CSULB DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

Masters Program

Research Opportunities and How to Apply

Fall 2018, Spring 2019

Graduate Advisors: Dr. Paul Weers (Biochemistry) and Dr. Michael P. Schramm (Chemistry)

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CSULB DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

Masters Program

WELCOME

The Department

The Department of Chemistry and Biochemistry at the California State University, Long Beach is dedicated to maintaining a reputation as an outstanding department on the basis of the rigorous curriculum, the quality of research conducted with bachelors and master-level students, and the caliber of its graduates. The department values teaching and research as equal and essential components of the education of our students and seeks to integrate research with teaching at every possible opportunity in the curriculum. Our 22 faculty have active research programs that focuses on providing stimulating research projects for students in chemistry and biochemistry. Many of these programs are federally supported, resulting in routine high-impact peer-reviewed publication where undergraduate and MS candidates are the lead authors. The department is housed in two state of the art buildings with a complete range of modern instrumental equipment that is used directly by students in pursuit of their training. Direct hands on use not only provides opportunities for answering research questions - but also provides the opportunity for advanced training with modern instrumentation. Our graduate class is currently composed of about 30 Biochemistry and 30 Chemistry MS candidates.

The Degree

Approximately half of CSULB's MS Chemistry and Biochemistry graduates go on to Ph.D. programs. Many of our MS graduates go on to pursue careers in industrial settings, pursue professional degrees or start teaching careers. We offer a strong program with a substantial emphasis on novel research and defense of a thesis. The objectives of our master's programs are:

- To enhance professional credentials in order to improve employability in industry or teaching.
- To offer students an opportunity to develop research skills and independence in the laboratory.
- To provide an opportunity for those with bachelor's degrees in the life sciences to achieve competence at the master's level in biochemistry.
- To provide a strong background in the chemical sciences for students who are developing skills, confidence and qualifications to enter a Ph.D. or professional program.

Most importantly, our department highly values both advanced academic coursework for graduate students and novel scientific research. We have a wide array of instrumentation and facilities available to our graduate students, and we are proud of the diverse range of active areas of research pursued in our department.

Prerequisites for the MS degree

CHEMISTRY: A bachelor's degree with a major in chemistry; or a bachelor's degree with undergraduate preparation in chemistry, physics and mathematics equivalent to that required for the bachelor's degree with a major in chemistry at this University. Typical undergraduate coursework for BA/BS degree includes: Organic, Physical, Inorganic, Analytical and Instrumental methods. A student deficient in any of these courses must complete the course(s) as a graduate student. The courses that must be taken to make up those deficiencies will be determined by the Graduate Adviser in consultation with the Graduate Studies Committee. Students with majors in other areas may be considered for admission at the discretion of the Graduate Adviser.

BIOCHEMISTRY: A bachelor's degree with a major in chemistry or one of the biological sciences. Students with majors in other areas may be considered for admission at the discretion of the Graduate Adviser. Prerequisite courses include Organic, Physical, Biochemistry, and courses in general molecular and cellular biology. A student deficient in any of these courses must complete the course(s) as a graduate student.

Financial Support

Whitaker fellowships (2/year) for incoming students as well as summer research stipends can be applied for. $5,000.

GA and TA positions are available for most students in good standing, positions include grading, leading lab and recitation sections, working in the stockroom and running the departmental NMRs for undergraduate courses and research students. Full time (20hr/week) appointments provide $12k (GA) and $20k (TA) per year in support.

RISE MS to Ph.D. https://web.csulb.edu/colleges/cnsm/sas/rise/ms2phd.html

Currently we accept 8 candidates per year that plan to pursue a Ph.D. in the biomedical sciences. Students must be committed to completing the MS in two years, students receive tuition support, a stipend, and support for research presentations and travel, $25K per year.

Life at “The Beach”

Long Beach is so close to every terrain and climate that in one day, you could surf in the morning, snow ski in the afternoon, and come home and see a movie at night. Every famous Southern California landmark, attraction, and destination is easily within a two-hour drive from the city.

Long Beach Attractions: RMS Queen Mary, Aquarium of the Pacific, Long Beach Convention Center, Belmont Shore/ Naples, Downtown Long Beach Nightlife, Long Beach Art museum, Museum of Latin American Art

Nearby Attactions (30-60 mintues): Disneyland, Santa Monica, Venice Beach, Getty Center, Downtown Los Angeles, Hollywood, Huntington Beach (Surf City U.S.A.), Universal Studios, Beverly Hills, Los Angeles Dodgers Baseball (Dodger Stadium), Los Angeles Lakers Basketball (Staples Center), Catalina Island

Long Beach Weather Conditions, Sunny Days : 333, Average High : 23 C, Average January High : 19 C

Average July High : 28 C, Average Humidity : 53%

Long Beach has been ranked by a leading consulting firm as “the large city with the highest quality of life” in Los Angeles county. Long Beach was placed at the top of the list based on such factors as low crime, good education, local attractions, climate, and the availability and affordability of housing.

Deadlines

Fall application submission before June 1 (April 1 for international students)
Spring application submission before November 1 (October 1 for international students).

How to Apply

1) Complete the online application as either a Graduate or International applicant.
https://www2.calstate.edu/apply

2) Please send official GRE (Graduate Record Examination) GENERAL test scores to CSULB (Code #4389).

3) Have official copies of your undergraduate transcript(s) sent to CSULB Enrollment Services. Official transcripts may be submitted electronically from a U.S. college to: ES-IDPTrans@csulb.edu
Official transcripts may also be sent in a sealed envelope to the address below:
Enrollment Services/Admissions
California State University, Long Beach
1250 Bellflower Blvd.
Long Beach, CA 90840

4) Please complete the Department of Chemistry and Biochemistry Application found here:
http://chemistry.csulb.edu/grad-app.pdf
this also serves as an application for teaching associate and graduate assistant positions.

5) Three Letters of recommendations must be submitted using the Department of Chemistry and Biochemistry Recommendation Letter for Graduate Applicant found here: http://chemistry.csulb.edu/grad-rec-form.pdf

Submit the department application (#4) and have your recommenders submit their letters (#5) via email (CHEMISTRY michael.schramm@csulb.edu BIOCHEMISTRY: paul.weers@csulb.edu
OR via Mail to:
Department of Chemistry and Biochemistry
for CHEMISTRY: ATTN: Dr. Michael Schramm, for BIOCHEMISTRY: ATTN: Dr. Paul Weers
California State University, Long Beach
1250 Bellflower Boulevard, Long Beach, California 90840-9507

Research Opportunities 2018-2019 for incoming students

(please contact other faculty if they are not listed: http://chemistry.csulb.edu/faculty.html)

PI: Xianhui Bu, Ph.D., Porous Materials, Crystal Growth and Structure, Energy Materials

Website: http://web.csulb.edu/~xbu/ Email: xianhui.bu@csulb.edu

Project 1: Homochiral porous materials for enantioselective separation or catalysis

Recent paper: Angew. Chem. Int. Ed. 2018, 57, 3737-3741

Project 2: Cationic porous materials for anion exchange and capture

Recent paper: Angew. Chem. Int. Ed. 2016, 55, 2768-2772

Project 3: Crystalline porous materials for gas separation and storage

Recent paper: Nat. Commun. 2016, 7, 13645.

PI: Deepali Bhandari, Ph.D., Cellular Biochemistry, Signal Transduction, Cancer Cell Survival and Migration

Website: https://bhandarilab-csulb.weebly.com/ Contact: deepali.bhandari@csulb.edu

Project 1: One of the major questions our research is focused on is to understand cells' ability to withstand Endoplasmic Reticulum (ER) stress. In particular, we are interested in understanding how cancer cells successfully evade ER stress induced death. Our lab has recently identified a novel role for a key signaling protein that promotes cancer cell survival during ER stress. The new student will be involved in further characterizing the role and/or interactions mediated by this protein, which lead to enhanced cancer cell viability in the face of stress.

Recent paper: Curr Protoc Chem Biol. 8(4): 265-298. 2016.

Project 2: The other major area the lab is focused on is to understand cell migration. The new student will be involved in delineating regulatory pathways which control activation/inactivation of key pro-migratory proteins.

Recent paper: Proc Natl Acad Sci USA. 112: E4874-4883. 2015.

PI: Paul Buonora, Ph.D., Synthetic Organic Methods Development and Library Synthesis

Website: http://chemistry.csulb.edu/paul-buonora.html Email: paul.buonora@csulb.edu

Project 1: Synthesis and Reactions of Acyl Radicals from alpha-Keto Acids.

Acyl radical species have a range of demonstrated activities and the potential for the development of transformations applicable to pharmaceutical and fine chemical applications. This project focuses on the catalytic generation of acyl radicals coupled with their controlled reactions with active species.

Project 2: Synthesis and Reactions of Alkyl Radicals via Decarboxylation of Alkyl Carboxylic Acids. While alkyl radical species have a range of demonstrated and potential applications, there has been limited study of their use in fine chemical synthesis. This project focuses on the catalytic generation of alky radicals by menas that limit rearrangement and self coupling.

Project 3: Library Synthesis of Chiral Phthalide and Isoindoline Targets.Members of the phthalide and isoindoline families have a wide range of biological and pharmacological activity. Building off projects I and 2, in this project the means to make libraries if members of these families of molecules will be developed.

PI: Hadi Tavassol, Ph.D., Materials Chemistry, Electrochemistry, Bioelectrochemistry

Website: http://web.csulb.edu/~htavasso/index.html, Email: hadi.tavassol@csulb.edu

We use chemistry and materials science to develop devices for a sustainable energy cycle, an important aspect of human survival. This means facilitating large-scale utilization of solar and wind energy using conversion and storage devices. We also study charge transfer in redox enzymes that perform small molecules (N2 and O2) catalysis relevant to energy cycle. The research in our lab focuses on fundamental understanding and design of chemical interfaces, especially in electrochemical systems. We fabricate materials for electrochemical devices, and mimics of biological systems. Then, we use advanced spectroscopic and electrochemical in-situ characterization techniques to study them.

Recent paper: Electrochemical stiffness in lithium-ion batteries, H Tavassol, EMC Jones, NR Sottos, AA Gewirth, Nature Materials 2016.

PI: Kasha Slowinska, Ph.D., Drug delivery systems, bioinspired materials, bioanalytical chemistry

Website: https://slowinskalab.weebly.com/

Project 1: Development of peptide-based carriers for cancer therapeutics and treatment of antibiotic resistance. We are interested in all aspects related to prodrug development, transport, targeting and efficacy.

Project 2: Thermal targeting: engineering and characterization of cooling wand for breast cancer applications.

Project 3: Design of tandem catalytic systems for simultaneous transformations (green chemistry)

Recent Papers: Medicinal Chemistry Letters 2017, 8, 814-819; Analytical Chemistry 2016, 88, 9654−9661; Protein Scaffolds in Methods Molecular Biology 2018 Vol. 1798

PI: Vasanthy Narayanaswami, PhD, FAHA; Lipoprotein metabolism, cholesterol transport, drug transport, nanomedicine

Website: http://chemistry.csulb.edu/vas-narayanaswami.html Email: vas.narayanaswami@csulb.edu

Project 1: Examining lipid-binding mechanism and lipid-associated conformation of apolipoprotein E using fluorescence, mass spectrometry and other biophysical approaches; understanding structure-function relationships of apolipoproteins using chimeras and hybrids

Recent paper: Lek, M. T., Cruz, S., Ibe, N. U., Beck, W. H. J., Bielicki, J. K., Weers, P. M. M. & Narayanaswami, V. (2017) Swapping the N- and C-terminal Domains of Apolipoprotein E3 and AI Reveals New Insights into their Structure/Activity Relationship. PLOS One 12, e0178346

Project 2: Evaluating use of HDL as a drug delivery and targeting vehicle using reconstituted HDL as a “nanovehicle”; drug transport across the blood brain barrier

Recent paper: Chuang, S. T., Shon, Y.-S., & Narayanaswami, V. (2017) Apolipoprotein E3 Mediated Targeted Delivery of 3, 10 and 17 nm Gold Nanoparticles Embedded in Reconstituted High Density Lipoprotein. Internatl. J. Nanomed. 12, 8495-8510

Project 3: Investigating the role dysfunctional HDL as a risk factor in cardiovascular and cerebrovascular diseases; examine oxidative stress modification of apoE and other apolipoproteins; study alterations to the HDL lipoproteome

Eric J. Sorin, Ph.D., Computational Biochemistry & Biophysics, Drug Design, RNA Structure & Function

Website: http://folding.cnsm.csulb.edu Email: eric.sorin@csulb.edu

Project 1: Enzyme Inhibition & Drug Design. In collaboration with local experimentalists, we seek to provide structural justification for, and prediction of, synthetic inhibitor activities against the butyrylcholinesterase enzyme, which has been implicated in numerous human ailments.

Recent paper: Bioorganic & Medicinal Chemistry 2017, 25(12), 3171–3181.

Project 2: RNA Structure & Function. RNA molecules are now known to play myriad cellular roles, such as the ribosomal frameshifting caused by some small viral RNAs. Computational studies provide insight into the structural basis for such function and can justify sequence-dependent activities observed experimentally.

Recent paper: Nucleic Acids Research 2017, 45(8), 4893–4904.

PI: Lijuan Li, Ph.D., Bioinorganic chemistry; Transition metal complexes; Organometallic chemistry; Inorganic Chemistry

Website: http://chemistry.csulb.edu/lijuan-li.html Email: Lijuan.li@csulb.edu

Project 1: Non-heme iron nitrosyl complexes containing N,N’-chelating ligands.

Recent paper: Inorg. Chem., 48, 9779 – 9785 (2009).

Project 2: Multinuclear iron sulphur nitrosyl clusters.

Recent paper: Coord. Chem. Rev. 306, 678-700 (2016).

Project 3: Transition metal complexes containing phosphines and bisphosphines.

Recent paper: Polyhedron, 70, 29-38 (2014).

Kensaku Nakayama, Ph.D., Organophosphorus Chemistry, Asymmetric Synthesis, Enzyme Inhibitor Synthesis

Email: kensaku.nakayama@csulb.edu

Project 1: Synthesis of Inhibitors of Butyrylchoinesterase and Acetylcholinesterase. We are exploring the design and synthesis of novel organophosphorus-based inhibitors of these two cholinesterase enzymes, which are influential in cognitive loss associated with Alzheimer's disease.

Recent paper: Bioorg. Med. Chem. 2017, 25, 3171-3181.

Project 2: Asymmetric Synthesis of Chiral Organophosphorus Compounds. We are investigating the development of chiral Lewis acids as promoters or catalysts of the stereoselective synthesis of organophosphates. These compounds have important roles as chiral antiviral and anticancer prodrugs.

PI: Jason P. Schwans, Ph.D., Bioorganic Chemistry, Enzymology, Enzyme Inhibition

Website: https://schwanslabatcsulb.weebly.com Email: jason.schwans@csulb.edu

Project 1: Synthesis and Evaluation of Fmoc-Amino Acids as Selective Cholinesterase Inhibitors. Elevated levels of the enzyme butyrylcholinesterase (BChe) are found in individuals with Alzheimer's disease, and specific inhibition of BChE is sought as a potential treatment to mitigate the effects of neurodegenerative diseases. We recently identified Fmoc-amino acids as a promising scaffold for cholinesterase inhibitors. We are currently synthesizing and biochemically evaluating new Fmoc-amino acid analogs as potential inhibitors.

Recent paper: Amino Acids 2016, 48, 2755-2763.

Project 2: Unnatural Amino Acid Synthesis for Biochemical Assays. Unnatural amino acids provide tools for the incisive and systematic perturbation of residues within proteins. We are synthesizing a series of analogs bearing fluorine and sulfur modifications for use in enzymatic studies.

Recent paper: Bioorganic and Medicinal Chemistry Letters 2017, 27, 2410–2414.

PI: Fangyuan Tian, Ph.D., Surface Chemistry, Materials Design and Characterization

Website: https://ftian.weebly.com/ Email: fangyuan.tian@csulb.edu

Project 1: Convert waste to energy: gas purification with hybrid zeolitic imidazolate framework (ZIF) materials. Design a hybrid ZIF/zeolite solid materials for separating methane from carbon dioxide and nitrogen.

Project 2: Surface-anchored crystalline coordination network thin films. The studies of optical and electronic properties of surface supportive metal-organic framework (MOF) materials allow the design of MOF thin film devices.

Recent paper: Ruiz, M.A., Sua, A., Tian, F., "Covalent attachment of metal-organic framework thin films on surfaces," Encyclopedia of Interfacial Chemistry: Surface Science and Electrochemistry, 2017, DOI: 10.1016/B978-0-12-409547-2.14124-1.

PI: Young-Seok Shon, Ph.D., Nanochemistry, Catalysis, Materials Synthesis

Website: https://sites.google.com/site/shonresearch/ Email: ys.shon@csulb.edu

Project 1: Colloidal Metal Nanoparticle Catalysis: Ligand-capped metal nanoparticles act as highly selective catalytic materials for chemo-, regio-, and stereo-selective chemical reactions and serve as an excellent model for understanding non-covalent interactions (enzyme site mimics).

Recent paper: Catalysis Science and Technology 2017, 7, 4823-4829.; Journal of Physical Chemistry C 2017, 121, 20882-20891.

Project 2: Micelle-like Nanoparticles for Green and Bio Catalysis: Metal nanoparticles stabilized with water-soluble ionic ligands are used for mono- or bi-phasic catalysis in water. Liposome- or lipopolymer-encapsulated metal nanoparticles provide an opportunity for transporting catalytic metal nanoparticles into the biological media and serve as a tool for biocatalysis.

Recent paper: Colloids and Surface A 2017, 513, 367-372.; International Journal of Nanomedicine 2017, 12, 8495-8510.

Project 3: Nanoparticle Hybrids for Thermal- or Photo-Enhanced Catalysis: Catalytic metal nanoparticles are encapsulated in structured framework to increase thermal stability and catalytic activity. Semiconductor nanodiscs

and graphene oxide nanosheets are used for supporting catalytic metal nanoparticles and harvesting photoenergy to increase stability and catalytic activity.

Recent paper: New Journal of Chemistry, 2017, 41, 177-183..

PI: Shahab Derakhshan, Ph.D., Energy Related Materials, Solid State Inorganic Materials Chemistry and Physics

Email: shah.derakhshan@csulb.edu

Project 1 : Low Dimensional Magnetism vs. Geometric Magnetic Frustration. This program is funded by the National Science Foundation and aims to develop more in-depth understanding about magnetic properties of 4d and 5d transition metal oxides.

Recent paper: Inorganic Chemistry 2017, 11633-11639. Inorganic Chemistry 2016, 12897–12903

Project 2: Thermoelectric Properties of Heavy Element Transition Metal-based Skutterudites: These materials are able to convert thermal energy to electricity and vice versa. This is a new collaborative effort between Jet Propulsion Laboratory (JPL, NASA) and Derakhshan's Lab at CSULB.

Project 3: 3d Transition Metal Oxides and Oxynitrides for Catalytic Reactions: These materials are used to for oxygen evolution reactions (OER) and hydrogen evolution reaction (HER) through electro-catalytic and/or photocatalytic water splitting process.

Project 4: Novel Phosphors Based on Olivine Type Oxides : This project aims to develop light emitting materials with enhanced efficiency and stability through chemical modification of metal oxides.

PI: Paul Weers, Ph.D., Biochemistry, Protein Structure and Function of Apolipoproteins

Website: http://weerslab.weebly.com Email: paul.weers@csulb.edu

Project 1: Self-association of human apolipoprotein A-I (apoA-I). ApoA-I forms oligomers, which affect the functionality of the protein. The project aims to identify the amino acids of the C-terminal domain of apoA-I that are responsible for self-association, as well as gaining insight into the mechanism of self-association.

Recent paper: Biochemistry 2018, in press

Project 2: Design of chimeric apolipoproteins. This project aims to gain insight into the domain organization of exchangeable apolipoproteins. The functional properties of apoA-I will be studied using chimeras made of apoA-I and apolipophorin III.

Recent paper: Biochim. Biophys. Acta. 2017, 1859, 1317-1325.

PI: Michael P. Schramm, Ph.D., Supramolecular Chemistry, Catalysis, Drug Transport

Website: https://schrammlab.wordpress.com Email: michael.schramm@csulb.edu

Project 1: Mono and Bis Gold Resorcinarenes: New, Potent Supramolecular Catalysts. Single and double Au containing resorcinarene cavitands act as surprising new catalysts that supply alkyne-acids with new selection rules for catalysis.

Recent paper: European Journal of Organic Chemistry 2016, 2514-2521.

Project 2: Calixarene mediated Membrane Transport. Supramolecular hosts show promise as a new general strategy to shuttle drug and drug like molecules across biological membranes.

Recent paper: Bioorganic and Medicinal Chemistry Letters 2017, 27, 2953–2956.

Research Facilities

- NMR: 400 MHz Avance III Bruker Spectrometer with SampleCase Autosampler and Broad Band Auto Tune and Match Prodigy Cryoprobe.
- NMR: 300 MHz Bruker Fourier with SampleXpress autosampler.
- Advion low resolution Mass Spectrometer with m/z up to 1,200
- GC/MS: Agilent 5975 GC-7820 MS
- GC/MS: ThermoFisher Trace 1300 GC ISQ QD MS

•CEM Discover Benchmate microwave reactor.
•Single crystal Bruker APEX II Single crystal X-ray diffractometer
•Xpert-Pro Powder X-ray diffractometer (PANalytical)
•BioLogic DuoFlow FPLC with fraction collector
•Pharmacia Akta purifier with fraction collector
•Two Sorvall RC5C plus centrifuges, Beckman L8-M Ultracentrifuge
•Savant SpeedVac
•modern Lyophilizer
•Milli-Q pyrogen-free water purification system
•Autoclaving facilities
•Olympus Fluoview 1000 confocal laser scanning system mounted on an inverted Olympus IX- 81 microscope (Access via Department of Biology)
•Nikon Eclipse TE2000-U Inverted Fluorescence Microscope with mercury lamp illumination, a variety of filter cubes and objectives, photomultiplier detector, and custom excitation laser
•MicroCal Auto-iTC200 Isothermal Calorimeter
•LabRAM HR Evolution Raman microscope with 532 nm, 633 nm laser lines
•Glovebox integrated Physical Vapor Deposition system for multi-layer films formation from Angstrom Engineering.
•Multiple new HPLC systems for a variety of chemical and biochemical applications.
•Perkin Elmer LS 55 Fluorescence Spectrophotometer; fluorescence, phosphorescence and bio- and chemi-luminescence, pulsed Xenon lamp, holographic gratings and automated polarizers
•Dynamic Light Scattering apparatus
•Cressington coating system model 308
•Jelight Company UVO –cleaner model 42
•CH Instruments bipotentiostat model 780A
•Differential Scanning Calorimeter (MicroCal, VP-DSC)
•Circular Dichroism Spectrometer (Jasco J-810)
•Cell Sorter (SH800)
•AFM, TEM, SEM facilities available
•Cell culture facilities both shared and PI owned
•Cold room facilities
•High Performance Computing Facility: Cores – 676 distributed over 32 nodes, CUDA Cores – 14336 total, RAM – 8.7 TB
•PCR
•Plate readers with Absorbance and Fluorescence capabilities
•Spectrophotometers
•LI-COR ODYSSEY FC Imaging Western Blot Reader
•BET Surface Area Analyzer for Gas Adsorption/Desorption
•ULVAC ZEM-3 for measurement of Seebeck & Electric Resistivity