SRI 2009
UC Santa Cruz Faculty

This is a list of faculty members and a brief summary of their research interests. For more information on the faculty listed below, please check the following websites.

http://www.chemistry.ucsc.edu/faculty/index.html
http://www.mcd.ucsc.edu/faculty.html
http://www.etox.ucsc.edu/fac_res/default.html

MARK AKESON, ASSISTANT PROFESSOR OF CHEMISTRY

Nanopores in lipid-bilayer membranes have the potential to be used to characterize DNA and RNA. Mark Akeson's primary research area concerns the manner in which these linear macromolecules traverse nanoscopic channels. He hopes to apply these studies of DNA structure and dynamics to HIV treatment and personal genomics.

REBECCA BRASLAU, ASSOCIATE PROFESSOR OF CHEMISTRY

Our research group is focused on reactions involving free radical intermediates. Much of the work involves the synthesis and use of designed nitroxides for the preparation of specialized polymers for applications in nanotechnology, and as sensors via fluorescence quenching. We are also engaged in the development of new synthetic methodologies via free radical intermediates.

MANEL CAMPS, ASSISTANT PROFESSOR OF ENVIRONMENTAL TOXICOLOGY

Spontaneous DNA Methylation results from methyl donors reacting with DNA. DNA methylation is a potent carcinogen. Paradoxically, in addition to being carcinogenic, methylating agents are also mainstays for cancer treatment. Among his research interests, Dr. Camps examines the molecular mechanisms of methylating agent toxicity to design safer and more effective strategies for cancer chemotherapy.

SHAOWEI CHEN, ASSOCIATE PROFESSOR OF CHEMISTRY

This research is centered around electron transfer chemistry at the nanoscale; more specifically, we are interested in the electron transfer properties of nanometer-sized particle molecules and their organized assemblies. Our strategy is to employ a series of chemical as well as physical manipulations to shed light onto the molecular origin of these unprecedented electrochemical phenomena. Currently there are three major research projects in my laboratory: 1) rectification of nanoparticle quantized charge transfer, 2) solid-state electronic conductivity of nanoparticle ensembles, 3) magnetoelectrochemistry of nanoparticle quantized charging.

PHILLIP CREWS, PROFESSOR OF CHEMISTRY

Application of nuclear magnetic resonance to problems of organic structure, marine organic chemistry – isolation and structure determination of biologically important substances, especially for marine sponges and their associated microorganisms.

DAVID FELDHEIM, ASSISTANT PROFESSOR OF MCD BIOLOGY

My lab is interested in understanding how neural connections are generated during development. It is thought that there is a combination of molecular cues and neural-activity dependant cues that help guide axons to their proper location and strengthen appropriate synapses. We use a combination of expression analysis, in vitro assays, electrophysiological and gene-knock out experiments to elucidate molecular mechanisms of CNS connectivity. We are currently trying to understand both the mechanisms that direct axon guidance in the visual system.

RUSS FLEGAL, PROFESSOR OF ENVIRONMENTAL TOXICOLOGY

My research is on the natural biogeochemical cycles of trace elements in the environment and the perturbation of those cycles by anthropogenic processes. The primary focus is on the biogeochemical cycle of lead in preindustrial and contemporary environments. This includes studies of lead cycles in the world's oceans, Mediterranean Sea, Great Lakes, European Alps, and Antartic. I am also involved with research on the

biogeochemical cycling of other trace elements in aquatic systems. This research is focused on the cycling of heavy metals and rare earth elements in the San Francisco Bay estuarine system and the northeast Pacific coastal zone. These studies involve analyses of elemental concentrations and isotopic compositions in aerosols, water, sediments, and organisms.

GRANT HARTZOG, PROFESSOR OF MCD BIOLOGY

Exploring the role chromatin plays in gene expression and the mechanisms by which chromatin structure is manipulated to regulate transcription. We study this in yeast using biochemistry and genetics, focusing on proteins that appear to modulate transcription by interacting with chromatin.

THEODORE HOLMAN, ASSOCIATE PROFESSOR OF CHEMISTRY & BIOCHEMISTRY

Bioinorganic Chemistry. Many critical processes require metal ions, such as respiration, photosynthesis and signal transduction. Our research group utilizes enzymology, site directed mutagenesis, molecular biology, inorganic chemistry, and spectroscopy to investigate the biological function of metalloproteins from a rigorous chemical perspective. Specifically, we study the biological function of lipoxygenase in order to understand its mechanism better and discover novel inhibitors.

MELISSA JURICA, ASSISTANT PROFESSOR OF MCD BIOLOGY

Our lab focuses on the spliceosome, a large protein/RNA complex responsible for editing the information contained in the RNA transcripts of over 90% of human genes. We combine structural and biochemical techniques to study the spliceosome including cryo-electron microscopy (cryo-EM) and X-ray crystallography. Our goal is to understand how the spliceosome is assembled and how it catalyzes the splicing reaction.

DOUG KELLOGG, PROFESSOR OF MCD BIOLOGY

Cells show extraordinary diversity in size and shape. Generation of diverse sizes and shapes requires regulation of the amount and location of growth, as well as coordination of cell growth with cell division. The mechanisms by which cells regulate cell growth and size are poorly understood and represent one of the most important and fundamental unsolved problems in cell biology. The goal of our work is to elucidate these mechanisms.

DAVE KLIGER, PROFESSOR OF CHEMISTRY

My research group spans the fields of physical chemistry and biophysics. We have been involved in developing a variety of spectroscopic techniques and applying them to a wide range of photochemical, photophysical, and photobiological problems. These techniques provide a powerful set of tools for studying molecular dynamic processes such as: 1. the mechanism of activation of visual pigments, 2. the mechanisms of function of the plant regulatory protein phytochrome and a variety of heme proteins, and 3. the early events in the folding of a variety of proteins and DNA.

YAT LI, ASSISTANT PROFESSOR OF CHEMISTRY

The primary aim of my research is to address fundamental science in low-dimensional materials through bottom-up paradigm, specifically consists of three interrelated areas including (i) design and rational synthesis of functional nanomaterials, (ii) investigation of their fundamental properties and (iii) use these novel nanomaterials to address the scientific issues in photovoltaic, nanoscale photonics and electronics.

ROGER LININGTON, ASSISTANT PROFESSOR OF CHEMISTRY

Marine natural products continue to be a source of inspiration and innovation in many areas of biomedical science. The research pursued in our laboratory focuses on two main areas of interest in this arena; drug discovery for neglected infectious diseases, and the use of natural products as probes for biological systems. Within these two related areas we are interested in the discovery of novel therapeutics for diseases including malaria, TB and dengue fever; the identification of novel targets for drug intervention; the determination of specific protein function using small molecule probes and the concerted development of all of these ideas to push our initial drug leads from early-stage discovery to preclinical development.

SCOTT LOKEY, ASSISTANT PROFESSOR OF CHEMISTRY

The primary goal is to develop chemical tools with which to study complex biological processes. We have three specific areas of interest: 1. the synthesis of combinatorial

libraries inspired by cyclic peptide natural products; 2. the study of membrane permeability using cyclic peptide model systems; 3. the development of cell-based assays to identify novel compounds with potent biological activity.

PRADIP MASCHARAK, PROFESSOR OF CHEMISTRY

Pradip Mascharak is interested in bioinorganic chemistry. His research activity includes modeling the active sites of enzymes that contain transition metal ions. This research involves syntheses of metal complexes/clusters with biologically relevant designed ligands that mimic various metalloenzymes in their structural, spectroscopic and catalytic behaviors. The ultimate goal is to elucidate the mechanism(s) of the complex biological transformations occurring at the metal-containing active sites.

GLENN MILLHAUSER, PROFESSOR OF CHEMISTRY AND BIOCHEMISTRY

Research in our laboratory ranges from physical chemistry to biochemistry. Three examples of our research are as follows: 1. Understanding how the primary sequence of peptides controls secondary structure in solution. 2. Use of ESR to monitor kinetic processes involved in the production of amyloid - a protein-rich deposit that appears to be the causative agent in Alzheimer's Disease and, perhaps, in the prion diseases such as Mad Cow Disease. 3. Use of NMR to solve the solution structures of small proteins; in particular, human agouti related protein (AGRP), a signaling molecule that plays a major role in the control of hunger and fat deposition.

SCOTT OLIVER, ASSOCIATE PROFESSOR OF CHEMISTRY

The Oliver research group deals with several ongoing materials chemistry projects. ACCESS students would join our efforts on the synthesis of new inorganic materials. We are working towards the discovery of new mineral-like structures with a positive charge, for environmental application as adsorbents of anionic pollutants.

KAREN OTTEMAN, PROFESSOR OF ENVIRONMENTAL TOXICOLOGY

The Ottemann laboratory investigates how bacteria translate chemical and physical cues in their host environment into a response that allows them to colonize a mammalian host. Our lab members are particularly interested in how pathogens use swimming during infection, using the bacterium *Helicobacter pylori* as a model for this ability. Their chemotaxis system allows us to examine the types of cues sensed by mammalian pathogens.

MICHAEL REXACH, ASSOCIATE PROFESSOR OF MCD BIOLOGY

Research in the Rexach lab focuses on nucleocytoplasmic transport. More specifically we are interested in the architecture and dynamics of the protein diffusion barrier in the nuclear pore complex (NPC). To this end, we are characterizing the structure of specific proteins of the nuclear pore complex. We are also interested in the mechanics of transport across the nuclear pore complex. The flow of most large proteins and RNA is restricted and requires specific transit signals. We study the mobile receptors, karyopherins, that recognize those signals and interact with proteins to shuttle cargo across the NPC.

SETH RUBIN, ASSISTANT PROFESSOR OF CHEMISTRY

Our research interests are in understanding the biochemical mechanisms that control the eukaryotic cell cycle. Our lab seeks to elucidate the biochemical determinants of protein interaction affinity and specificity and how these factors are affected by regulatory modifications to protein composition and structure. We apply a variety of structural and biochemical techniques to attain atomic resolution structures of protein complexes and to learn how structural changes and chemical modifications affect biological function.

CHAD SALTIKOV, ASSISTANT PROFESSOR OF ENVIRONMENTAL TOXICOLGY

My lab focuses on understanding how microbial anaerobic respiratory processes influence the fate and transport of pollutants in the environment with a specific interest in the metalloid arsenic. Microbial metabolic activity is increasingly thought to play a significant role in controlling the fate and transport of toxic metals in aquatic systems. In the case of arsenic, two primary redox reactions have been described: (i) the oxidation of arsenite (As(III)) to arsenate (As(V)) and (ii) the reduction of As(V) to As(III). Current research projects are directed at: (i) constructing a whole-cell model for how bacteria respire As(V), (ii) investigating the diversity of the *arrA* functional gene, and (iii) applying this molecular biological information to understanding how microbial redox processes

affect the As biogeochemical cycle.

DON SMITH, PROFESSOR OF ENVIRONMENTAL TOXICOLOGY

Our research seeks to understand the mechanistic basis and functional outcomes of metal toxicity. Our efforts have centered around the effects of lead in model systems and humans, with emphasis on the study of therapeutic treatments for lead poisoning. We have also become quite interested in the neurotoxicology of manganese and other redox active metals, and how they contribute to neurologic disease. We use an array of analytical, biochemical, and molecular techniques to investigate basic mechanisms of action at the biochemical/molecular level, and the functional outcomes at the organ and whole organism level.

JIN ZHANG, PROFESSOR OF CHEMISTRY

The Zhang research group is primarily interested in the design, development, characterization, and application of advanced materials with emphasis on optical and electronic nanomaterials of both semiconductors, metal oxides, and metals. We explore emerging technological applications of these advanced nanomaterials in areas such as solar energy conversion, hydrogen generation and storage, photocatalysis, photovoltaics, photoelectrochemistry, sensors and imaging (particularly based on SERS), detection of cancer biomarkers, solid state lighting, and lasers.