Graduate Program in Chemistry and Biochemistry

For more information regarding the Master's Degree programs in Chemistry or Biochemistry, please write or e-mail:

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Visit the CSUN Chemistry and Biochemistry home page
http://www.csun.edu/chemistry
THE UNIVERSITY: California State University Northridge (CSUN) is one of 23 institutions that comprise the California State University system. CSUN is located on 350 acres in the northwestern part of the San Fernando Valley, a suburban area of the City of Los Angeles.

Utilizing the facilities of many physical structures on a beautifully landscaped campus, the 1,821 full and part-time faculty members and over 30,000 students engage in intellectual, cultural, social and recreational activities designed to increase the personal and professional development, the sense of commitment, and the desire for involvement of all who make up the University community.

Graduate student Joe Benoun evaluating his fluorescence microscopy data.

GRADUATE PROGRAM: The Chemistry and Biochemistry Department currently offers two Master of Science degrees. The MS Chemistry degree allows specialization in the areas of organic, inorganic, physical, analytical or biochemistry and is primarily intended for students desiring research-oriented careers in the chemical industry, post-secondary chemistry teaching or entry into Ph.D. programs. The MS Biochemistry degree allows specialization in the areas of biochemistry, molecular biology, or bioorganic chemistry and is primarily intended for students desiring research-oriented careers in chemical, biochemical, biotech industry, post-secondary chemistry teaching or entry into Ph.D. programs. Both programs require 30 units of graduate study, including a research project and a thesis. The modest size of our graduate program should be particularly attractive to those students who wish to pursue a program of research and study in close collaboration with a research advisor of their choice.

DEPARTMENT FACILITIES: The Department is housed in a three-story science complex, complete with excellent technical support staff and facilities.

The Department has a complete range of modern instrumentation including laser Raman, high-field (400 and 600 MHz) multinuclear NMR spectrometers, low temperature X-ray diffractometer, FT-IR, a molecular graphics facility, GC, LC and inductively-coupled plasma mass spectrometers, and numerous other spectrophotometers, chromatographs, microscopes and microprocessor-controlled instruments.

The university library contains over 1.2 million volumes and approximately 2,500 current periodicals, most of which are also available online, as well as a CAS ONLINE service. Excellent computing facilities are available.

HOW TO APPLY: The University accepts applications beginning Nov. 1 for the following fall semester, and Aug. 1 for the spring semester. It is to the applicant's advantage to file during the month of November or August for the subsequent fall or spring semester. However, the University will continue to accept applications beyond these months as long as applications do not exceed the available openings. Submit your application to www.csumentor.edu, and send a personal statement and at ≥1 letter of recommendation to the Department of Chemistry & Biochemistry.

EXPENSES: The cost of attending CSUN is an exceptional value. For the latest information on fees, see the California State University, Northridge website: www.csun.edu. Living expenses are additional.

FINANCIAL SUPPORT: Teaching assistantships are available to qualified candidates each semester, and supplementary income may be obtained in summer. Applications should be made directly to the Graduate Coordinator, Department of Chemistry & Biochemistry, CSUN, Northridge, CA 91330-8262.

FINANCIAL AID: The Financial Aid Office of CSUN administers a variety of programs for students demonstrating financial need. For further information, please visit the CSUN Financial Aid Office website (www.csun.edu/financialaid).

HOUSING: The University's on-campus housing can accommodate over 2,100 students. There are also numerous apartments, houses, and rooming arrangements located near the university listed with the Off-Campus Housing Office.

RECREATION FACILITIES: Northridge is close to the beaches, the mountains, the desert and the cultural activities of the greater Los Angeles area. In addition, CSUN is within easy reach of Caltech, JPL, UCLA and USC and the social and intellectual activities there. The University maintains a variety of recreational facilities.

Graduate student Nick Baca with an ultra-high vacuum x-ray photoelectron spectrometer.
MASTER OF SCIENCE IN CHEMISTRY

The Master of Science in Chemistry requires submission of an acceptable thesis based on laboratory research, within five years of attaining classified status. This option prepares students for research-oriented careers in the chemical industry, for entry to doctoral degree programs or for teaching chemistry at institutions such as community colleges.

For admission to classified graduate status in the program, a student needs the following:

1. A Bachelor’s Degree with a 3.0 overall grade point average and a Chemistry major equivalent to that at CSUN.

2. Entering graduate students are required to take proficiency examinations in organic, analytical, physical, and inorganic chemistry. These are standardized, multiple-choice exams prepared by the American Chemical Society covering basic one-year sequences in the given areas. The exams are given before registration week of the semester in which a student enters our program, and the results are used to help plan a course of study. Unsatisfactory scores will require remedial coursework before entering regular graduate courses. International students must submit a minimum TOEFL score of 213 or IELTS score of 6.5.

3. Departmental approval.

4. A passing score on the Upper Division Writing Proficiency Examination.

For the Degree:

1. A minimum of 30 units of graduate work including a thesis. At least 21 units must be taken in 500- or 600-level courses.

   a. Required Courses (6-12 units)
      - Chem. 691 Literature Seminar 1 unit
      - Chem. 692 Thesis Seminar 1
      - Chem. 696 Directed Graduate Research 3-7
      - Chem. 698 Thesis 1-3

   b. Electives (18 to 24 units)
      These electives should be selected with the approval of the graduate advisor from 400- and 500-level Chemistry courses and must include at least one course that has a laboratory component. A maximum of 9 units of 400-level courses may be applied toward the 30 units required for the degree.


3. Formal approval by the Graduate Thesis Committee.

MASTER OF SCIENCE IN BIOCHEMISTRY

The Master of Science in Biochemistry degree requires submission of an acceptable thesis based on laboratory research, within five years of attaining classified status. This option prepares students for research-oriented careers in biochemistry or biotechnology industries, for entry to doctoral degree programs or for teaching biochemistry at institutions such as community colleges.

For admission to classified graduate status in the program, a student needs the following:

1. A Bachelor’s Degree with a 3.0 overall grade point average with major in Chemistry, Biochemistry or other areas with the appropriate science content.

2. Entering graduate students are required to take proficiency exams in biochemistry and organic chemistry plus one more chemistry (analytical, physical or inorganic chemistry). These are standardized, multiple-choice exams prepared by the American Chemical Society covering basic one-year sequences in the given areas. The exams are given in advance of the semester in which a student enters our program, and the results are used to help plan a course of study. Unsatisfactory scores will require remedial coursework before entering regular graduate courses. International students must submit a minimum TOEFL score of 213 or IELTS score of 6.5.

3. Departmental approval.

4. A passing score on the Upper Division Writing Proficiency Examination.

For the Degree:

1. A minimum of 30 units of graduate work including a thesis. At least 21 units must be taken in 500- or 600-level courses.

   a. Required Courses (12 to 18 units)
      - 500-level Biochemistry Courses 6 units
      - Chem 691. Literature Seminar 1
      - Chem 692. Thesis Seminar 1
      - Chem 696. Directed Graduate Research 3-7
      - Chem 698. Thesis 1-3

   b. Electives (12-18 units)
      These electives should be selected with the approval of the Graduate Advisor from 400- and 500-level Chemistry and Biochemistry/Biology courses and must include at least one course that has a laboratory component. A maximum of 9 units of 400-level courses may be applied toward the 30 units required for the degree.


3. Formal approval by the Graduate Thesis Committee.
MADS P.S. ANDERSEN (Sulbaek.Andersen@csun.edu)

B.S., University of Southern Denmark, Denmark, 1999; M.S., University of Southern Denmark, Denmark, 2002; Ph.D., University of Copenhagen, Denmark, 2006; Post-doctoral research, University of California, Irvine, 2006 – 2009 and Jet Propulsion Laboratory, Pasadena CA, 2010 – 2012. (Analytical Chemistry)

Dr Andersen’s research: analytical and environmental chemistry, with a focus on:
- Molecular spectroscopy and kinetics and mechanisms of reactions important in Earth’s atmosphere and other planetary atmospheres.
- Aerosols, photochemistry and health: from the lower troposphere to the lower stratosphere.
- Atmospheric chemistry and environmental fate of non-CO₂ greenhouse gases and their role in a feasible plan for climate stabilization.
- The environmental fate, dispersion, and persistence of consumer/industrial chemicals.
- Technologies addressing issues in energy, transportation and human health.
- Environmental policy: Impacts and economics of energy policies, sustainable strategies and global change.

Selected Publications (from a total of 51):


Professor Charonnat's research interests are: 1) the total synthesis of natural products, and 2) the development of new synthetic methodology. The first project is a highly stereo- and regio-controlled total synthesis of the GABA antagonist, (-)-anisatin (shown below). This functionally complex sesquiterpene is one of very few naturally occurring beta-lactones. The second category includes studies on mild, selective Conia cyclizations, and conjugate additions to enol tosylates of alpha-dicarbonyl compounds.

**Selected Publications:**


**M. S. Thesis:**

B.A. Rhode Island College, 1977; Ph.D. Florida State University, 1981; Post-doctoral Research, Lawrence Berkeley Laboratory and the Max-Planck-Institut, Germany. (Physical Chemistry)

Professor Collins’ main research interests are in the area of low temperature (10 K) photochemistry and spectroscopy. The technique of matrix-isolation is currently being used to stabilize unstable photochemical reaction intermediates and study them with Fourier Transform Infrared Spectroscopy. The ultimate goal is to be able to study photoreactions at 10 K and to correlate IR structural studies with luminescence studies related to the excited state reaction potential energy hypersurface.

Selected Publications:


W. Moran, G. Johnson and S. Collins, "The Photochemistry of (\(\mu_2\)-\(\eta^2\)-CH\(_3\)CH\(_2\)=CH\(_2\))\(\mu\)-CO)Os\(_3\)(CO)\(_9\) and (\(\mu_2\)-\(\eta^2\)-CH\(_3\)CH\(_2\)=CH\(_2\))\(\mu\)-H)Os\(_3\)(CO)\(_9\) in Rare Gas Matrices at 10 K", J. Molecular Structure, 222, 235 (1990).

M. S. Theses:


FTIR spectra of argon matrix-isolated flavone, 5-hydroxyflavone (5HF), and 3-hydroxyflavone (3HF) at 10 K, depicting the carbonyl stretch region.
Dr. Crowhurst’s research uses NMR spectroscopy to study the roles of structure, biophysical properties and protein dynamics on the specificity of protein-protein interactions and the activities of disordered proteins. The lab is currently pursuing two major projects:

1. **The role of internal motions in the specificity and affinity of RGS proteins for their Gα signaling partners.** Members of the RGS protein family are responsible for deactivating G protein signaling. Ultimately, RGS proteins control the relay of signals that are triggered by light, smell, hormones or neurotransmitters. The lab’s primary goal is to better understand how RGS proteins are selective for particular Gα targets, despite having very similar binding sites, and how this influences signal transmission. Since these proteins are critical for the initiation or regulation of signaling cascades, answers to these questions may lead to improved understanding of the mechanisms that cause conditions such as cancer, schizophrenia and neurodegenerative diseases, and can aid in drug design.

2. **In vitro and in-cell investigation of the acid-stress chaperone HdeA.** The stomach is an important barricade that helps to kill many bacteria before they can cause illness, in part by using its acidity to inactivate bacterial proteins. Some bacteria contain a small chaperone protein called HdeA that helps protect other proteins from becoming permanently inactivated and therefore helps bacteria survive and cause infection. Biophysical studies have provided clues that HdeA unfolds below pH 3.0 and interacts with its binding partners via hydrophobic interactions. However, there is a lack of data that monitors, in detail, the mechanism of unfolding and activation, both in vitro and in cells. Insight we gain may aid future development of vaccines or therapeutics that combat dysentery.

The protein NMR spectroscopic techniques used to address these biological questions are sophisticated and provide significantly more information than can be obtained from standard one-dimensional 1H or 13C spectra. Students joining the lab will have the opportunity to expand their understanding of the mechanism and biophysical properties of proteins at a detailed, molecular level. In addition, they can gain experience in expressing and purifying isotopically labeled proteins, in running multidimensional NMR experiments, and in using specialized computer software to analyze the collected data and obtain information about protein structure and motions.

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**Selected Publications:**


**M. S. Theses:**

J. Maly “The integral role of the SUMO fusion protein system in successful expression and purification of two difficult proteins for NMR studies” (2013); K. Kim “Expression and purification trials of human brain-derived neurotrophic factor (hBDNF) and its cognate receptor, tropomyosin-related kinase B (hTrkB), to characterize their conformational dynamics by NMR spectroscopy” (2013); W.H. Kim “Intermediate timescale exchange in apo TrkB receptor provides insight into the role of molecular motions in its binding selectivity for neurotrophin signaling proteins” (2012); N. Battala “Development of a protocol to prepare isotopically labeled human neurotrophin-4 (hNT-4) and preliminary characterization of the protein by NMR spectroscopy” (2011); T. Vartanian “Development of a protocol to express and purify isotopically labeled human Brain Derived Neurotrophic Factor for NMR analysis” (2009).

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See also the Crowhurst group website: www.crowhurstlab.com
Dr. Curtis’ research interests include the spectroscopic properties of atmospheric aerosol particles. Particles in the atmosphere affect visibility, global climate, and human health, yet their optical properties and effects on Earth’s radiation budget are poorly understood.

The Curtis lab currently performs laboratory and field measurements of the absorbance and scattering of light by naturally occurring aerosol particles and their interaction with pollution gases to determine their effect on global climate and visibility. In addition, the optical properties of the particles are needed to interpret remote sensing data of particles from space and ground-based measurements.

Selected Publications


M. S. Theses:

C.J. McCrowey “A new portable polar nephelometer with angularly resolved light intensity detection for the determination of Mie scattering of aerosol particles” (2013); S.S. Tinilau “Laboratory studies of the changes in the scattering properties of aged sea-salt aerosol particles with changes in composition and their effect on climate” (2013); G. Chen Reddy “Laboratory studies of phase transition changes of atmospherically relevant salts by UV/Vis diffuse reflectance spectroscopy” (2011); A. Rasheed “Laboratory studies of the optical properties of atmospheric aerosol particles using cavity-enhanced aerosol extinction spectroscopy (CE-AES)” (2010).
Dr. Eloranta’s research uses laser spectroscopic techniques to study dynamics of superfluid helium (e.g. liquid flow and viscosity) on molecular scales by using atoms and molecules as probes. The main aim of the research is to understand how chemical reactions proceed at low temperatures where solvent layers, vortices or external electric fields dictate the atomic and molecular approaches. This has applications in preparing novel molecular structures, synthesizing high-energy materials and fuels, and controlling chemical reactions (“field guided molecular synthesis”). Dr. Eloranta’s other fields of research include: Electron Spin Resonance (ESR) spectroscopy of organic radicals, decomposition reactions of peroxides in aqueous solutions and studies of reaction intermediates using the matrix isolation technique. For more information, see the group web page: http://www.csun.edu/~jeloranta

Selected Publications:


N. Bonifaci, F. Aitken, V.M. Atrakhev, S.L. Fiedler, and J. Eloranta, “Experimental and theoretical characterization of the long-range interaction between He*(3s) and He(1s)”, Physical Review A, 85, 042706 (2012).


M. S. Theses:

Dr. Fischhaber’s group is investigating the protein biochemistry of DNA repair in *S. cerevisiae* (baker’s yeast). In human beings, failure to repair covalent modifications to DNA (DNA damage) by the biologic repair pathways results in genetic mutations and cancer, particularly skin cancer. DNA damage is ubiquitous in living cells and much of it is unavoidable, so DNA repair pathways are crucial for survival.

A variety of *in vitro* biochemical techniques as well as fluorescence microscopy are used in the Fischhaber lab to establish the temporal and spatial relationships among key proteins participating early in DNA repair. Early protein participants likely govern the cellular “decision” about which repair modes to activate and to what extent.

One area of current focus is the yeast Rad1/Rad10 protein complex, which is required in several distinct DNA repair pathways as well as DNA recombination. The lab has labeled the Rad10 protein factor with green fluorescent protein so that Rad10 can be monitored with the aid of a fluorescence microscope in real time in live yeast cells undergoing DNA repair. Using this exciting technology the Fischhaber lab has established that Rad10 is recruited directly to the sites of DNA double strand breaks and that recruitment is dependent on another repair factor, Rad52. The ultimate goal is to understand precisely how cells shunt themselves toward the most appropriate DNA repair pathway to avoid burdensome levels of mutations that would otherwise give rise to cancer.

**Selected Publications:**


P. L. Fischhaber and E. C. Friedberg, “How are specialized (low-fidelity) eukaryotic polymerases selected and switched with high-fidelity polymerases during translesion DNA synthesis?”, *DNA Repair (Amst)*, 4, 279 (2005).


**M. S. Theses:**

J. Benoun “Alternative roles for Rad7 in NER and Rad51 in SSA” (2013);

D. Moore “Recruitment of the Rad1-Rad10 Protein Complex to sites of DNA Double Strand Break Repair and Nucleotide Excision Repair in Saccharomyces cerevisiae: Examination of Rad52, Rad51 and Mre11 in DNA Double Strand Break Repair and Rad1 genetic mutations in DNA Nucleotide Excision Repair by Fluorescence Microscopy” (2011);

J. Karlin “Rad51 Strand Exchange Activity Mediates Rad1-Rad10 Recruitment to Synthesis-Dependent Strand Annealing Sites” (2010);

Dr. Garrett’s general research area is in the field of experimental surface science, a cross-disciplinary area encompassing aspects of analytical and physical chemistry, materials science and physics. Surface science is concerned with the interactions between solid surfaces and adsorbed molecules and the reactions that may occur as a result of these interactions. Of particular interest to Dr. Garrett are reactions occurring on water-ice surfaces, because of their importance in the environment and in astrochemistry, and nanoparticle materials with unique optical, chemical or physical properties.

Icy cloud surfaces are known to play a role in the chemistry of Earth’s atmosphere by catalyzing chlorofluorocarbon reactions that ultimately lead to the destruction of ozone. Ice may also participate in the chemistry of other planets known to contain water, such as Mars and some of the moons of Jupiter, and in the formation of complex molecules found in comets. Comets are largely composed of ice but also contain small and large organic molecules. The origin of the larger molecules is unclear but at least one theory speculates that they formed as a result of small molecule chemistry initiated by protons, electrons or photons. To confirm this hypothesis, Dr. Garrett performs experiments with small molecules such as HCN, H$_2$S and H$_2$CO (formaldehyde) that have been positively identified in comets. These molecules are adsorbed on thin ice layers in vacuum at temperatures down to 85 K (-188 °C) then irradiated with photons and/or electrons. The products are detected by mass spectrometry. A second research area revolves around the synthesis and characterization of nanoparticles, materials with at least one dimension in the 1-100 nm range. Dr. Garrett is particularly interested in materials with desirable photocatalytic or unusual magnetic properties. For example, TiO$_2$ surfaces are known to photocleave water according to $2 \text{H}_2\text{O(l)} \rightarrow 2 \text{H}_2\text{(g)} + \text{O}_2\text{(g)}$. However, the process is very inefficient. Using nanoparticles is one possible route to improving efficiency and producing hydrogen cheaply using solar radiation and in large quantities. Hydrogen is ideal for powering the next generation of electric vehicle fuel cells. The synthetic technique used to make the nanoparticles involves evaporating the material of interest through a ‘mask’ layer then removing the mask. Using self-assembly to make the mask is particularly attractive and is exploited in Dr. Garrett’s laboratory. The particles and masks are examined by microscopy, particularly atomic force microscopy.

Students in Dr. Garrett’s laboratory learn a wide range of skills and analytical techniques using sophisticated instrumentation in a cross-disciplinary environment. This makes them particularly attractive to recruiters in industry, academia and education.

Selected Publications:


M. S. Theses:

N. Baca “Weldability and corrosion resistance of OF Cu$_{47}$Ti$_{13}$Zr$_{13}$Ni$_8$ metallic glass” (2012).
**Overview.** The Kelson group is developing and applying transition metal catalysts for the support of very difficult and/or pharmaceutically important reactions. The specific projects below push the envelope of traditional catalysis.

**Dimeric catalysts for pharmaceutically important applications.** The Kelson lab is investigating dimeric complexes where two metals (often of different oxidation states) cooperate to assist reactions in ways that traditional single-metal catalysts cannot. In particular, their polypyridine based ruthenium dimers catalyze the pharmaceutically important transfer hydrogenation of ketones. They are now investigating electronic cooperation within our dimers and exploring strategies for customized selectivity.

**Rapid synthesis of customized polypyridines for catalysts and anti-tumor agents.** Dr Kelson’s group has developed simple means of coupling pyridines into complex and customized polypyridines that can support catalysts (as described above) and/or bind DNA as anti-tumor agents. Since some tumor cell lines actively import terpyridines and their complexes, the Kelson lab believes their polypyridines (and their complexes) can target and kill tumors. This is under active investigation.

**Nano-crystalline metal catalysts.** The Kelson group has developed reliable methods for preparing nanocrystals and nanowires of silver that feature specific crystal faces and capture light to drive reactions. They also have found that silver nanoparticles are convenient templates for other reactive metals that broaden the application of these nanoparticles to more reactions.

**Opportunities for students.** Research in the Kelson lab utilizes a wide range of synthetic and analytical techniques in the preparation of new catalysts, characterization of their activity, and investigation of their mechanistic details. Students will acquire industrially relevant experience in cutting-edge organic and inorganic chemistry that can be a steppingstone toward a medical or graduate career.

**Selected Publications:**


E. P. Kelson, N. S. Dean and E. Algarin, "Bis(3-methoxy-2-pyridonato)aq(2,2'-6',2"-terpyridine)ruthenium(II), Hydrate, Acetonitrile (1/1/1)," *Acta Crystallographica C*, C63, m108 (2007).


**M.S. Theses:**

D. Tran "Investigation of Mixed-Valent Ruthenium Dimers as Inner Sphere Ketone Transfer Hydrogenation Catalysts" (2013); B. Avitia "Dimer Intermediates in Polypyridine Supported Transfer Hydrogenation Catalysis and Custom Ligand Synthesis" (2010); S. Muhia "Ligand Synthesis for Structure Versus Activity Correlations in Polypyridine Supported Transfer Hydrogenation Catalysts" (2010); E. Algarin "Influence of Intramolecular Ligand Interactions on the Redox and Transfer Hydrogenation Chemistry of Ruthenium Polypyridyl Complexes" (2006); M. Behroozi "Development and Investigation of Ru and Rh Dechlorination Catalysts" (2005); R. Binderwalla "Catalytic Dehydrogenation of Alcohols Using Rh Complexes" (2004); R. M. Lazik "Hydrogen Transfer Catalysts by a Polypyridine Ruthenium Complex Incorporating 7-Azaindolato Ligands" (2004); M. Zhu "Electrochemistry of Polypyridine Ruthenium Complexes Bearing 2-Pyridonato, 2-Pyrrolidinonato, and 7-Azaindole Ligands" (2003); M. A. Heine "Development and Mechanistic Investigation of Homogeneous Ruthenium and Rhodium Catalysts for the Transfer Hydrogenation of Ketones" (2002); P. P. Phengsy "Ruthenium Based Catalysts for Base Assisted Alcohol Oxidation Reactions" (2001).
isoforms of the PPAR-γ transcript in macrophages. The next step is to evaluate the functional differences between these isoforms using mammalian expression vectors specific for individual isoforms.

All of these research projects will provide a better understanding of the biochemical basis for the development and progression of cardiovascular disease.

**Selected Publications:**


R.L. Kawashima and J.D. Medh, "Down-regulation of lipoprotein lipase increases ABCA1-mediated cholesterol efflux in THP-1 macrophages", *Biochemical and Biophysical Research Communications*, 450, 1416 (2014).


**Recent MS Theses:**

M. Jan “Silencing LPL Promotes Insulin Sensitivity in rat Skeletal Muscle Cells and Development of DMD-hiPSC Derived SMPCs for Regenerative and pre-Clinical Applications for DMD” (2015); R. Kawashima “Regulatory Functions of Lipoprotein Lipase on Cholesterol Transporter ATP-Binding Cassette Transporter A1” (2013); S. Nazemzadeh “Regulation of PPAR-δ target genes by GWS01516 in HepG2 Cells” (2012); D. Dahabreh “Effects PPAR-γ activation on the synthesis of apolipoprotein in HepG2 cells” (2010); P. Fausten “Investigation of a low molecular weight chromium binding peptide potentially involved in glucose metabolism” (2009); Anna Jimenez “Regulation of effector genes in THP-1 macrophages by PPAR-gamma isoforms” (2009); M. Haghnegahdar “Quantitation of estrogen receptor-alpha mRNA in MCF-7 cells by real-time reverse transcriptase-polymerase chain reaction (RT-PCR)” (2008); D. Akopian “Regulation of cholesterol efflux from cultured human skin fibroblasts by lipoprotein lipase and phospholipids” (2007).
Professor Melikyan’s research interests include radical and ionic reactions of transition metal-complexed unsaturated systems; novel therapeutic agents for breast cancer treatment; stereocontrolled radical transformations of coordinated molecules; new synthetic methodologies in organic and organometallic chemistry; nonsteroidal hormones; food chemistry; antioxidants; supplements; cosmetics; environmental chemistry. Dr. Melikyan is author or coauthor of 84 research publications in peer-reviewed scientific journals, including 7 reviews, and over 88 presentations at national and international conferences. He is also an author of the award-winning book “Guilty Until Proven Innocent: Antioxidants, Foods, Supplements, and Cosmetics” (www.csun.edu/gmelikyan).

Selected Recent Publications:

G.G. Melikyan and B. Anker, “Radical reactions of 1,4-alkadiynes: metal coordination as an effective tool for controlling the regio- and stereoselectivity of the C-C bond formation”, Organometallics 34, 4194 (2015).


G.G. Melikyan, R. Spencer and A. Rowe, “1,3-Steric Induction in Intermolecular Radical Reactions Mediated by a Co2(CO)6-Metal Core”, Organometallics, 29, 3556 (2010).


Recent MS Theses:

MAOSHENG MIAO (Maosheng.Miao@csun.edu)

M.S. Jilin University, 1991; Ph.D. Jilin University, 1994; Postdoctoral Researcher University of Antwerp, Belgium; Research Associate, Case Western Reserve; Research Scientist, Washington State University; Associate Specialist, UCSB. (Physical Chemistry)

Dr. Miao’s research focuses on three major areas:

**New chemistry under high pressure:** Recent work from the Miao lab showed that the conceptual boundaries of valence electrons are not absolute, especially under extreme conditions like high pressure. For example, Dr. Miao demonstrated that both the 5p electrons and the 5d empty orbitals in Cs can become reactive; making Cs behave either like a p-block element or an anion with negative charges beyond -1 under pressure. His work continues in this area.

**Structure-property relation of functional materials:** First principles computations connect the composition and structure of matter with their properties and functions, and therefore are indispensable techniques for materials and solid state chemistry research. Not only can they help in the design new materials through the search of large composition space, they can also provide in-depth information of the atomistic and electronic structures. Equipped with a wide spectrum of computational methods, such as DFT with advanced functionals and large scale automatic structure search methods, Dr Miao's group is studying novel two-dimensional materials, the surfaces and interfaces of semiconductor and other functional materials.

**Computational methods development:** Dr. Miao’s major interests in this area include large scale electronic structure simulation based on orbital free density functional theory, and automatic unbiased structure search for functional materials, surfaces and interfaces etc. His lab recently developed an efficient method that can automatically explore the surface structures by virtue of structure swarm intelligence. While applying the method on the "simple" diamond (100) surface, he discovered a hitherto unexpected surface reconstruction featuring self-assembly of carbon nanotubes (CNTs) arrays. The intriguing covalent bonding between the neighboring tubes creates a unique feature of carrier kinetics.

Using computer simulation, Dr Miao proposed and revealed a rich perspective of combining the coordinate chemistry of macrocyclic molecules with honeycomb lattice of graphene. The combination also leads to a family of new materials that has potentials in many areas including photolysis and two-dimensional superconductivity.

Using cutting edge computer simulation methods based on quantum mechanics, Dr Miao found that the molecules added to functionalize carbon nanotube (CNT) may form strong covalent bond with the latter. Calculations have revealed the chemical interaction between the molecules and CNT, and may guide development of carbon based electronics.

**Selected Publications:**


THOMAS G. MINEHAN (Thomas.Minehan@csun.edu)
B.A., Columbia College, New York, 1992; Ph.D., Harvard University, 1998; Postdoctoral fellow, California Institute of Technology. (Organic Chemistry)

Dr. Minehan’s research involves the development of atom-efficient and environmentally friendly methodologies for organic synthesis. Of particular interest are reactions that allow multiple carbon-carbon bonds to be formed in a single operation with high degrees of stereoselectivity. The utility of such reactions will be demonstrated by the preparation of complex, biologically active natural products.

The Claisen rearrangement is a powerful method for forming carbon-carbon bonds, and it is particularly useful for introducing quaternary centers in a stereo-defined fashion. The lab is currently exploring the efficiency and stereoselectivity of a Claisen-like sigmatropic rearrangement of allyl-alkynyl ethers, which potentially allows up to three carbon-carbon bonds to be formed in a single step.

Indium metal is a benign reagent that has been used extensively for carbon-carbon bond formation in aqueous media. Furthermore, organoindium compounds (R3In) atom-efficiently transfer all three of their organic ligands in coupling reactions. The Minehan lab has successfully employed indium reagents in the synthesis of C-aryl glycosides, which are naturally occurring molecules with potent antitumor and antibacterial activity. They continue to explore their utility for the stereoselective formation of carbon-carbon bonds in these and other classes of natural products.

Selected Publications:


M. S. Theses:

increased reactivity for unreactive systems in traditional solvents. Improvement of chemical transformations, specifically higher selectivity and interest lies in that ionic liquids with unique solvation properties can catalyze and induce asymmetry in organic transformations. This area involves the development of chiral Lewis acids that can considerably in their pharmacological effects. The Oh lab project in this area involves the development of chiral Lewis acids that can catalyze and induce asymmetry in organic transformations.

The Oh lab also has an interest in ionic liquids and use of ionic liquids in organic reactions. Some reasons for this interest are that it is a potential environmentally friendly synthetic method, immobilization of catalyst for a more efficient synthetic method, and others. This interest lies in that ionic liquids with it unique solvation properties can improve chemical transformations, specifically higher selectivity and increased reactivity for unreactive systems in traditional solvents.

Many drugs are chiral existing in right-and left-handed molecular forms, that is, the two mirror images of the drug can differ considerably in their pharmacological effects. The Oh lab project in this area involves the development of chiral Lewis acids that can catalyze and induce asymmetry in organic transformations.

The Oh lab also has an interest in ionic liquids and use of ionic liquids in organic reactions. Some reasons for this interest are that it is a potential environmentally friendly synthetic method, immobilization of catalyst for a more efficient synthetic method, and others. This interest lies in that ionic liquids with it unique solvation properties can improve chemical transformations, specifically higher selectivity and increased reactivity for unreactive systems in traditional solvents.

Selected Publications:


T. Oh, P. Lopez and M. Reilly, "Simultaneous coordination of dimethyl crotonthioamide by 1,8-naphthalenediylibis(mercuric trifluoroacetate). Synthesis of optically pure 2,2'-bisboryl, bismercuric, bissilyl, bistannyl-substituted 1,1'-binaphthyl compounds. Catalysis of Diels-alder reactions of O-ethyl crotonthioate by 2,2'-bismercuric-1,1'-binaphthalene", Recent Research Developments in Organic Chemistry 6, 379 (2002).


T. Oh and M. Reilly, "Chiral Bidentate Lewis Acids Derived From 1,8-Naphthalenediylibis(dichloroborane) and N-Toluenesulfonyl Amino Acids or Diols", Trends in Organic Chemistry 9, 107 (2001).


P. Lopez and T. Oh, "Simultaneous Coordination of Dimethyl Crotonthioamide by 1,8-Naphthalenediylibis(mercuric trifluoroacetate)", Tetrahedron Letters, 41(14), 2313 (2000).

M. S. Theses:

Dr. Schrodi’s research employs techniques of organic synthesis, inorganic and organometallic chemistry and catalysis, utilizing special equipment (e.g., inert-atmosphere glove boxes, inert-gas/vacuum lines, and modern solvent purification systems of the Grubbs-type) and a wide range of analytical methods (e.g., multinuclear NMR, single-crystal X-ray crystallography, GC, GC-MS, and LC-MS).

In addition to learning these synthetic and analytical lab techniques, students in the Schrodi laboratory will acquire strong skills in areas such as problem solving and proper use of laboratory notebooks. These assets will help them build a successful career in fields like education, academic or industrial research, and medical professions.

**Selected Publications:**


**M. S. Theses:**

S. Ruark “Iron and Molybdenum Complexes Supported by Pincer Ligands: Towards the Development of New Olefin Metathesis Catalysts” (2016); W.-S. DeRieux “Iron Coordination with Bis-Phosphinite PONOP and Bis-Phosphate PONOP Pincer Ligands: Toward the Development of Iron Alkylidenes” (2013); D. Tabari “First Regeneration of a Ruthenium-Based Olefin Metathesis Catalyst” (2012).
Flavin-containing monooxygenases (FMOs). Representatives of this inexpensive methods for catalysis of industrial chemical reactions, therapeutics, carry out more efficient bioremediation, or develop biotechnological applications; for example, to design more effective researchers to harness the power of these bacteria for understanding of the mechanisms of these processes will allow valuable products, and breakdown of pollutants. A thorough understanding of the mechanisms of these processes will allow researchers to harness the power of these bacteria for biotechnological applications; for example, to design more effective therapeutics, carry out more efficient bioremediation, or develop inexpensive methods for catalysis of industrial chemical reactions.

A starting point for research in the Vey lab is an attempt to understand the structural determinants for activity of the Class D flavin-containing monooxygenases (FMOs). Representatives of this enzyme family have been identified in antibiotic biosynthetic pathways as well as pathways bacteria use to degrade several specific aromatic molecules (dibenzo thiophene, for example). New members of this class of enzymes are continually being discovered, and Dr. Vey suspects that this scaffold will prove to be quite useful for biotechnological applications. A more complete understanding of the Class D FMO mechanisms will allow for enzyme engineering for specific biotechnological purposes (developing new antibiotics, for example).

The Vey lab is currently focusing on the structural characterization of two Class D FMOs: isobutylamine-N-hydroxylase (vlmH) and DnmZ. Both of these enzymes are involved in the biosynthetic pathways of molecules with antibiotic and anticancer activity (valanimycin and daunorubicin, respectively, both of which have efficacy against bacteria as well as several cancers – including leukemias), and characterizing them will help provide an understanding of the methods bacteria used to make these two antibiotics.

The primary method the Vey laboratory uses is protein X-ray crystallography. Crystals of the protein of interest are grown in small volumes and examined under a microscope. These crystals are frozen and shipped to synchrotron facilities, where they are irradiated with high intensity X-rays. The crystals diffract the X-rays, yielding a diffraction pattern (shown below). Analysis of the diffraction pattern allows for the generation of electron density maps (also shown below) that are used to build atomic-level models of the protein of interest. Analysis of the structure gives insight into the mechanism of action of the protein.

Students in the Vey lab have the opportunity to learn standard biochemical techniques, including protein expression and purification, assaying for enzymatic activity, molecular biology, crystallization, analysis of X-ray diffraction data and model building / refinement, and bioinformatics. Participation in this research will provide students with a molecular-level understanding of enzymatic catalysis in their enzyme of interest, familiarity with common biochemical research techniques and experience with the analysis and communication of scientific results. Several projects aimed at structural characterization of biotechnologically interesting enzymes are currently ongoing. For more detailed descriptions of current research projects, please contact Dr. Vey.

Selected Publications:


Surfing at Topanga beach

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