and in mentoring trainees in Biophysics research, focusing on applications of single-molecule fluorescence microscopy to study complex biochemical systems. Our research was a natural fit for, and benefitted enormously from students in the Biophysics program. The potential of a similar program at UCR is therefore really exciting. I will be delighted to participate in the program as it is established.

If I can assist in any way, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Seán O'Leary". The signature is stylized with a large, sweeping flourish at the bottom.

Seán O'Leary

Jeff Perry, Ph.D.
Assistant Professor,
Department of Biochemistry
University of California, Riverside
900 University Avenue
Riverside, CA 92521-0127
jeff.perry@ucr.edu

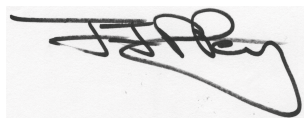
August 1st, 2016

RE: Interest in participating in the Biophysics Program at UCR

Dear Russ,

I am most keen to participate in the interdepartmental graduate program in the field of Biophysics, which is under consideration at UCR. I think this is a truly excellent idea, leveraging the molecular and spectroscopic biophysics based expertise of existing Faculty at UCR, as well as being highly complimentary to existing graduate programs.

Best regards,

A handwritten signature in black ink, appearing to read 'Jeff Perry', with a stylized, looping flourish at the end.

Jeff

May 16, 2017

Russ Hille
Distinguished Professor of Biochemistry
1643 Boyce Hall
University of California
Riverside, CA 92521

Dear Dr. Hille,

I am writing to express interest in the initiative to create a graduate program in Biophysics at the University of California, Riverside. I am an Assistant Professor in the Department of Biology, and my research focuses on the community ecology of plants and pollinators under global change. Systems biophysics is particularly relevant to my research area. I am happy to offer my participation in this initiative.

Sincerely,



Nicole Rafferty, Ph.D.
Assistant Professor
nicole.rafferty@ucr.edu
951-827-3800



May 18, 2017

Dear Professor Russ Hille,

Thank you for asking me to join the graduate program in biophysics. This is indeed one of the future research directions of my lab. For example, finding a student interested in using atomic force microscopy to measure cell wall properties or examining protein dynamics using single molecule imaging or other biophysical experiments would be valuable. In addition, establishing collaboration with colleagues with this type of expertise (and equipment) would be useful.

I would be happy to join the biophysics graduate program and contribute live-cell imaging expertise. Attached please find a recent CV. Please contact me if you have any questions.

Sincerely,



Carolyn G. Rasmussen, Ph.D.
Department of Botany and Plant Sciences
carolyn.rasmussen@ucr.edu



DEPARTMENT OF BOTANY AND PLANT SCIENCES

RIVERSIDE, CALIFORNIA 92521-0122

June 15, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of plant physiological ecology, which incorporates a vast amount of biophysics within our study of the physics of water transport in plants, the conversion of light energy to carbon-based compounds, and the energy exchange between the vegetated surfaces and the atmosphere. The maintenance of plant tissues within biological temperature ranges and the responses of plants to climate change also fall within the discipline of biophysics.

Several of my courses taught at UCR also incorporate components of biophysics, including BIOL 05B (Introduction to Organismal Biology), BPSC 143 (Plant Physiology), but likely most importantly, my graduate course, BPSC 243 (Plant Physiological Ecology) could be an important potential component of the graduate curriculum for this program.

Sincerely,

A handwritten signature in black ink, appearing to read "Louis S. Santiago".

Louis S. Santiago
Associate Professor of Botany & Plant Sciences
and
Research Associate, Smithsonian Institution



DEPARTMENT OF BIOCHEMISTRY

RIVERSIDE, CALIFORNIA 92521-0122

June 15, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of structural biology and epigenetics. We study molecular mechanisms that underlie epigenetic regulation using structural approaches (X-ray crystallography and NMR spectroscopy). In the past, we have revealed the structure-function relationships of several crucial enzymes involved in chromatin modification or pathogen-host interaction (Cell 2010, 141:1183-94; Science 2011, 331:1036-40; Science 2012, 335:709-712; Nature 2012 484:115-9; Cell Rep 2015, 12:1400-6; Cell Rep. 2016, 14:493-505; Nat. Struct. & Mol. Bol. 2016).

Sincerely,

A handwritten signature in black ink that reads "Jikui Song".

Jikui Song
Assistant Professor
Department of Biochemistry
Phone: 951-827-4221
Email: jikui.song@ucr.edu

Russ Hille
Department of Biochemistry

September 6, 2016

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of using mass spectrometry for studying the covalent modifications of biological molecules, including DNA, RNA and proteins.

Sincerely,

A handwritten signature in black ink that reads "Yinsheng Wang". The signature is written in a cursive, flowing style.

Yinsheng Wang
Professor of Chemistry



DEPARTMENT OF CHEMISTRY

RIVERSIDE, CALIFORNIA 92521-0122

Aug 20, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I write to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. My own expertise is in the area of bioanalytical chemistry and my group aims to develop novel chemical probes for detecting and imaging large biomolecules. A large part of my research falls into the realm of Biophysics, and I will be able to contribute to the teaching of related courses in the program.

I believe that the proposed Biophysics graduate program will largely aid in the interaction of related research groups and the integration of campus resources. In addition, it will be a great program where students can obtain interdisciplinary knowledge and develop a promising career track.

I look forward to hearing about the updates on the proposal progress.

Sincerely,

Min Xue

Assistant Professor
Department of Chemistry
University of California, Riverside



BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO •
SAN FRANCISCO • SANTA BARBARA • SANTA CRUZ

Department of Physics and Astronomy

August 29, 2016

Russ Hille
Department of Biochemistry
CAMPUS

Dear Russ:

I would like to express my enthusiasm to participate in the graduate program in Biophysics that is being proposed. As you know, I have been working on the physics of virus assembly and have created several biophysics courses offered in the Physics Department at UCR. In particular, I have created and taught the undergraduate Physics courses 145A, B, C and the graduate level Biophysics 246. Physics 145A was offered a couple years ago and I had 15 students in the course. This number is quite high for an upper division Physics course. We also have several students in the Physics Department who are completing their BS in the Biophysics track. We have been attracting very good undergraduate students to this program. Our graduate students working on Biophysics projects are also very strong. As a matter of fact, this year the award for the best Ph.D. graduating student was given to one of my students who had completed several Biophysics projects. I am very excited about the Biophysics graduate program and am eager to participate in and assist you in implementing the program.

Sincerely,

A handwritten signature in black ink, which appears to read "ROYA ZANDI".

*Roya Zandi
Professor of Physics
University of California
Riverside, CA 92521
Tel: (951) 827-2096*

Dear Dr. Russ Hille,

It is really a good news to me that you are proposing a new graduate program in Biophysics at UCR. I think it is a much needed program for our campus to meet the needs of recruiting students with good background in biology and physics who can be trained and conduct interdisciplinary research at the areas related to biophysics. Since the research work in my group is centered on bioanalytical chemistry and biophysics is critical for us to develop new techniques and study new biological problems, it will be my great pleasure to participate in this program. If approved, I will be happy to recruit students from this program to my group and collaborate with other faculty members in the program. Hope with the collective efforts from us, this program will be approved and run well on our campus.

Thank you very much for your kind invitation.

Sincerely,



Wenwan Zhong, Professor;
Department of Chemistry;
University of California;
Riverside, CA

Appendix III. Letters from UCR Department Chairs and UC Biophysics Program Directors

UCR Department Chairs

Richard Debus, Chair, Department of Biochemistry, UC Riverside

Michael Allen, Chair, Department of Biology

Patricia Springer, Chair, Department of Botany and Plant Sciences, UC Riverside

Jingsong, Zhang, Chair, Department of Chemistry, UC Riverside

Kenneth Barish, Department of Physics and Astronomy, UC Riverside

Directors of of other interdepartmental graduate programs in Biophysics at UC campuses

Template request letter

Dr. James Hurley

Graduate Program Chair

Biophysics Graduate Group

574 Stanley Hall, MC 3220

Berkeley, CA 94720

In care of: katechase@berkeley.edu

John Voss, PhD

Director, Biophysics Graduate Group

227 Life Sciences

One Shields Avenue

Davis, CA 95616

jcvooss@ucdavis.edu

A letter was also requested from Tanja Kortemme, PhD, Director, Biophysics Graduate Program University of California, San Francisco (UCSF), but no response was received.

RICHARD J. DEBUS
PROFESSOR AND CHAIR OF BIOCHEMISTRY
DEPARTMENT OF BIOCHEMISTRY
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CA 92521-0129

Phone: 951-827-3483
Fax: 951-827-4294
Email: richard.debus@ucr.edu

August 29, 2016

Russ Hille
Distinguished Professor of Biochemistry
1463 Boyce Hall

Dear Russ,

I am writing to express enthusiastic support for the development of a Biophysics Graduate Program at UC Riverside. As you point out in the proposal, substantial expertise in biophysics already exists on campus and the Departments of Biochemistry, Chemistry and Bioengineering have hired numerous biophysically-trained faculty in recent years. Currently, these faculty are spread over multiple departments and colleges and lack a cohesive training environment. An interdepartmental Graduate Program in Biophysics will complement the Department of Biochemistry's expanding critical mass in structural biochemistry [e.g., X-ray crystallography, NMR, small angle X-ray scattering (SAXS), single-molecule fluorescence measurements (FRET), and various forms of spectroscopy] and link it with the growing expertise in biophysics in the Departments of Chemistry, Bioengineering, Physics & Astronomy, Mathematics, and other departments. This program will have a very positive impact on the research programs of several faculty in the Department of Biochemistry and promote numerous collaborative ventures between faculty all over campus, will complement existing graduate programs in Biochemistry, Chemistry Bioengineering, and Physics & Astronomy, and will increase the campus's research portfolio, particularly in areas of research of interest to the NIH and faculty in UC Riverside's School of Medicine. I thus anticipate highly positive interactions with the proposed program.

The development of an interdepartmental graduate program in biophysics has been discussed periodically for many years. I am grateful for your work in developing a specific proposal that takes advantage of the recent hiring of many biophysically-trained faculty throughout campus in recent years.

Sincerely,

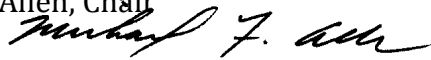
A handwritten signature in blue ink that reads "Richard J. Debus".

Richard J Debus

13 September 2016

To: Russ Hille
Distinguished Professor of Biochemistry
1463 Boyce Hall

From: Michael F. Allen, Chair



Re: Biophysics Graduate Program at UC Riverside

Dear Russ,

I am writing to also express support for the development of a Biophysics Graduate Program at UC Riverside. Expertise in biophysics already exists on campus and several Departments, including Biology. We have hired faculty focused in biophysics at higher scales, from biophysical ecology of Professor Ruibal, a founding faculty, to current faculty using biophysical processes to study physiology and ecology. The program will also simultaneously complement the expanding program in adaptive processes directing evolution and understanding environmental stressors from the environment (ecology) affecting survival and reproduction of organisms. It will also link biologists with the growing expertise in the Departments of Chemistry, Bioengineering, Physics & Astronomy, Mathematics, and other departments. Currently, faculty members working in the broader area of biophysics are spread over multiple departments and colleges and lack a cohesive training environment. An interdepartmental Graduate Program in Biophysics will provide a connecting strand for all faculty and will positively impact the research programs of several faculty in the Evolution, Ecology and Organismal Biology (EEOB) graduate program. It will also increase the campus's research portfolio, particularly in areas of research of interest to the NIH and NSF.

I anticipate highly positive interactions with the proposed program. The development of an interdepartmental graduate program in biophysics has been discussed across the Biology Department for many years, and I appreciate your work in developing this proposal. Please do not hesitate to contact me if you have additional needs or questions.

*Patricia Springer
Professor and Chair
Department of Botany and Plant Sciences
Riverside, CA 92521-0124
patricia.springer@ucr.edu*

September 30, 2016

Russ Hille
Distinguished Professor
Department of Biochemistry
University of California
Riverside, CA 92521

Dear Russ,

I am writing in support of your proposal to develop a Biophysics Graduate program at UCR. An increasing number of faculty in Botany and Plant Sciences have research programs that intersect with biophysics. These include faculty who study cell division, cell shape, plant architecture, and plant physiological processes such as photosynthesis. In addition to our departmental graduate program in Plant Biology, many of our faculty participate in the graduate programs in Cell, Molecular, and Developmental Biology (CMDB), Genetics, Genomics, and Bioinformatics (GGB), Biochemistry and Molecular Biology (BMB), and Ecology, Evolution, and Organismal Biology (EEOB). These programs don't typically attract students interested in using biophysical approaches to address questions. Therefore, I see your proposed Biophysics graduate program as highly complementary to existing programs in the life sciences. It will be a welcome addition to our campus.

Good luck with the proposal.

Sincerely,



Patricia Springer



PROFESSOR JINGSONG ZHANG, CHAIR
DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA, RIVERSIDE
RIVERSIDE, CA 92521-0403

PHONE: (951) 827-3488
FAX: (951) 827-2435
e-mail: jingsong.zhang@ucr.edu

September 16, 2016

Russ Hille
Distinguished Professor of Biochemistry
1463 Boyce Hall

Dear Russ,

I am writing to express a strong support for the development of a Biophysics Graduate Program at UC Riverside. As discussed in your proposal, a substantial number of faculty in the areas related to biophysics are already present on the UCR campus, while these faculty are spread over multiple departments and colleges and would benefit from a cohesive graduate training environment in biophysics. The proposed interdepartmental Graduate Program in Biophysics will complement the current expertise in bioanalytical chemistry and biophysics in the Department of Chemistry. The proposed Biophysics program will have a very positive impact on the research programs of several faculty in the Department of Chemistry, promote extensive collaborative research activities between faculty all over the campus, and increase the campus's research portfolio. I believe that the proposed Biophysics program complements and will have positive interactions with the Chemistry Graduate Program.

Sincerely yours,

Jingsong Zhang

KENNETH N. BARISH
CHAIR & PROFESSOR
DEPARTMENT OF PHYSICS & ASTRONOMY
PHYSICS BUILDING, ROOM 3047A
RIVERSIDE, CALIFORNIA 92521-0413
PHONE: (951) 827-7700
EMAIL: kenneth.barish@ucr.edu

September 16, 2016

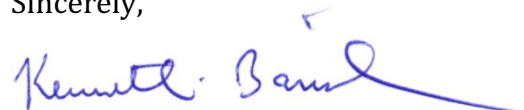
Russ Hille
Distinguished Professor
Department of Biochemistry
240B Boyce Hall

Dear Russ,

I am delighted to support the development of an interdepartmental Biophysics Graduate Program at UC Riverside. The program will leverage the expertise in biophysics that already exists on campus from the Departments of Biochemistry, Bioengineering, Chemistry and Physics & Astronomy, and promises to attract top applicants. A Biophysics graduate program will complement the Department of Physics & Astronomy's biophysics research, which includes sensitive force measurement techniques to study the interaction between single molecules involved in signal transmission in the human brain. Expanding biophysics as a top priority of the department, as reflected in recent hiring plans. The program will also utilize existing Physics classes.

Biophysics is an expanding and vibrant field. I fully support the establishment of an interdepartmental biophysics graduate program. Thank you for working to establish this program.

Sincerely,



Kenneth N. Barish
Chair and Professor
Physics and Astronomy Department



RUSS HILLE
DISTINGUISHED PROFESSOR OF BIOCHEMISTRY
1463 BOYCE HALL
Phone: (951) 827-6354
e-mail: russ.hille@ucr.edu
Fax : (951) 827-2364

RIVERSIDE, CALIFORNIA 92521-0122

July 30, 2016

Dear Dr. XXXX:

We are in the process at UC Riverside of proposing an interdepartmental graduate program in Biophysics, leading to the degree of Ph.D. In accordance with the review policy established by the systemwide Coordinating Committee of Graduate Affairs (CCGA), I write to provide you, as Director of an existing comparable program, with a copy of the current draft of our proposal. We would be very grateful for any feedback you may wish to offer, so that the proposal may be made as strong as possible prior to submission.

AA background, please understand that the format and contents of the proposal follow the required outline found in the CCGA Handbook, and that internal and external reviewers will later be asked to address the following four points when examining our final submission:

- Quality and academic rigor of the program
- Adequacy of the size and expertise of faculty to administer the program
- Adequacy of the facilities and budget
- Applicant pool and placement prospects for the graduate students

If you wish to provide feedback, we would appreciate receiving it within four weeks of the date of this letter, as we intend to submit the proposal for campus review at that time. We very much appreciate your taking the time to do so.

With best regards,

A handwritten signature in black ink, appearing to read "Russ Hille", is written over a horizontal line.

Russ Hille, Ph.D.
Distinguished Professor of Biochemistry



Professor James Hurley
Department of Molecular and Cell Biology
374D Stanley Hall #3220
Berkeley, CA 94720-3220
Voice: (510) 643-9491
jimhurley@berkeley.edu

September 26, 2016

Professor Russ Hille
Distinguished Professor of Biochemistry
University of California Riverside

Re: Proposed Biophysics Program at UCR

Dear Dr. Hille,

Biophysics has an outsized role to play at the interface between the methods and approaches of physics on the one hand, and, on the other, problems in biology that are of central importance to society, medicine, and fundamental understanding of life. At UC Berkeley, we have had a Biophysics Graduate Program in some form since 1942. Interest from prospective students continues to grow. We had an entering class of 12 this year, a record in recent years. We have sustained interest from faculty, and the presence of the program is an attractor in recruitment. It was certainly important to me when I joined UC Berkeley 3 years ago, and I believe it was a factor in our recent recruitment of Nobelist Eric Betzig. Many of our graduates have gone on to distinguished academic careers, while others have been snapped up upon graduation by Bay Area industry employers. I believe it makes sense for every UC campus to have a Biophysics program, track, or department in some form, and certainly it makes sense for UC Riverside to pursue this.

The structure of your proposed program closely resembles the one at Berkeley in most respects. The core curriculum and duration of the program are similar, as are the plans for funding students and administration. It appears to me that the critical mass of faculty is already present at Riverside. Your plan strikes me as realistic and well thought out. At this time, I have no improvements or changes to suggest, since you seem to have thought of everything. Should your program be approved, as it deserves to be, I would be happy to consult in the future if there is any input I could provide that would be useful.

In conclusion, I strongly support your proposal and wish you the best of luck with it.

Yours,

A handwritten signature in black ink, appearing to read "James H. Hurley", written in a cursive style.

James H. Hurley
Judy C. Webb Chair
Professor of Biochemistry, Biophysics and Structural Biology
Chair, Graduate Group in Biophysics



BIOPHYSICS GRADUATE GROUP
GRADUATE GROUP COMPLEX
FAX: (530) 752-8822

ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616

September 13, 2016

PROFESSOR Russ Hille

Distinguished Professor of Biochemistry
University of California Riverside

RE: PROPOSED BIOPHYSICS PROGRAM AT UCR

Dear Dr. Hille,

I congratulate you on assembling a motivated group of faculty to organize and participate in a new graduate program in Biophysics. As described in your proposal, there is a growing demand for life science investigators that have a strong quantitative foundation in math, chemistry and physics. Your proposed program in Biophysics meets this need by assembling an interdisciplinary team of faculty that offer students training on the cutting-edge developments in biophysical tools and theory.

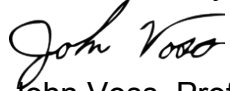
Since its inception in 1961, the Biophysics program at UC Davis has enjoyed a long run of graduating outstanding students, the vast majority with the PhD degree. We are now considering adding a M.S. plan similar to your Plan II. Having a well-defined Masters option from the outset is an excellent idea and will help justify and motivate faculty to develop new courses.

Although the interdisciplinary nature of biophysics brings together an exciting mix of faculty and students from across the campus, it can present a challenge in terms of institutional support compared to programs that align with a single department or college. Thus depending on the structure for graduate student support at UCR, formulating some commitments of support from the home colleges/schools of participating faculty would be very helpful by solidifying a shared ownership of the program. For example, the lack of a home department/college for Biophysics at UCD severely limits our student access to TA positions within the undergraduate curriculum. This challenge has pushed us to be conservative in our number of admits each year, as without TA positions we do not have mechanisms to support students in cases where the major advisor has a gap in funding.

Your proposed curriculum comprehensively covers the major and emerging areas of biophysics with rigor and quality faculty. In addition, your identified course list with example tracks is especially important for recruiting students.

The size and expertise of the faculty is adequate to administer the program. I expect the program to grow in faculty numbers with increased recognition of the unique students within the program.

Yours sincerely,

A handwritten signature in black ink that reads "John Voss". The signature is written in a cursive style with a large, stylized "J" and "V".

John Voss, Professor and Chair
Biophysics Graduate Group
University of California Davis
jcvoss@ucdavis.edu

Appendix IV. Letters from CNAS Dean's office

Kathryn Uhrich, Dean, College of Natural and Agricultural Sciences (10/7/2016)

Kathryn Uhrich, Dean, College of Natural and Agricultural Sciences (8/3/2017)

Umar Mohideen, Divisional Dean for Physical Sciences and Mathematics

Frances Sladek, Divisional Dean for the Life Sciences

To: Kevin Esterling, Interim Dean, Graduate Division

From: Kathryn Uhrich, Dean, CNAS



Date: October 7, 2016

Re: Interdepartmental Graduate Program in Biophysics.

I write to endorse the proposal for an interdepartmental graduate program in Biophysics. This proposal is fully aligned with the College's and campus's strategic goals of increasing its research portfolio, particularly in biomedically relevant areas. UCR is unique in having all the applied and fundamental sciences under a single administrative umbrella, but owing to the various departmental missions, disciplinary strengths in the biological sciences has been scattered among many separate departments, most of which operate their own graduate programs. As a consequence, we have often lacked a unified approach to graduate education in fundamental areas of biological sciences that fully utilizes all of our faculty strengths.

The program envisioned in this proposal will provide much need unity and integration in the vital area of biophysics, and I enthusiastically endorse its creation.

August 3, 2017

Distinguished Professor Russ Hille
Department of Biochemistry
University of California
Riverside CA, 92521

RE: UCR Senate comments on the proposed Interdepartmental Graduate Program in
Biophysics

Dear Russ,

We have reviewed the comments and recommendations on the proposed Graduate Program in Biophysics from the UCR Senate committees on Planning & Budget, Library and Information, and Graduate Council.

We note the extremely positive endorsement that each committee provided for the new Biophysics Graduate Program. Nonetheless, two of these committees raised some concerns about issues related to budget, course schedule, TA allocations, and diversity which we address here:

Director stipend: Stipends for directors of CNAS Interdepartmental Graduate Programs are provided by CNAS. As we do for departmental chair positions, we are intent on providing, within our budgetary constraints, stipends that at least partially compensate our college leaders for their effort and time.

Program funding: We recognize that our interdepartmental graduate programs need to be placed on more substantial financial footing: this has been the subject of discussions between ourselves and former Dean Childers for several years. These discussions are ongoing and now, with the new campus-wide funding plan in place, we are in a more informed position to work with Graduate Division to formulate a plan for their stability and growth. That being said, we do not believe that this new interdepartmental graduate program should be delayed pending these discussions. Graduate training in biophysics on our campus is long overdue, especially as the field is undergoing something of a renaissance. Furthermore, the establishment of yet another interdepartmental graduate program in CNAS will act as a catalyst for the new financial planning that all our interdepartmental graduate programs require.

TA allocations: The question of TA allocations to this new program is an inevitable part of the planning process. We note that CNAS already has extensive experience in assigning TAs from both departmentally based and interdepartmental graduate programs in the life sciences through the TA Allocation Committee (TAAC) established by Divisional Dean Walling in the 2000s. TAAC has functioned extraordinarily well for more than a decade and so offers a model for how TAs may be assigned to graduate students in the Biophysics program.

Faculty diversity: We completely agree with Graduate Council's recommendation that more attention be paid to diversity among the faculty and cooperating faculty of the program. At the same time, we appreciate the efforts that you have made to diversify the faculty and the challenges that one faces in the field of biophysics. Faculty diversity is something that the graduate program and the college will maintain as a top priority.

Please let us know how we can be of further assistance in establishing this important graduate program on campus. We thank you for your leadership and care in shepherding this proposal through the various campus and Senate committees.

Sincerely,

A handwritten signature in black ink, appearing to read 'K E'.

Kathryn E. Uhrich
Dean
College of Natural & Agricultural Sciences

A handwritten signature in blue ink, appearing to read 'Frances M. Sladek'.

Frances M. Sladek
Divisional Dean of Life Sciences

A handwritten signature in black ink, appearing to read 'Umar Mohideen'.

Umar Mohideen
Divisional Dean of Physical & Mathematical
Sciences

October 26, 2016

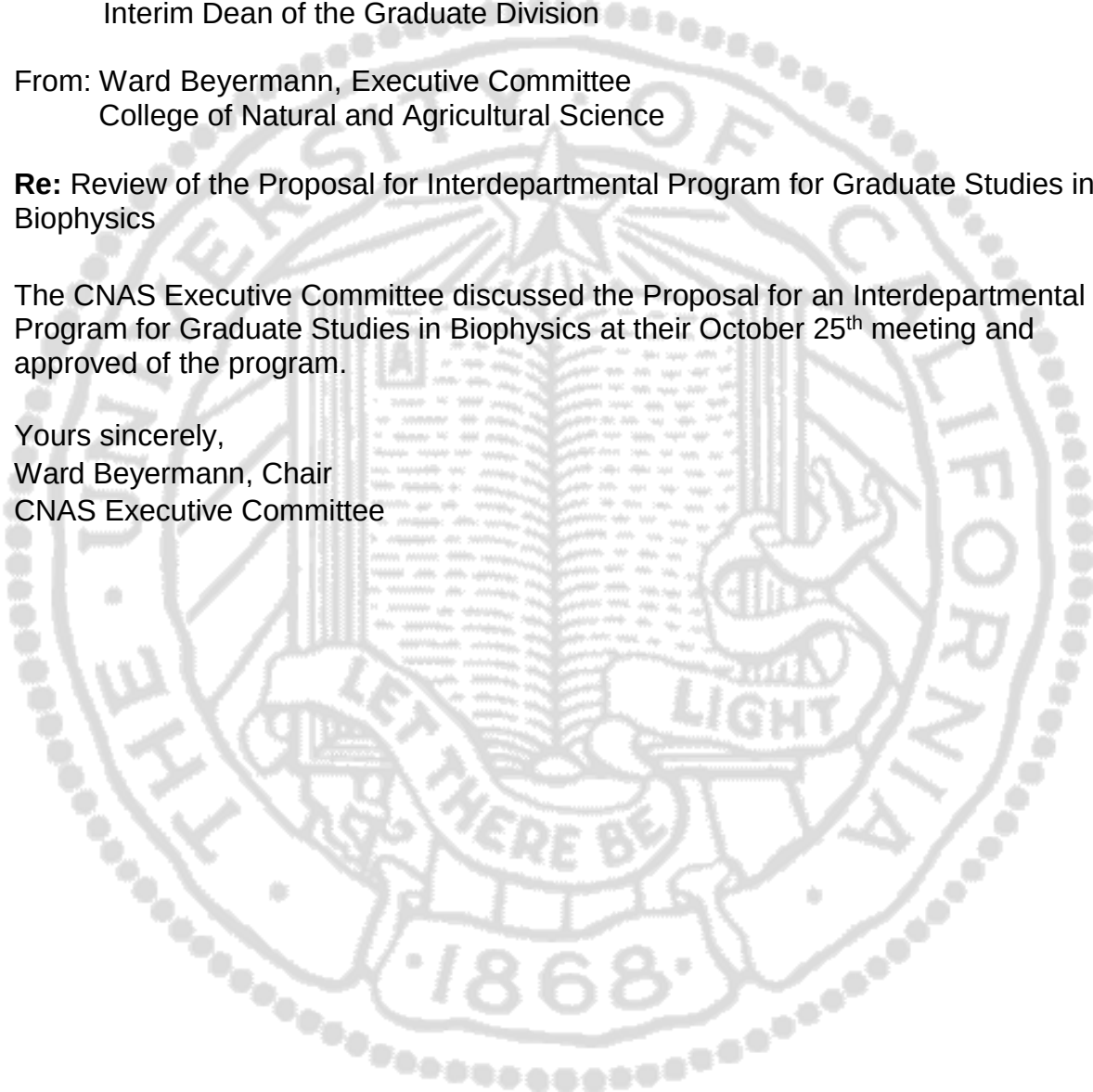
To: Kevin Esterling
Interim Dean of the Graduate Division

From: Ward Beyermann, Executive Committee
College of Natural and Agricultural Science

Re: Review of the Proposal for Interdepartmental Program for Graduate Studies in
Biophysics

The CNAS Executive Committee discussed the Proposal for an Interdepartmental
Program for Graduate Studies in Biophysics at their October 25th meeting and
approved of the program.

Yours sincerely,
Ward Beyermann, Chair
CNAS Executive Committee



Course catalog descriptions of proposed core courses

BCH 184 Topics in Physical Biochemistry (4 units) Lecture, 3 hr; discussion, 1 hr. Prerequisite(s): BCH 100 with a grade of "C-" or better or BCH 110A with a grade of "C-" or better; BIEN 135 with a grade of "C-" or better, or CHEM 109 with a grade of "C-" or better or CHEM 110A with a grade of "C-" or better; or consent of instructor. Explores modern biophysical methods determining the structures of biological macromolecules and relating structure to function. Covers X-ray crystallography, NMR, and cryoelectron microscopy. Addresses imaging and mass spectrometry for determining structure and ultraviolet, visible, infrared Raman, fluorescence, NMR, EPR and other forms of spectroscopy for relating macromolecular structure to function.

BIOL 203 Cellular Biophysics (3 units) Lecture, 3 hrs. Prerequisite(s): BIOL 200/MCDB 200; BIOL 201/MCDB 201; CHEM 109 or equivalent; or consent of instructor. Biophysical principles that determine cellular structure and function, including diffusion, electrochemical gradients, transport, macromolecular interactions, and genetic recombination. Illustrative examples are used to highlight the importance of these principles in modern cell biology and physiology.

PHYS 246 Biological Physics (4 units) Lecture, 3 hr; Discussion, 1 hr. Prerequisite(s): PHYS 134 or consent of instructor. Introduces topics at the interface of physics and biology: cell physiology, probability and information, diffusion, random walks, electrostatics, elasticity of biopolymers and membranes, DNA topology, friction in fluids, and low Reynolds numbers. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.

BCH 184 – Topics in Physical Biochemistry – Winter 2016

Professors: Richard Debus, Jikui Song, and Li Fan

TA: Matthew Harter (mhart005@ucr.edu)

(Office Hours: Thursdays, 10:00 AM to noon in Boyce Hall 5487)

Discussion Sections: Meets on Mondays or Tuesdays

Section 1 Instructor: Prof. Richard Debus (richard.debus@ucr.edu)

Textbook: Atkins, P. & de Paula, J. (2011) *Physical Chemistry for the Life Sciences*, 2nd edition (ISBN #: 978-1-4292-3114-5) (1st edition is OK too) and readings posted on iLearn

Office Hours: Monday, 1:30 to 3:30 PM in room 2446A Boyce Hall

January 4	Quantum Chemistry
January 6	Atoms & Molecules
January 8	Centrifugation
January 11	Mass Spectrometry
January 13	Introduction to Spectroscopy; Vibrational Spectroscopy 1
January 15	Vibrational Spectroscopy 2
January 18	Holiday (no lecture)
January 20	UV/Vis spectroscopy; CD spectroscopy
January 22	Fluorescence Spectroscopy 1
January 25	Fluorescence Spectroscopy 2
January 27	EPR spectroscopy 1
January 29	EPR spectroscopy 2; Double Resonance methods
February 1	Exam 1 (in classroom): 150 points

Section 2 Instructor: Prof. Jikui Song

Textbook: Hore, P. J. (1995) *Nuclear Magnetic Resonance* (ISBN #: 0-19-855682-9)

Office hours: TBA

Feb.3	Introduction and Basic Concepts
Feb.5	Basic Concepts and 1D NMR Spectroscopy
Feb. 8	Spin-Spin Coupling and Nuclear Overhauser Effect
Feb. 10	Pulse Sequences, NMR Relaxation
Feb.12	¹ H NMR Spectroscopy
Feb. 15	holiday
Feb. 17	Multi-dimensional Heteronuclear NMR
Feb. 19	Chemical Shift and Protein Structure Analysis
Feb. 22	NMR Structure Determination and Course Overview
Feb. 24	Exam 2 (in classroom): 100 points covering section 2

Section 3 Instructor: Prof. Li Fan

Textbook: Rhodes, Gale (2006) *Crystallography Made Crystal Clear*. 3rd Ed. (ISBN #: 0-12-587073-3).

Office Hours: TBA

February 26	X-ray Crystallography #1 – Overview and Protein Crystals (Assigned Reading: Rhodes, Chapters 1-3)
Feb. 29	X-ray Crystallography #2 – Principles of X-ray Diffraction I (Assigned Reading: Rhodes, Chapter 4)
March 2	X-ray Crystallography #3 – Principles of X-ray Diffraction II (Assigned Reading: Rhodes, Chapter 4)
March 4	X-ray Crystallography #4 – From diffraction to electron density (Assigned Reading: Rhodes, Chapters 2 & 5)
March 7	X-ray Crystallography #5 – Estimation of Phases – Molecular Replacement (Assigned Reading: Rhodes, Chapter 6)
March 9	X-ray Crystallography #6 – Estimation of Phases – Experimental Methods (Assigned Reading: Rhodes, Chapter 4 & 6)
March 11	X-ray Crystallography #7 – Structural Refinement & Judging the Molecular Model (Assigned Reading: Rhodes, Chapter 7-8)
March 17	Final Exam (11:30-1:00): 100 points covering Section 3

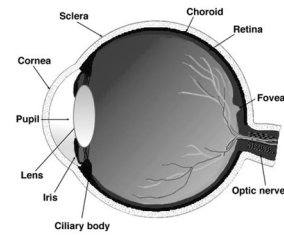
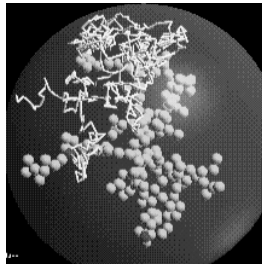
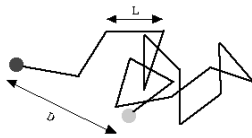


Fig. 6. Vertical sagittal section of the adult human eye.

Biology 203
Cellular Biophysics and Physiology
Rich Cardullo, Department of Biology

Week	Topic	Assignment Due
9/27 – 10/1	Probability Theory/Sex Distribution in Families	
10/4 – 10/8	Average charge on a macromolecule	HW 1 due 10/8
10/11 – 10/15	The random walk/protein folding	
10/18 – 10/22	Diffusion modeling	HW 2 due 10/22
10/25 – 10/29	Transport across membranes	
11/1-11/5	Filtration	HW 3 due 11/5
11/8 – 11/12	Poisson Processes	
11/15 – 11/19	The Luria-Delbrück Experiment	HW 5 due 11/19
11/22 – 11/26	The photon detection limit of the eye	
11/29 – 12/3	Special Topics	HW due 12/3

Final Exam: December 6, 2004 from 8 a.m. – 11 a.m. in Spieth 1239.

Grading: Homework is worth 75%, Final is worth 25%.

Physics 246

Biological Physics

Instructor

Roya Zandi
Office: 3026 Physics Building
Office hours: 2:00-3:00 Thursdays, or by appointment.
Email:roya.zandi@ucr.edu

Class meetings

Tuesdays /Thursdays, 9:40-11:00 pm
Location: ENGR2 141

Course Description

Single-molecule studies of macromolecules now allow tests of the conceptual foundations of statistical mechanics. The class provides a review of the physical and mathematical foundations of equilibrium and non-equilibrium statistical mechanics with emphasize on selected "hot topics" that lie at the interface of physics and biology.

Prerequisites

Statistical Mechanics (134)

Textbook

Biological Physics: Energy, Information, Life by Philip Nelson (2004) ISBN 0 7167 4372 8

We are using Nelson as the basic structure, but I will probably expand on some topics and introduce some other new ones.

There are many excellent resources on the web. Here are a few examples;

ITP Program on Bioinformatics: <http://matisse.ucsd.edu/itp-bioinfo/>

A course by Prof. Goldenfeld on Statistical Physics of Biological Information and Complexity:<http://guava.physics.uiuc.edu/%7Enigel/courses/498BIO/>

A course at Berkeley on Molecular Biophysics: <http://alice.berkeley.edu/biophysics/>

Tentative outline

- 1) Probability and Information
- 2) RNA, DNA, and proteins
- 3) Random Walks, Friction, and Diffusion
- 4) Brownian Motion, the Einstein relation, and the Fokker-Planck Equation
- 5) Langevin Equation and the Fluctuation Dissipation Theorems.
- 6) Non-equilibrium Thermodynamics, the Onsager Reciprocity Relations and Entropy Production.
- 7) Polymer Theory: Softening of rigidity by fluctuations, Entropy and Markov chains, Flory theory, Worm-like chain model
- 8) *Electrostatics*: Macro-ions, counter-ions, pH, Poisson-Boltzmann equation, Debye equation
- 9) DNA Topology (Link, Twist, and Writhe).

Assignments

The homework assignments are an important part of this course, and the overall average homework score will count for *60% of the final grade*. **You may consult with classmates in "study groups," as long as you write out your own answers.**

Problem sets should be turned in at the beginning of class on the due date. No problem sets will be accepted after the solutions have been posted. Problem sets handed in after the deadline but before the solutions have been posted are subject to a 50% grade penalty.

A Final Project will count for 40% of the final grade.

Final project: An in-class presentation on a topic of your choice. The presentation will be about 30 minutes and can cover any topic at the interface of biology and physics. You'll need to discuss your topic with me in advance.

APPENDIX VII. Catalog Descriptions of Elective Courses

BCH 186 Topics in Molecular Bioenergetics (3) Lecture, 3 hours. Prerequisite(s): BCH 100 with a grade of "C-" or better or BCH 110B with a grade of "C-" or better; BCH 184 with a grade of "C-" or better; or consent of instructor. Introduction to biological energy transduction. Describes the coupling of oxidative phosphorylation and photosynthesis to adenosine triphosphate (ATP) synthesis and the coupling of ATP hydrolysis to ion transport, chemotaxis, molecular motors, biomimetics, and other biological processes on the basis of recent structural and mechanistic studies of the protein complexes involved.

BCH 187 Fundamentals of Enzymology, 3 units, Lecture, 3 hours. Prerequisite(s): BCH 100 or BCH 110A with a grade of C- or better. An introduction to the fundamental principles of enzymology. Specific topics include, acid-base catalysis, strain effects, transition state theory, enzyme kinetics (including isotope effects), enzyme dynamics and enzyme regulation. Considers in detail the reactions of several representative enzymes.

BCH 210 Biochemistry of Macromolecules, 4 units, Lecture, 4 hours. Prerequisite(s): BCH 110A, BCH 110B, BCH 110C or equivalents; BCH 184 (may be taken concurrently); CHEM 109; graduate standing or consent of instructor. Discussion of recent advances in the knowledge of the molecular architecture of proteins and nucleic acids, especially with respect to new experimental approaches for analyzing their structure and function. Chemistry of the active site of enzymes.

BCH 230F Advanced Topics in Biochemistry (2) Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): BCH 100 or both BCH 110A and BCH 110B or consent of instructor. Addresses advances in enzymology by analysis of the recent literature.

BIEN 135 Biophysics and Biothermodynamics, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIEN 101, MATH 10B, MATH 046, PHYS 040C. An introduction to the application of thermodynamic principles to understanding the behavior of biological systems. Discusses biophysical properties of biomacromolecules such as proteins, polynucleotides, carbohydrates, and lipids, as well as the methods of characterizing their properties and interactions.

BIEN 142 Introductory Biomedical Optical Imaging, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PHYS 040C and MATH 010B; or consent of instructor. Examines fundamental theory and basic design of biomedical optical imaging systems. Topics include a basic understanding of the working principles of optical components, diagnostic light-tissue interaction, and design of imaging systems to exploit the interaction of light with biological phenomena.

BIEN 160 Biomedical Imaging, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIEN 120. An introduction to the fundamental physics and engineering principles for medical imaging systems. Covers X-ray, ultrasound, radionuclide, magnetic resonance imaging, positron emission tomography, optical coherent tomography, and other optical methods. Includes image formation and reconstruction, image characteristics, and quality and image processing.

BIEN 165 Biomolecular Engineering, 4 units, Lecture, 2 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): BIEN 135, or consent of instructor. Emphasizes engineering, biochemical, and biophysical concepts and technologies intrinsic to specific topics of biomolecular engineering. Introduces the history of genetic and protein engineering. Topics include biological thermodynamics, molecular kinetics, biochemical and biophysical approaches, protein engineering, high-throughput screening technologies, and protein engineering with unnatural amino acids.

BIEN 242 Advanced Biomedical Optical Imaging, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIEN 142 or equivalent; graduate standing or consent of instructor. Examines advanced theory and optimized design of biomedical optical imaging systems. Topics include a full understanding of the working principles of optical components, diagnostic light-tissue interaction, and design of imaging

systems to exploit the interaction of light with biological phenomena. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.

BIEN 245 Optical Methods in Biology, Chemistry, and Engineering, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CHEM 109 or equivalent; graduate standing; consent of instructor. Covers the origin of fluorescence and other emission processes that modulate the characteristics of molecular emissions. Presents emission-based analytical and bioanalytical methods and techniques. Reviews state-of-the-art instrumentation, including their applicability, limitations, and source. Also provides interpretation and meaning of the measured signals as applied to biological systems. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor. Course is repeatable as content changes. Cross-listed with MSE 226.

BIEN 249 Integration of Computational and Experimental Biology, 4 units, Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005B; MATH 010B, MATH 046, PHYS 040C; graduate standing. A multidisciplinary introduction to computational methods used to analyze experimental biological data. Introduction to mathematical concepts needed to understand protein structure and dynamics, protein-protein interactions (structures and networks), gene regulatory networks, signal transduction networks, metabolic networks, and kinetic modeling of cellular processes. Also covers techniques used to derive experimental data. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor. Cross-listed with CEE 249.

BIEN 251 Biophotonics: Optical Microscopy and Its Biological Applications, 3 units, Lecture, 2 hours; discussion, 1 hour. Prerequisite(s): graduate standing or consent of instructor. Examines the fundamentals of optical system design and system integration in light microscopy. Covers design components, including light sources, lenses, mirrors, dispersion elements, optical fibers, and detectors. Also covers optical system analysis, transfer functions, magnification, resolution, contrast, and molecular, cellular, organ, and organism applications.

CHEM 201A Advanced Physical Chemistry: Quantum Mechanics (3) Lecture, 3 hours. Prerequisite(s): CHEM 113 with a grade of "C" or better. Covers concepts in quantum mechanics including wavepackets, uncertainty, single particles in multiple dimensions, and approximate methods for solving the Schroedinger equation.

CHEM 201B Advanced Physical Chemistry: Quantum Mechanics and Spectroscopy (3) Lecture, 3 hours. Prerequisite(s): CHEM 113 with a grade of "C" or better. Covers concepts in quantum mechanics with particular applications to spectroscopy.

CHEM 201C Advanced Physical Chemistry: Elementary Statistical Mechanics (3) Lecture, 3 hours. Prerequisite(s): CHEM 110A and CHEM 110B with grades of "C" or better. Covers concepts in elementary statistical mechanics including ensembles, interpretations of thermodynamic functions, and quantum statistics.

CHEM 201D Advanced Physical Chemistry: Thermodynamics (3) Lecture, 3 hours. Prerequisite(s): CHEM 110A and CHEM 110B with grades of "C" or better. Covers concepts in thermodynamics including fundamental equations, potentials, Maxwell relations, and stability criteria. Cross-listed with MSE 205.

CHEM 201E Advanced Physical Chemistry: Kinetics (3) Lecture, 3 hours. Prerequisite(s): CHEM 110A and CHEM 110B with grades of "C" or better. Covers concepts in kinetics including reaction mechanisms and the molecular interpretation of reaction dynamics.

CHEM 206A Introduction to Computational Quantum Chemistry (3) Lecture, 3 hours. Prerequisite(s): CHEM 113 or equivalent, graduate standing; or consent of instructor. Introduces computational techniques in quantum chemistry. Includes Hartree-Fock theory, Density Functional Theory, and

electron correlation methods. Emphasizes practical applications in a research setting. Cross-listed with MSE 225C.

CHEM 206B Modeling Chemical and Biochemical Molecules (3) Lecture, 3 hours. Prerequisite(s): graduate standing in Chemistry or a related field or consent of instructor. Introduces students to the principles, concepts, and techniques for modeling chemical and biological systems. Covers the various methods and techniques for molecular simulations, energy calculations, obtaining initial data, accessing data reliably, visualization and analysis of molecules, and screening and designing chemicals for proteins.

CHEM 209 (E-Z) Advanced Topics in Physical Chemistry (2-3) lecture, 2 hours (2 units) or 3 hours (3 units). Prerequisite(s): consent of instructor. Additional prerequisites are required for some segments of this course; see department. Selected advanced topics from modern physical chemistry.

CHEM 211D Spectrometry in Organic Structure Analysis (3) Lecture, 3 hours. Prerequisite(s): graduate standing or consent of instructor. Utilizes modern spectroscopic techniques such as IR, mass spectrometry, and ^1H and ^{13}C NMR to determine the structure of complex organic molecules. Topics include advanced NMR techniques such as 2D NMR, NMR pulse sequences, diffusion NMR, and MRI. Cross-listed with MSE 225A.

CHEM 229G Advanced Topics in Analytical Chemistry (2 or 3) Lecture, 2-3 hours. Prerequisite(s): consent of instructor. Additional prerequisites may be required for segments of this course; see department. Selected advanced topics from modern analytical chemistry. Course content will vary.

PHYS 145A Biophysics, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CHEM 001C or CHEM 01HC; MATH 010B; MATH 046; one of the following: PHYS 002C with B- or better, PHYS 041C with a C- or better, PHYS 040E with a C- or better. Covers physical modeling of the structure of proteins; protein folding; structure of nucleic acids; electrostatic potential of DNA; dynamics of biomolecules; structure of a biological cell; osmotic pressures of cells; non-equilibrium thermodynamics; and biochemical reactions.

PHYS 145B. Biophysics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PHYS 145A; BCH 100 or BCH 110B; or consent of instructor. Covers conformation of biopolymers, intermolecular forces, dynamics of biopolymers, Brownian motion, biopolymers as polyelectrolytes, electrolytic solutions, and the Debye-Huckel theory.

PHYS 145C. Biophysics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PHYS 145B or consent of instructor. Examines stochastic thermodynamics; the Fluctuation Theorems and the Jarzynski relation; protein and RNA denaturation; tests of the Jarzynski relation; chemical forces and selfassembly; enzymes and molecular machines; survey of molecular devices found in cells; and kinetics of real enzymes and machines.

PHYS 212A Thermodynamics and Statistical Mechanics, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): graduate standing; consent of instructor. Covers thermodynamics, statistical mechanics, ideal Bose systems, ideal Fermi systems, and bulk motion. Cross-listed with MSE 204.

PHYS 212B Thermodynamics and Statistical Mechanics, 4 units, Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MSE 204/PHYS 212A; graduate standing; consent of instructor. Addresses functional integrals and approximation techniques. Provides an introduction to phase transitions and the renormalization group.