Graduate Program in Chemistry and Biochemistry

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

Graduate Coordinator
Department of Chemistry and Biochemistry
California State University, Northridge
Northridge, California 91330-8262
E-mail: katsu.ogawa@csun.edu

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.](image)

GRADUATE PROGRAM: The Chemistry and Biochemistry Department currently offers the Master of Science Degree with two options. The chemistry option 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 biochemistry option 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 modern 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.

![Graduate student Nick Baca with an ultra-high vacuum x-ray photoelectron spectrometer.](image)

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 November 1 for the following fall semester, and August 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. Write to Admissions and Records for an application or contact Graduate Coordinator, Department of Chemistry and Biochemistry, CSUN, Northridge, CA 91330-8262.

EXPENSES: The cost of attending CSUN is an exceptional value. For the latest information on fees, look up 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 contact the CSUN Financial Aid Office (818-677-4085).

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.
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 2.75 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 examinations 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. Foreign students must submit a TOEFL score of 550 or better and a TWE score of at least 4.5.

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 2.75 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 examinations in biochemistry, organic, analytical, physical or inorganic chemistry. These are standardized, multiple-choice examinations 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. Foreign students must submit a TOEFL score of 550 or better and a TWE score of at least 4.5.

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 Courses 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 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-CO$_2$ greenhouse gasses 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 (form 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:

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 $\{\mu_3\eta^2-\text{CH}_3\text{CH}_2=\text{CCH}_2\text{CH}_3\}(\mu_2\text{-CO})\os_3(\text{CO})_9$ and $\{\mu_3\eta^3-\text{CH}_3\text{CH}_2=\text{C}(\text{H})\text{CH}_3-\text{(H)}\os_3(\text{CO})_9$ in Rare Gas Matrices at 10 K", *J. Molecular Structure*, 222, 235 (1990).

M. S. Theses:

KARIN A. CROWHURST (Karin.Crowhurst@csun.edu)

Selected Publications:


K.A. Crowhurst, “$^{13}$C, $^{15}$N and $^2$H backbone and side chain chemical shift assignment of acid-stress bacterial chaperone HdeA at pH 6”, Biomolecular NMR Assignments, available online (2013).

J. Maly and K.A. Crowhurst, “Expression, purification and preliminary NMR characterization of isotopically labeled wild-type human heterotrimeric G protein $\alpha_{i1}$”, Protein Expression and Purification, 84, 255 (2012).


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).

See also the Crowhurst group website: www.crowhurstlab.com

The protein NMR spectroscopic techniques applied by the lab to address these biological questions are, by necessity, more sophisticated and provide significantly more information than can be obtained from standard one-dimensional $^1$H or $^{13}$C spectra. These experiments require analysis of 2D and 3D spectra, in which the signals of multiple nuclei are linked to each other to provide detailed information about structural and dynamic properties of proteins.

Students joining the lab will have the opportunity to expand their understanding of the mechanism and biophysical properties of signaling proteins at a detailed, molecular level. In addition, they can gain experience in expressing and purifying isotopically labeled proteins, in running multidimensional NMR experiments on the department’s brand-new 600 MHz NMR spectrometer, and in using specialized computer software to analyze the collected data and obtain information about protein structure and motions.

The Crowhurst lab focuses specifically on two protein families: neurotrophins and RGS proteins. Neurotrophins provide the signal for the growth and differentiation of neurons in the brain, thereby influencing synaptic function, learning and memory. 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 proteins in both families bind to their specific targets and how changes in protein structure help in transmitting signals. Since both protein families 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 stroke, chronic pain, cancer, epilepsy, neurodegenerative diseases and schizophrenia, and can aid in the design of drugs to treat these conditions.

Dr. Crowhurst’s research uses multidimensional NMR spectroscopy to better understand the mechanisms of signal transduction in the brain. In particular, the group is interested in understanding the roles of structure, biophysical properties and protein dynamics in the specificity and affinity of interactions between proteins and their targets involved in several signaling cascades.

B.Sc (Honours), Queen’s University, Canada, 1995; M.Sc., University of Toronto, Canada, 1997; Ph.D., University of Toronto, Canada, 2003; Post-doctoral research, California Institute of Technology, 2003 – 2006. (Biochemistry and Structural Biology)
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.

Spectroscopic techniques used in the Curtis lab include cavity ringdown spectroscopy (CRDS), UV/Vis diffuse reflectance spectroscopy, UV/Vis transmission spectroscopy, and laser spectroscopy of angular scattering from particles.

Aerosol particles impact global climate by absorbing and scattering light, altering the Earth’s radiative balance. In addition, studies of aerosol optical properties can improve remote sensing studies of particles in the atmosphere.

Selected Publications


M. S. Theses:

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).
JUSSI M. ELORANTA (Jussi.Eloranta@csun.edu)

M.S. University of Jyväskylä, Finland, 1993; Ph.D. University of Jyväskylä, Finland, 1997; Post-doctoral research, University of California at Irvine. (Physical Chemistry)

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. Atrazhev, 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).


E. Popov, J. Välisaari, V.-M. Vuorenpalto, R. Aksela and J. Eloranta, “Stabilization of H$_2$O$_2$ in presence of Fe(II) and Mn(II) impurities under alkaline conditions”, Holzforschung, 61, 543 (2007).

Alternative roles for Rad7 in NER and Rad51 in SSA

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:


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); A. Mardiros “The Temporal Relationship of Nucleotide Excision Repair Factors Rad14 and Rad1-Rad10” (2009).
M.A. Keane - "Adsorbed on thin ice layers in vacuum instrumentation in a cross 2 2 - e formation of - - s en and - - particles, materials with at least one rett. "Adsorption and Laser ext generation of electric vehicle fuel cells. sical chemistry, materials science and physics. 36x62 ideal for powering the n 36x73 cheaply using solar radiation and in large quantities. Hydrogen is magnetic properties. For example, TiO 36x129 interested in materials with desirable photocatalytic or unusual dimensional in the 1 36x151 characterization of nano - - - - and/or electrons. The products are detected by mass spectrometry. 36x184 at temperatures down to 85 K ( 36x206 H Garrett performs experiments with small molecules such as HCN, protons, electrons or photons. To confirm this hypothesis, Dr. 36x239 that they formed as a result of smal 36x250 of the larger molecules is unclear but at least one theory speculates of ice but also contain small and large organic molecules. The origin comets. Comets are largely composed 36x327 Earth’s atmosphere by catalyzing chlorofluorocarbon reactions that ultimately lead to the destruction of ozone. Ice may also participate 36x316 cy cloud surfaces are known to play a role in the chemistry 36x524 University of Toronto 1993; Postdoctoral research, Northwestern University 1991-1993; Postdoctoral research, University of Toronto 1993-1996; Faculty, Michigan State University 1996-2003; Faculty, California State University, Channel Islands 2004-2008. (Analytical, Materials and Physical Chemistry)

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, H2S and H2CO (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, TiO2 surfaces are known to photocleave water according to 2 H2O(l) → 2 H2(g) + O2(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 Cu47Ti34Zr11Ni8 metallic glass” (2012).
Professor Hajdu's current interest focuses on elucidation of the mechanism of action of lipolytic enzymes with specific emphasis on phospholipase A2. Ongoing efforts are directed at 1) kinetic characterization of lipolysis by the pancreatic enzyme acting on phosphatidylcholine-surfactant mixed micelles, 2) design and synthesis of specific and potent phospholipase inhibitors, and 3) development of new assay systems for the study of lipid hydrolyzing enzymes.

Other studies involve structural and mechanistic elucidation of the chemistry of the metal complexes of streptonigrin, a naturally occurring antitumor antibiotic.

Selected Publications:


R. Ranganathan, C. Vautier-Giongo, M. Bakshi, B. L. Bales and J. Hajdu, “Characterization of Mixed Micelles of 1,2-Diheptanoylsn-Glycero-3-Phosphocholine (DHPC) and Sodium Dodecyl Sulfate, and DHPC and Dodecyl Trimethylammonium Bromide”, Chemistry and Physics of Lipids, 135, 93 (2005).


Recent M. S. Theses:

ERIC P. KELSON (Eric.Kelson@csun.edu)

B.S., Honors, University of Utah, 1988; Ph.D., California Institute of Technology, 1993; NIH Postdoctoral Fellow, Princeton University, 1993 – 1995. (Transition metal complexes, homogeneous catalysis, organometallics, electrocatalysis)

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.

Mixed-valent dimer catalysts. Most transition-metal complex catalysts rely on the activity of a single metal for their activity. Unfortunately, this restricts the individual steps of the catalytic process to those that single metal can support. Some catalytic reactions, such as the pharmaceutically important transfer hydrogenation of ketones, entail processes characteristic of different metals or oxidation states of the same metal. The Kelson group is exploring means where a single complex can be designed with the properties of two or more oxidation states. Specifically, special ligands are being used to bind and electronically couple pairs of ruthenium atoms, and these resulting complexes are being used to catalyze inner-sphere ketone transfer hydrogenation.

Single-flask tandem reactions. While traditional syntheses entail individual reactions each carried out in their own flasks, many researchers are developing ways that multiple steps can be carried out conveniently in a single-flask. The Kelson group itself is developing methods for coupling aren[e and pyridine rings through reaction sequences supported by a single catalyst in a single flask. Specifically, they have already used these methods to prepare asymmetric bipyridines and terpyridines that are anti-tumor candidates as well as novel ligands for transition metal complexes.

Nano-crystalline metal catalysts. A means of preparing nanometer sized cubic and prismatic crystals of silver and other metals has been developed, and these nano-crystals have proven capable of capturing light through an electronic resonance ("plasmon resonance") on their surfaces. The Kelson group is exploring the chemical modification of metal nano-crystals and investigating the possible coupling of plasmon resonances to heterogeneous reactions on their surfaces with the hope that light can provide the equivalent of high temperatures and pressures.

Opportunities for students. Research carried out 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 in the group acquire industrially relevant experience in cutting-edge organic and inorganic chemistry that can be a steppingstone toward a medical or graduate career.

Selected Publications:


M.S. Theses:


12
Dr. Medh’s overall research interest is in the area of lipoprotein metabolism and atherosclerosis. It is well known that abnormal plasma low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol levels result in cardiovascular disease. The lab is interested in the molecular and cellular mechanisms that translate an anomalous lipoprotein profile into atherosclerotic lesions. The group is studying various components of the atherogenesis pathway including apolipoproteins, lipases and lipoprotein receptors. The current emphasis is on understanding cellular events that are unique to the vessel wall and may initiate lesion formation.

The lab investigates two lipases, lipoprotein lipase (LPL) and hepatic triglyceride lipase (HTGL). Both lipases hydrolyze the triglyceride component of plasma chylomicrons and very low-density lipoprotein (VLDL) particles and contribute to cholesterol homeostasis. Recent studies have established that LPL and HTGL also function as apoproteins and ligands for lipoprotein receptors, associate with lipoprotein particles and hepatic lipoprotein receptors, and thereby enhance lipoprotein catabolism and clearance.

The Medh lab also employs in vitro studies in cultured cells to examine the cellular mechanisms of cholesterol efflux from cultured macrophages. A recently discovered cell surface transport protein called ABCA1 was shown to be responsible for apolipoprotein A-I mediated cholesterol efflux. These studies are aimed at dissecting this cellular transport pathway and identifying its requirements.

A third area of investigation asks why diabetics are predisposed to premature atherosclerosis. The prevalence of glycated and oxidized lipoproteins in diabetics has been implicated for their cardiovascular complications. The Medh lab is examining if diabetic conditions of hyperglycemia, hyperinsulinemia and hypertriglyceridemia enhance the expression various pro-atherosclerotic genes.

A recently discovered member of the nuclear receptor gene family, PPAR-γ, has been associated with atherosclerosis and obesity. A number of molecular processes are altered upon activation of PPAR-γ by specific ligands, which include lipid- and glucose lowering pharmaceutical agents. The Medh lab has recently identified 4 novel 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:


Recent MS Theses:

S. Nazemzadeh “Regulation of PPAR-δ target genes by GW501516 in HepG2 Cells” (2012); D. Dahabreh “Effects PPAR-γ activation on the synthesis of apolipoprotein in HepG2 cells” (2010); P. Fausset “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. Haghneghadar “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 liapse and phospholipids” (2007); S. McClelland “The effects of disparate 5’ UTRs of PPAR-g splice variants on the translation of the PPAR-g receptor” (2007); Q. Feng “Bioavailability of tea compounds: flavanols and theaflavins” (2006); Y. Chen “Identification and Regulation of Novel PPAR-gamma isoforms in THP-1 Macrophages” (2004).

Professor Melikyan’s research interests include radical and ionic reactions of transition metal-complexed unsaturated systems; novel therapeutic agents for breast cancer treatment; sterecontrolled 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 78 research publications in peer-reviewed scientific journals, including 7 reviews, and 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 Publications:


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:

A New Route for the Stereoselective, molecular [2 + 2] Cycloaddition, allatabakhsh. 3

These and other classes of natural products. utility for the stereoselective formation of carbon antitumor and antibacterial activity. glycosides, which are naturally occurring molecules with potent of their organic ligands in coupling reactions.

organoindium compounds (R Indium metal is a benign reagent that has been used extensively for step. allows up to three 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 (R,In) 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.

a. The Synthesis of C-Aryl Glycosides.
b. 3,3-Sigmatropic Rearrangement of Allyl-Alkynyl ethers.

Selected Publications:


A. Allatabakhsh, M. Pham and T.G. Minehan, ”Synthesis of Oxa-Bridged 7- and 8-Membered Rings Via Indium-Mediated Annulation of 1,4- and 1,5-Dicarbonyl Compounds with 3-Iodo-2-[(trimethylsilyl)methyl]propene”, Heterocycles, 72, 115 (2007).


M. S. Theses:

B.S., Minnesota State University, Mankato, 2000; Ph.D., North Dakota State University, 2005; Postdoctoral fellow, University of Florida. (Materials Chemistry)

Organic/Organometallic Materials Chemistry
Two major research areas of Ogawa group are 1) design and development of highly ordered 2-dimensional conjugated polymer matrices for photovoltaic and electroluminescent devices and 2) development of fluorescent chemo-sensing materials for biologically active small molecules and ions.

Two Dimensional Conjugated Polymer Matrixes
Dr. Ogawa is interested in controlling morphologies of 2-dimensional conjugated polymer sheets by taking advantage of two orthogonal polymerization methods: transition metal catalyzed chemical polymerization and electrochemical oxidative polymerization. A solution processable 1-dimensional polymer can be obtained by chemical polymerization. Then it can be spin coated onto an electrode followed by oxidative polymerization to achieve the final product. One goal is to control the morphology via self-assembly of the 1-D polymer. Another goal is to control the photophysical / electrochemical properties of the 2-D polymers.

Chemo-sensing Materials
Another major interest for Dr. Ogawa is design and development of fluorometric or colorimetric sensors for biologically important species, such as metal ions and endocrine disrupting chemicals. Sensors consist of two major parts: receptor and reporter. Receptors bind to analytes, which causes conformational changes or alteration of electronic environment of lumophore/chromophore (reporter). Such changes result in variation of optical signals. The research involves optimization of both receptor and reporter moieties.

Multidisciplinary nature of the research in Ogawa group requires a wide variety of techniques. Students are involved in organic/organometallic syntheses, photophysical measurements, and electrochemical analyses/syntheses.

For more detailed descriptions of the projects and instrumentation, please contact Dr. Ogawa (Katsu.Ogawa@csun.edu).

Selected Publications:


Selected Publications:


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


P. Lopez and T. Oh, "Simultaneous Coordination of Dimethyl Crotonthioamide by 1,8-Naphthalenediylbis(mercurictrifluoroacetate)", 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 laboratory 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:


R.R. Schrock, P.J. Jr. Bonitatebus and Y. Schrodi, "CH Bond Activation in Cations of the Type \([\{2,4,6-\text{Me}_3\text{C}_6\text{H}_2\text{NCH}_2\text{CH}_3\}_2\text{NMe}_2\text{ZrR}\}]^+\) and a Simple Solution that Yields a Catalyst for the Living Polymerization of 1-Hexene", _Organometallics_, 20, 1056 (2001).

R.R. Schrock, S.W. Seidel, Y. Schrodi and W.M. Davis, "Synthesis of Zirconium Complexes That Contain Diamidophosphine Ligands \([\text{Me}_3\text{SiNC}_2\text{H}_2\text{CB}P\text{H}]^2\) or \([\text{RNSiMe}_2\text{C}_2\text{H}_2\text{CB}P\text{H}]^2\) (R = t-Bu or 2,6-\text{Me}_2\text{C}_6\text{H}_3)", _Organometallics_, 18, 428 (1999).
B.S., Temple University, Philadelphia, 2001; Ph.D., Massachusetts Institute of Technology, 2008; Postdoctoral fellow, Vanderbilt University. (Biochemistry and Structural Biology)

The general research interests of the Vey lab lie in protein structure and engineering. X-ray crystallography, bioinformatics and biochemical characterization are used to elucidate the details of enzyme catalysis, with the long-term goal of modifying target enzymes in a rational manner.

Bacteria carry out many processes that are essential to humans, such as fermentation to produce food and alcohol, synthesis of medically 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 monoxygenases (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:


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

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