SRI 2018
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.metx.ucsc.edu/faculty/index.html
http://www.bme.ucsc.edu/people/faculty

JAMES ACKMAN, ASSISTANT PROFESSOR OF MCD BIOLOGY

Our overall goal is to understand the fundamental principles which govern how the nervous system is wired together and how neural circuit structure and function is established. A central focus of our work is exploring the sources and the flow of brain activity in the cerebral cortex that are involved in the development of synaptic connections between brain regions. Another major effort is concerned with investigating how patterns of activity across brain circuits shape the planning and execution of behavior.

ALEX AYZNER, ASSISTANT PROFESSOR OF CHEMISTRY

We are broadly interested in understanding the influence of molecular and macromolecular structure of small-molecule and polymeric organic semiconductors on the efficiency and dynamics of light harvesting. Current work in the group aims to address the three fundamental steps involved in photoelectric and photochemical conversion: energy transfer, interfacial electron transfer, and long-range charge transport.

NEEDHI BHALA, ASSOCIATE PROFESSOR OF MCD BIOLOGY

We are interested in the mechanisms that ensure that chromosomes segregate correctly during cell division, particularly in meiosis. Defects in meiosis can generate gametes with the incorrect number of chromsomes and typically produce inviable embryos. In some cases, the presence of an extra copy of a chromosome results in serious developmental disorders, such as Down and Klinefelters syndrome. We combine genetic and biochemical approaches with high-resolution microscopy and cytological techniques to gain a more informed view of how molecular events during meiosis govern and are governed by higher-order chromosome behavior.

REBECCA BRASLAU, 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.

SUSAN CARPENTER, ASSISTANT PROFESSOR OF MCD BIOLOGY

Protection against infection and maintenance of homeostasis are the hallmarks of the innate immune system. In recent years long noncoding RNAs (lncRNA) have emerged as major regulators of chromatin remodeling, transcription and post-transcriptional regulation of gene expression in diverse biological contexts and they are emerging as an additional layer in the regulation of immune responses where they can promote, fine-tune and restrain the inflammatory program. Our goal is to understand the functions for lncRNA within Innate Immunity.

SHAOWEI CHEN, 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, DISTINGUISHED PROFESSOR OF CHEMISTRY

The Crews lab applies nuclear magnetic resonance to problems of organic structure, marine organic chemistry – isolation and structure determination of biologically important substances, especially for tropical marine sponges and their associated microorganisms. Using bioassay-guided isolation assists us in the discovery of natural products potent against human diseases such as cancer or viruses. The search for novel active compounds incorporates elements of structure elucidation but includes questions in the areas of chemical ecology, marine natural products biosynthesis, and the relationship between secondary metabolite chemistry and taxonomy.

OLOF EINERSDOTTIR, PROFESSOR OF CHEMISTRY

Cytochrome oxidase is an oxidizing enzyme found in mitochondria and important in cell respiration as an agent of electron transfer from certain cytochrome molecules to oxygen molecules. It is the last enzyme in the respiratory electron transport chain. The primary aim of my research is to understand the mechanism of coupled electron transfer and proton translocation in cytochrome oxidases.

CAMILLA FORSBERG, PROFESSOR OF BIOMOLECULAR ENGINEERING

The Forsberg lab focuses on stem cell fate decisions of the blood system, seeking to understand their molecular determinants in order to prevent and treat both genetic and acquired disorders of the hematopoietic system. We tackle questions regarding these decisions from multiple angles - by *in vivo* and *in vitro* experimental approaches, by focusing on specific molecules as well as analyzing global changes.

GRANT HARTZOG, PROFESSOR OF MCD BIOLOGY

1) We are interested in understanding the role chromatin plays in gene expression and the mechanisms by which chromatin structure is manipulated to regulate transcription. The spatial arrangement of nucleosomes on a gene influences its transcription by modulating the ability of regulatory proteins to access specific DNA sequences and by modulating the rate at which RNA polymerase travels down genes. We study this problem in the yeast, *Saccharomyces cerevisiae,* using biochemistry and genetics. 2) We are also interested in isolating new bacteriophage (bacterial viruses) which may lead to identification of novel genes and proteins. In addition, new bacteriophage may provide tools enabling study of their bacterial hosts.

THEODORE HOLMAN, PROFESSOR OF CHEMISTRY AND 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, an enzyme in humans that has been implicated in a variety of diseases (asthma, atherosclerosis, and cancer), in order to understand its mechanism better and discover novel inhibitors.

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, DISTINGUISHED 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, ASSOCIATE 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.

SCOTT LOKEY, 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.

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, 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 MICROBIOLOGY

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.

CARRIE PARTCH, ASSOCIATE PROFESSOR OF CHEMISTRY AND BIOCHEMISTRY

Our goal is to identify the fundamental basis of crosstalk between the circadian clock and DNA damage checkpoint response to understand how disruption of the clock regulates oncogenesis. We will achieve this by integrating diverse experimental approaches from cell biology to solution NMR spectroscopy to gain an atomic-level understanding of the clock, as well as providing new targets and/or a temporal basis for improved therapeutic intervention in cancer.

NADER POURMAND, PROFESSOR OF BIOMOLECULAR ENGINEERING

The Pourmand lab develops genome sequencing technology and uses high-throughput sequencing and bioinformatics to understand genetic variation and its function in health, disease, and biological systems (UCSC Genome Sequencing Center). They also develop nanoscale sensors that can be used for biological research at the cellular level (Biosensors and Bioelectrical Technology group).

SETH RUBIN, PROFESSOR OF CHEMISTRY AND BIOCHEMISTRY

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, PROFESSOR OF MICROBIOLOGY AND ENVIRONMENTAL TOXICOLOGY

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.

BILL SAXTON, PROFESSOR OF MOLECULAR, CELL AND DEVELOPMENTAL BIOLOGY

The Saxton lab studies mechanisms that drive intracellular transport and cytoplasmic organization, using Drosophila as a model organism. We are currently focusing on how motor proteins accomplish their normal transport jobs in neurons and oocytes, and on identifying the cellular mechanisms that link defective transport to axon degeneration in our Drosophila spastic paraplegia model system

NIKOLAUS SGOURAKIS, ASSISTANT PROFESSOR OF CHEMISTRY AND BIOCHEMISTRY

We study proteins of the immune system that play important roles in human health. To perform their roles, these proteins must interact with other biomolecules. Elucidating these molecular interactions will help establish the biochemical basis of immune recognition and the knowledge gained from our detailed molecular description will enable us to develop new therapeutic molecules for emerging immunotherapy applications to combat viral infections, autoimmune diseases, and cancer.

DON SMITH, PROFESSOR OF MICROBIOLOGY AND 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.

MICHAEL STONE, ASSOCIATE PROFESSOR OF CHEMISTRY AND BIOCHEMISTRY

Using single molecule techniques, the Stone laboratory studies the structure and function of telomerase, an enzyme that synthesizes telomere DNA. Telomeres are specialized chromatin structures that prevent deleterious chromosome fusion events by differentiating normal chromosome ends from sites of DNA damage. Since telomerase activation is restricted to rapidly dividing cell types (such as stem cells and the majority of human tumors), it is of direct medical importance to understand fundamental mechanisms governing its assembly and function.

CHRIS VOLLMERS, ASSISTANT PROFESSOR OF BIOMOLECULAR ENGINEERING

The Vollmers lab uses DNA sequencing tools to analyze B cells on both a population and a single cell level. B-cells are part of our adaptive immune system and are unique in their capability to produce antibody proteins that specifically target any pathogen that an individual will encounter in his lifetime. Understanding B-cell development will give us insight into how our immune system works, as well as how it relates to disease.

FITNAT YILDIZ, PROFESSOR OF MICROBIOLOGY AND ENVIRONMENTAL TOXICOLOGY

The Yildiz laboratory is interested in understanding the molecular mechanisms of *V. cholerae* biofilm formation and its role in *V. cholerae* biology. To this end they are identifying and characterizing structural components and signal transduction networks controlling biofilm formation. Understanding the mechanisms involved in biofilm formation and maintenance, as well the role of biofilms in overall *V. cholerae* biology, will pave the way for developing strategies to predict and control cholera epidemics.