# BIOMEDICAL ENGINEERING IDP FACULTY

## Aberle, Denise PhD

Department: Radiological Science
Academic Title: Professor
Email Address: daberle@mednet.ucla.edu
Field(s): Medical Imaging Informatics (MII)

**RESEARCH:** Dr. Aberle's primary research interest is in *lung cancer* and the *applications of imaging for early detection, prognosis, prediction, and treatment response assessment*. She has a strong background in quantitative image analysis, including computer aided lung cancer detection and nodule characterization and she is the UCLA Co-PI to the NCI-funded five-member consortium, the Lung Imaging Database Consortium (LIDC), which is building an annotated lung imaging database for the use of computer added diagnosis (CAD) development. Dr. Aberle is the national PI for the NCI-sponsored ACRIN-National Lung Screening Trial, which is evaluating the benefits of two screening tests -- low dose helical CT versus chest radiography -- by comparing lung cancer mortality rates in individuals at high risk of lung cancer. Finally, she is actively engaged in informatics research and education, and specifically, the use of information technologies in oncology.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Bergsneider, Marvin M.D.

Department: Surgery/Div. of Neurosurgery
Academic Title: Professor in Residence
Email Address: mbergsneider@mednet.ucla.edu
Field(s): Biomedical Signal/Image Processing (BSIP)
Biomedical Instrumentation (BMI)
Neuroengineering (BNE)

**RESEARCH:** Analog circuit modeling of the cerebral circulation in relationship to the pathophysiology of elevated intracranial pressure. The project uses computer modeling to investigate how a reduction in intracranial compliance leads to an increase in venous blood flow pulsatility and a resultant change in hemodynamics. The model is based on and compared to in vivo data obtained from the laboratory.

## Bezanilla, Francisco

Department: Physiology
Academic Title: Professor
Email Address: fbezanil@ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:**

# BIOMEDICAL ENGINEERING IDP FACULTY

## Bisley, James PhD

Department: Neurobiology
Academic Title: Assistant Professor
Email Address: jbisley@mednet.ucla.edu
Field(s): Neuroengineering (BNE)

**RESEARCH:** Our lab studies the neural mechanisms and circuitry underlying the cognitive processing of visual information. This includes investigations into visual memory, visual perception and visual attention. Our methods primarily involve recording the neuronal responses of single cells from animals that perform complex behavioral tasks. Data from these experiments are used to create hypotheses that are tested by stimulating or inactivating groups of neurons to see if small, but predictable, changes in behavior can be induced.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Black, Douglas L. PhD


Department: Microbiology, Immunology, & Molecular Genetics
Academic Title: Professor
Email Address: dougb@microbio.ucla.edu

Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Dr. Black is interested in the regulation of pre-mRNA splicing and the biochemical mechanisms that control changes in splice sites. The sequences of metazoan genomes, with their relatively low gene numbers, have highlighted the question of how protein number can be expanded beyond the gene number for a complex organism. Alternative splicing, which allows the production of multiple mRNAs and hence multiple proteins from a single gene, is a major contributor to protein diversity. However, despite its key role in gene expression, this process is poorly understood mechanistically. Alternative splicing is particularly common in genes expressed in the mammalian nervous system, where many proteins important for neuronal differentiation and function are made in diverse isoforms through controlled changes in splicing. The Black lab works on a range of projects related to the control of pre-mRNA splicing in neurons. Their goal is to determine the mechanisms of action of splicing regulators, as well as to understand their roles in neural development and mature neuronal function.

## BIOMEDICAL ENGINEERING IDP FACULTY


### Bouchard, Louis PhD

Department: Chemistry & Biochemistry
Academic Title: Assistant Professor
Email Address: bouchard@chem.ucla.edu


Field(s): Biomedical Signal/Image Processing (BSIP)
Biomedical Instrumentation (BMI)

**RESEARCH:** The Bouchard lab develops new instrumentation for multi-modality biomedical imaging. In one project we study metabolism (Krebs cycle) and catalytic reactions in single cells, with the use of spin-polarized fluids to enhance the NMR signal and novel RF imaging probeheads for use in microfluidic settings. In a second project we develop nanoscale scanning probe magnetometry and optically detected magnetic resonance technology with diamond for the study of chemical reactions involved in cancer and other biological processes at the single molecule level.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Bui, Alex Ph.D.


Department: Radiological Science
Academic Title: Associate Professor
Email Address: buia@mii.ucla.edu

Field(s): Medical Imaging Informatics (MII)

**RESEARCH:** Dr. Alex Bui is an Assistant Professor in the Department of Radiological Sciences at UCLA. He obtained his BS degree in computer science from UC Berkeley in 1995, and his Master's and PhD degree from UCLA in computer science in 1998 and 2000, respectively. Dr. Bui is part of the UCLA Medical Imaging Informatics Group, with research interests focusing on distributed information architectures for biomedical research and clinical environments, probabilistic data modeling, and visualization of medical information. He is the project leader/principal investigator of several research grants, including an NIH RO1, entitled /An Engineering Approach to Individually Tailored Medicine/, and UC Discovery Grant, /An XML-based Infrastructure for Supporting Distributed Medical Information Environments/. Dr. Bui is also the Course Director for the MII NLM training program in medical imaging informatics.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Carman, Greg Ph.D.

Department: Mechanical and Aerospace Engineering
Academic Title: Professor
Email Address: carman@seas.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Biomedical Instrumentation (BMI)

**RESEARCH:** Active materials research; electro-magneto-thermomechanical response of advanced material systems and related sensor systems. Active materials includes graphite/epoxy composite systems, nitinol shape memory material, terfenold magnetostrictive material, and PZT piezo-electric material; Sensor systems focus on Extrinsic Fabry-Perot interferometric fiber optic sensors.

## Chan, Tony Ph.D.

Department: Mathematics
Academic Title: Professor
Email Address: tonyc@college.ucla.edu
Field(s): Biomedical Signal/Image Processing (BSIP)

**RESEARCH:** Computational mathematics, image processing and computer vision, medical imaging, brain mapping and VLSI design optimization.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Chen, Yong Ph.D.

Department: Mechanical and Aerospace Engineering
Academic Title: Professor
Email Address: yongchen@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:**

## Chiou, Pei-Yu PhD

Department: Mechanical and Aerospace Engineering
Academic Title: Associate Professor
Email Address: pychiou@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** Dr. Eric P. Y. Chiou's general research interest is in the development of biomedical instrument utilizing photonic, electronic, and microfluidic devices. His current research focuses on two major directions. One is to develop laser driven ultrafast microfluidic devices that lead to several novel applications such as high efficiency single cell laser surgery tools, optical image patterned multiplexed gene transfection and macromolecule delivery into cells, and high speed microscale fluorescent activated cell sorters. The second direction is to develop optoelectronic tweezers for high throughput single cell mRNA analysis on monolithically integrated microfluidic devices. He is also interested in utilizing optoelectronic tweezers for parallel manipulation of a large oil immersed aqueous droplet array with light images, targeting for rapid preparation of a large combinatorial chemical library for high throughput drug screening.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Chow, Samson Ph.D.


Department: Molecular and Medical Pharmacology
Academic Title: Professor
Email Address: schow@mednet.ucla.edu

Field(s): Molecular & Cellular Bioengineering (MCB)
Biomedical Signal/Image Processing(BSIP)

**RESEARCH:** My laboratory studies the molecular mechanism of integration of a viral genome into its host cell's DNA, a process essential for reproduction of HIV and other retroviruses. Retroviral integration is mediated by the viral protein integrase. We are currently focusing on understanding thebiochemistry of integration, identifying integrase domains responsible for target site selection, imaging HIV infection and nuclear import ofintegration complexes, studying the interaction between integrase and reverse transcriptase and the effect on viral replication, and developing novel retroviral vectors for delivering exogenous DNA into specific target sites. Knowledge gained will be used for developing therapeutics for retroviral diseases and improving genetic engineering and therapy in mammalian cells.

Recent Publications


Zhu K, Dobard CW and Chow SA. Requirement for integrase during reverse transcription of human immunodeficiency virus type 1 and the effect of cysteine mutations of integrase on its interactions with reverse transcriptase. J Virol 78: 5045-5055, 2004.

Tan W, Zhu K, Segal DJ, Barbas CF, 3rd and Chow SA. Fusion proteins consisting of HIV-1 integrase and the designed polydactyl zinc-finger protein E2C direct integration of viral DNA into specific sites. J Virol 78: 1301-1313, 2004.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Cohen, Mark PhD


Department: Psychiatry
Academic Title: Professor in Residence
Email Address: mscohen@ucla.edu


Field(s): Biomedical Signal/Image Processing (BSIP)
Medical Imaging Informatics (MII)
Biomedical Instrumentation (BMI)
Neuroengineering (BNE)

**RESEARCH:** Research:Through the development of modern methods of neuroimaging, we are interested in exploring the relationships between structure and function in the human brain, particularly as related to higher level cognition, such as mental imagery. Our lab is involved in the creation of technologies - including:

Rapid Methods of MR Imaging
Fusion of Electrophysiology and fMRI

Novel means of MR Imaging
Advanced approaches to MR data analysis

Our applications work address questions of cognition including mental imagery, decision making and perception.

# BIOMEDICAL ENGINEERING IDP FACULTY


## Demer, Joseph M.D., Ph.D.

Department: JSEI-Ophthalmology & Neurology
Academic Title: Professor
Email Address: jld@ucla.edu
Field(s): Biomedical Instrumentation (BMI)
Biomedical Signal/Image Processing(BSIP)


**RESEARCH:** There are several lines of funded research in my laboratory
1). Eye and head movement experiments in human volunteers. These are intensive and are done several times per week. We use magnetic search coils and flux gate magnetometer sensors to study human vestibulo-ocular reflexes during natural activities such as ambulation, and during controlled vestibular stimulation at high angular and linear accelerations using a short arm centrifuge. We make extensive use of time and frequency domain mathematical models and simulation to understand our data.

2). Eye alignment measurements in strabismus surgery patients. We are constructing a system to automatically measure binocular alignment by video tracking of the position of each eye. Software control of this system is incomplete and could benefit from the involvement of a BME student. Ideally, this new measurement system would form a "front end" for our strabismus simulation software, which is undergoing clinical and laboratory validation.

3). MRI and x-ray CT scans of the eye sockets of strabismus surgery patients and normal volunteers. We do quantitative morphometry of extraocular muscles and other orbital tissues to provide data for computational simulation of strabismus in the same patients.

4). Histological processing and computer reconstruction of whole eye sockets from cadavers. We have a high-volume histological laboratory equipped for digital scanning of embedded block faces as well as large histological and immunohistochemical slides to enable us to perform 3-dimensional reconstruction of whole eye sockets. Correction for shrinkage and other geometrical distortions in processing is a major effort guided by x-ray and MRI tomography

in the same specimens prior to embedding.

5). Computer simulation of strabismus and strabismus surgery. Our consortium has developed and continues to refine a computational model of ocular statics that permits quantitative diagnosis and pre-operative simulation of strabismus (misalignment of the two eyes that causes double vision), as well as surgical treatment of strabismus. The model produces 3-dimensional renderings of the muscles color coded to reflect variations in mechanical parameters. It requires substantial new refinements in light of previously-unrecognized connective tissues and smooth muscles discovered in our laboratories.

6). 3-dimensional kinematic analysis of eye movements. Three-dimensional rotations of an object such as the eye have mathematical properties that are not immediately obvious, such as non-commutativity of operations and position-dependence of velocities. These mathematical properties have implications for the neural control of eye movements, and involve the connective tissue suspensions of the eyeball and eye muscles that we have discovered in the anatomy laboratory. Our eye movement recordings and MRI scans permit testing of quantitative hypotheses concerning these kinematics.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Demer, Linda M.D., Ph.D.


Department: Medicine Cardiology
Academic Title: Professor
Email Address: ldemer@mednet.ucla.edu

Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** My research laboratory is studying the cellular and molecular mechanisms of artery wall/vascular calcification. We have recently demonstrated that this process is not a passive, degenerative process as previously believed, but a regulated process that closely resembles the formation of bone in the embryo. Similar developmental programs and morphogenetic factors are expressed, following time courses of expression similar to those in osteogenesis. We have developed a tissue culture model in which artery wall cells produce bone mineral within 3 dimensional structures that resemble reaction-diffusion patterns which suggests higher levels of organization. We also have a knock-out mouse model that develops complete ossification of the wall of the aorta, and we are using echocardiographic imaging techniques to demonstrate the hemodynamic consequences of aortic calcification.

## BIOMEDICAL ENGINEERING IDP FACULTY

# Deming, Timothy

Department: Bioengineering
Academic Title: Professor
Email Address: demingt@seas.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:** Research in the Deming group is focused on synthesis, processing, characterization and evaluation of biological and biomimetic materials based on polypeptides. These materials are being studied since they can be prepared from renewable resouces, they can be biocompatible and biodegradable, and possess unique self-assembling properties. We utilize innovative chemistry techniques to synthesize materials with properties that rival the complexity found in biological systems. The polymers are then processed into ordered assemblies, which are characterized for both nanoscale structure as well as biological function. This interdisciplinary approach stimulates innovations and ideas which direct this research into new, exciting areas.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Di Carlo, Dino PhD


Department: Bioengineering
Academic Title: Assistant Professor
Email Address: dicarlo@seas.ucla.edu


Field(s): Biomedical Instrumentation (BMI)
Molecular & Cellular Bioengineering (MCB)
Biosystem Science and Engineering(BSSE)

**RESEARCH:** We are exploiting unique physics, microenvironment control, and the potential for automation associated with miniaturized systems for applications in basic biology, medical diagnostics, and cellular engineering. Current research is focused on:
(i) Quantitative cell biology and mechanics of cancer metastasis. Microfluidic methods to control the surface chemistry, mechanical, and soluble environment are well suited to address questions associated with cell migration and movement. We are particularly interested in the process of cancer metastasis and intravasation.
(ii) Nonlinear microfluidics. Nonlinear fluid dynamic effects are usually not considered in microfluidic systems but may provide simple methods to manipulate and sort rare populations of cells at high-throughputs. We are studying the physical basis of inertial migration of particles and engineering novel portable and robust diagnostic and analysis systems using this phenomenon for applications in the developed and developing world.
(iii) Microfluidic directed cellular evolution. Microfluidic technologies may offer advantages in creating new useful selection criteria for cellular evolution. Besides gaining an understanding of dominant molecular pathways in controlling these behaviors, the resultant evolved cell populations and genetic modifications may be useful for therapeutic applications.

Lab website: http://dicarlo.bol.ucla.edu/

## BIOMEDICAL ENGINEERING IDP FACULTY

# Dipple, Katrina


Department: Human Genetics
Academic Title: Associate Professor
Email Address: kdipple@mednet.ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)
Biomedical Instrumentation (BMI)


**RESEARCH:**

## BIOMEDICAL ENGINEERING IDP FACULTY

### DiStefano, Joseph Ph.D.

Department: Computer Science
Academic Title: Professor
Email Address: joed@cs.ucla.edu
Field(s): Biosystem Science and Engineering(BSSE)
Molecular & Cellular Bioengineering (MCB)
Neuroengineering (BNE)

**RESEARCH:** Joe DiStefano, III, a professor of Medicine in the Division of Endocrinology, as well as a professor in the Computer Science Department, has been actively teaching and pursuing biomedical engineering research for many years at UCLA. In the Biocybernetics Laboratory, which he has directed since its inception in 1966, the emphasis is on development and exploitation of the synergistic and methodologic interface between biomodeling and laboratory experimentation. Work in the laboratory focuses on integrated approaches for solving complex biosystem problems from sparse biodata, figuratively "squeezing blood from a stone." DiStefano's interdisciplinary research is directed toward development and application of cutting-edge engineering cybernetics principles and computer simulation methods for solving basic and applied problems in neuroendocrine physiology and medicine, as well as in pharmacology and related biomedical fields.

Most recently, with the assistance of graduate student Thuvan Nguyen and postdoctoral fellow Koen Mol, DiStefano's lab successfully applied their novel graphical approach to a long unsolved and very important problem the determination of how much self-regulating thyroid hormone is produced in the brain cells of a mammal. Conventional methods have yielded little information and DiStefano's results are the first for thyroid hormone production in any single organ in any species. This demonstration has potentially important clinical implications, as thyroid hormone is critical to brain development in the developing fetus, and cognitive behavior in the adult.

This work, and other work of the lab, has been supported primarily by the National Institutes of Health (NIH), but also by the National Science Foundation, Genentech, and Knoll Pharmaceutical

Corporations.

## Dunn, Bruce Ph.D.

Department: Material Science and Engineering
Academic Title: Professor
Email Address: bdunn@ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:** Sol-gel biosensors based on the encapsulation of enzymes and other proteins. The general theme of the research program in Bruce Dunn's group is the synthesis of ceramics and inorganic compounds and characterization of their electrical and optical properties. For the biomedical materials areas, we are interested in sol-gel materials which incorporate organic, organometallic and biological molecules in the matrix. These materials are based on the encapsulation of enzymes and other proteins and serve as highly sensitive and specific sensors for a wide variety biomedical and chemical sensing applications

# BIOMEDICAL ENGINEERING IDP FACULTY

## Dunn, James M.D., Ph.D.

Department: Pediatric Surgery
Academic Title: Professor
Email Address: jdunn@mednet.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:** Tissue Engineering of Internal Organs

1. Intestinal Tissue Engineering
2. Adrenal Cortical Stem Cells
3. Mass Transfer in Tissue Engineering
4. Mechanical Forces in Tissue Engineering
5. Intracellular Signaling in Tissue Engineering

More information can be found at http://www.bioeng.ucla.edu under Faculty/Research

## Edgerton, Victor R. Ph.D.

Department: Physiological Science/Neurobiology
Academic Title: Professor
Email Address: vre@ucla.edu
Field(s): Neuroengineering (BNE)

**RESEARCH:** Application of Robotics to Neuromotor Adaptations

## BIOMEDICAL ENGINEERING IDP FACULTY


### Eldredge, Jeff D. PhD

Department: MAE
Academic Title: Associate Professor
Email Address: eldredge@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)


**RESEARCH:** RESEARCH :
Development and application of high-fidelity numerical methods for exploring incompressible and compressible fluid flow physics; Investigations of biomedical device flows; flow-based techniques for microparticle manipulation; aquatic and aerial locomotion in biological and bio-inspired systems.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Ennis, Daniel PhD

Department: Radiological Science
Academic Title: Assistant Professor
Email Address: daniel.ennis@ucla.edu
Field(s): Biomedical Signal/Image Processing (BSIP)
Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:** My research interests focus on using magnetic resonance imaging to assess myocardial structure, function, and remodeling – particularly during the pathogenesis of cardiovascular disease.

Most of my work utilizes the application of novel cardiac magnetic resonance imaging techniques and principled tensor analysis methods for characterizing changes in myocardial strain tensor fields (function) and diffusion tensor fields (structure).

In general, I am interested in magnetic resonance imaging, cardiovascular pathophysiology, image processing, continuum mechanics, tensor analysis, soft tissue biomechanics, and the intersection of all these fields.

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### Garfinkel, Alan Ph.D.

Department: Medicine (Cardiology) and Physiological Science
Academic Title: Professor
Email Address: agarfinkel@mednet.ucla.edu
Field(s): Biosystem Science and Engineering(BSSE)
Neuroengineering (BNE)
Biomedical Signal/Image Processing(BSIP)

**RESEARCH:** Large-scale simulations of cardiac conduction in arrhythmias; design of rationally-based therapies for ventricular fibrillation

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## BIOMEDICAL ENGINEERING IDP FACULTY


### Garrell, Robin Ph.D.

Department: Chemistry & Biochemistry
Academic Title: Professor
Email Address: garrell@chem.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** Understanding the chemistry of adhesion at solution-solid interfaces. Applications include new biopolymeric adhesives, biosensors and implantable materials.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Giza, Christopher PhD

Department: Surgery/Neurosurgery
Academic Title: Assistant Professor in Residen
Email Address: cgiza@mednet.ucla.edu
Field(s): Neuroengineering (BNE)

**RESEARCH:** Areas of research interest and active investigation include developmental TBI and its pathophysiology. Ongoing studies include those examining impaired neurotransmission, altered developmental plasticity, acute alterations in metabolism, morphological injury, vulnerability to secondary insults and behavioral impairments. Basic research into post-traumatic brain activation, molecular signaling and experience-dependent plasticity are fundamental parts of the laboratory program. We are currently investigating the response of molecular signaling molecules after developmental TBI, and how post-injury environment may modulate the molecular and neuroplastic potential of the immature brain. Specifically, there appears to be an impairment of excitatory neurotransmission and activity-dependent neurotrophin expression that represent mechanisms underlying the injury-induced impairment of brain plasticity. Another basic research area spans the terrain between acute neuronal injury and delayed plasticity. Using induction of post-traumatic seizures as a secondary injury, we are studying the vulnerability of the injured immature brain. By conducting long-term behavioral, electrophysiological and morphological assessments of these subjects, we also gain insight into aberrant neuronal sprouting and epileptogenesis following TBI. In addition to the basic science approach to the problem of pediatric TBI, the group is currently engaged in establishing a translational/clinical program. This will be designed to capture physiological monitoring and imaging data from the acute hospitalization, with standardized outpatient clinic followup. One area of clinical investigation already underway is the study of neuropsychological function, anatomical imaging, functional brain mapping and white matter tract morphology across time in normal developing control children and in children recovering following moderate to severe TBI. A second clinical area under development

will be the correlation of acute physiological variables (such as intracranial pressure, cerebral perfusion, magnetic resonance spectroscopy, acute white matter lesions, and early secondary insults) with neurological and behavioral outcomes. One important goal of the group is to translate research findings between laboratory and clinical arenas to gain better mechanistic insight into the physiological distinctions of pediatric TBI, and to better understand and to eventually facilitate how the developing brain recovers from TBI.

## Graeber, Thomas PhD

Department: Molecular & Medical Pharmacology
Academic Title: Assistant Professor
Email Address: tgraeber@mednet.ucla.edu
Field(s): Biosystem Science and Engineering(BSSE)
Medical Imaging Informatics (MII)

**RESEARCH:** Systems biology of cancer signaling

My group is working to understand cancer signaling from a systems viewpoint. We focus on developing genome- and proteome-wide detection assays, applying these assays to measuring and computationally modeling aberrant cancer signaling, and translating our discoveries to clinical applications. We have developed a mass-spectrometry based protocol for identifying tyrosine-phosphorylated proteins from cancer cell lysates. We are using this proteome-wide 'phosphorylation profiling' assay to identify the signaling pathways activated by various oncogenic initiating events (e.g. kinase mutations), and to elucidate the interconnectedness of classical signaling pathways into a more comprehensive signaling network. In modeling cancer signaling, one of our goals is to identify minimal sets of informative components that best reflect the state of the cell and serve as molecular targets for diagnostics, imaging, and patient tailored treatment. As with all of systems biology, our research relies on an interdisciplinary approach that merges biology, chemistry, mathematics and computation/bioinformatics.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Grundfest, Warren M.D., FACS

Department: Bioengineering/Surgery
Academic Title: Professor
Email Address: warrenbe@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** Excimer Lasers for Medical Applications. The laser research lab has pioneered the development of pulse ultra-violet of excimer lasers for biomedical applications. We continue to investigate cardiovascular, ophthalmologic, orthopaedic and neurosurgical application of this technology. Biologic spectroscopy, the use of spectral data to identify and classify tissue is another major focus of our research. We employ multiple techniques including time resolved spectroscopy, hyperspectro-imaging, photo bleaching and laser attenuation spectroscopy for the study of biologic systems. Clinically, we are actively involved in the development of minimally invasive imaging and surgical tools.

### Gunsalus, Robert Ph.D.

Department: Microbiology, Immunology, & Molecular Genetics
Academic Title: Professor
Email Address: robg@microbio.ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Understanding the chemistry of adhesion at solution-solid interfaces. Applications include new biopolymeric adhesives, biosensors and implantable materials

## BIOMEDICAL ENGINEERING IDP FACULTY

### Gupta, Vijay Ph.D.

Department: Mechanical and Aerospace Engineering
Academic Title: Professor
Email Address: vgupta@seas.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Biomedical Instrumentation (BMI)

**RESEARCH:** Areas of interest include measurement of cell adhesion to metallic substrates for prosthesis, biomechanics of bone healing and fixation apparatus, and laser diagnostics and surgery.

### Ho, Chih-Ming Ph.D.

Department: Mechanical and Aerospace Engineering
Academic Title: Professor
Email Address: chihming@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** Applying Micro Electro Mechanical Systems (MEMS) technology to control minute amount of fluid motion for biomedical applications, such as cellular dynamics, drug delivery, DNA identification; MEMS based DNA identification; MEMS based bio-fluidics; Artificial sphincter.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Hu, Xiao PhD

Department: Surgery/Neurosurgery
Academic Title: Associate Professor in Residen
Email Address: xhu@mednet.ucla.edu
Field(s): Biomedical Signal/Image Processing (BSIP)
Neuroengineering (BNE)

**RESEARCH:** We are interested in studying clinical informatics and dynamics in terms of their roles in improving diagnosis, treatment, monitoring and management of brain injury and stroke patients. We are currently funded for research in modeling dynamics of cerebral blood flow and intracranial pressure and the analysis of biomedical signals including intracranial pressure, cerebral blood flow velocity, arterial blood pressure, and heart rate variability. We are also active in research and development in medical informatics that involve large-scale clinical database, predictive data mining, and clinical decision support.

### Ju, Yongho Sungtaek Ph.D.

Department: Mechanical and Aerospace Engineering
Academic Title: Associate Professor
Email Address: just@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)
Neuroengineering (BNE)

**RESEARCH:**

## BIOMEDICAL ENGINEERING IDP FACULTY

### Judy, Jack Ph.D.


Department: Electrical Engineering
Academic Title: Professor
Email Address: jjudy@ee.ucla.edu

Field(s): Neuroengineering (BNE)

**RESEARCH:** The UCLA NeuroEngineering Training Program (NET) will promote the application of new engineering technologies to neuroscience, including micromachining and microelectromechanical systems (MEMS). The implications of MEMS technologies for neuroscience are revolutionary. We now have the potential to develop arrays of microsystems, which can be tailored to the physical and temporal dimensions of individual cells. Neuroscientists can now realistically envision sensing devices that allow real-time measurements at the cellular level. Information from such sensors could be monitored, analyzed, and used as a basis of experimental or medical intervention, again at a cellular level.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Kamei, Daniel Ph.D.

Department: Bioengineering
Academic Title: Associate Professor
Email Address: kamei@seas.ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** My research program is in the area of molecular cell bioengineering, where we develop and employ quantitative design principles obtained from a cell-level context to engineer more effective molecular therapeutics. Specifically, experiment and computational modeling are combined to rationally design peptides and proteins with the goal of improving existing therapies. Instead of optimizing merely any individual step among the complex network of dynamic processes involved in cell regulation, my research takes a systems approach to analyzing cellular processes. With this quantitative analysis, design criteria for enhancing efficacy are identified and then achieved using a combination of molecular modeling and site-directed mutagenesis.

### Kangarloo, Hooshang Ph.D.

Department: Radiology
Academic Title: Professor Emeritus
Email Address: hkangarloo@mii.ucla.edu
Field(s): Medical Imaging Informatics (MII)

**RESEARCH:** Research in the Medical Imaging Informatics area is located at the following URL: http://www.mii.ucla.edu/

## BIOMEDICAL ENGINEERING IDP FACULTY


### Kasko, Andrea Ph.D.

Department: Bioengineering
Academic Title: Assistant Professor
Email Address: akasko@ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** Structural hierarchy is an important concept in the design of new materials for biomedical applications. Because natural materials exhibit structural hierarchy from the nanoscale to the macroscale, biomaterials should ideally exhibit a similar hierarchy. Current research in biomaterials is often limited to chemicals available "off the shelf", which are either naturally occurring materials or biocompatible synthetic polymers. Collagen, heparin, hyaluronic acid, and agarose are examples of natural materials used for biomedical applications, but there is limited control over their chemical and physical properties and thus they are only suitable for specific applications. Poly(ethylene glycol) (PEG), poly(vinyl alcohol), poly(caprolactone) and poly(D,L-lactic-co-glycolic acid) are examples of biocompatible synthetic polymers with the physical and chemical behaviors that can be controlled and/or modified, but that exhibit very little structural hierarchy. In order to mimic, influence or control natural processes, we need to rationally design new materials from the nanoscale to the macroscale, with control over the chemical and physical properties at multiple levels. By controlling molecular structure, assembly and interaction on multiple levels, we can better replicate the critical aspects of physiological materials and processes. We are interested in developing materials with controllable chemistry and properties from the nanoscale to the macroscale. We are also interested in designing materials with predictable, triggerable degradation and release profiles.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Kim, Chang Jin Ph.D.

Department: Mechanical and Aerospace Engineering
Academic Title: Professor
Email Address: cjkim@ucla.edu
Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** Microelectromechanical systems; designs and fabrication of microstructures, microactuators, and microsensors, as well as mechanics in microscale; mercury-contact micromechanical relays electroplated microchannels, microinjector arrays for combustion, packaging for MEMS devices, inchworms with micro machined surface, bubble-driven micropumping and microsliders for turbulence control.

### Klug, William S. PhD

Department: Mechanical and Aerospace Engineering
Academic Title: Assistant Professor
Email Address: klug@seas.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Theoretical and computational biomechanics; mechanics of solids and structures; mechanics of viruses; membranes mechanics of cells and cell organelles; finite element modeling of proteins; couple multiphysics modeling of the heart.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Koeffler, H. Phillip M.D., PhD


Department: Medicine
Academic Title: Professor in Residence
Email Address: koeffler@cshs.org

Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Having developed a program in breast cancer research, Dr. H. PhillipKoeffler is looking at the molecular causes of the disease and researching novel forms of therapy. Koeffler has also developed a program in prostate cancer research and is looking at novel forms of therapy. Koeffler is studying the basic biology of leukemias, preleukemias and lymphomas, and developing novel forms of therapy for these diseases as well, including vaccines. He has cloned a pivotal hematopoietic control gene known as C\EBP-epsilon, and is now making transgenic and "knockout" mice to define the in vivo activities of this gene. Koeffler has recently cloned a cyclinA1gene and a protein processing gene using molecular biology and genetic techniques, and he is now defining the biology of these genes and their implications to cancer development. He has established a research team that uses computers, data banks and gene libraries to clone rapidly novel, interesting genes. Koeffler and his colleagues are also working to identify novel tumor suppressor genes using extensive tumor DNA banks from over twenty tumor types with matched normal control DNA from the same individual using high density SNP Chips. Koeffler's group is sub-localizing the site of tumor suppressor genes and oncogenes that are mutated in a variety of cancers.

# BIOMEDICAL ENGINEERING IDP FACULTY


## Kreiman, Jody PhD

Department: Surgery
Academic Title: Professor in Residence
Email Address: jkreiman@ucla.edu
Field(s):


**RESEARCH:** My NIH-supported research, jointly conducted with Bruce Gerratt, PhD, focuses on the perception (and secondarily on the production) of normal and pathological voice. Voice quality is a primary means by which humans signal their identity, internal state, and intentions to others, and voice disorders can have devastating personal and professional consequences, creating an undesirable personal image and making vocal communication difficult or impossible. However, despite the importance of voice perception and large literatures in disciplines ranging from music to medicine, little progress has been made in understanding how listeners perceive voices. In fact, the modern history of voice research may be viewed as a series of efforts to circumvent the problem of measuring quality by substituting "objective" measures of acoustics, physiological function, or airflow. Unfortunately, objective measures of quality are meaningless unless they are validated against perceptual measures. Thus, perception of voice remains of central importance even in efforts to eliminate perceptual measures.

Our research attempts to develop models of voice perception and speaker recognition. Without such models, the goal of understanding how listeners perceive voices will not be achieved. Initial studies in our laboratory sought to specify the sources of variability in listeners' ratings of vocal quality. More recently, studies have focused on developing reliable, valid methods to measure perceived vocal quality, by controlling the factors underlying response variability. We have devised a new, theoretically-motivated method of assessing quality-listener-mediated analysis-resynthesis-in which listeners explicitly compare synthetic and natural voice samples, and change speech synthesizer parameters to create acceptable auditory matches to voice stimuli. This method is designed to replace unstable internal

standards for qualities like breathiness and roughness with externally-presented stimuli. Initial results indicate that this technique does control the major hypothetical sources of disagreement in rating scale judgments.

A reliable and valid method of measuring what listeners hear is an essential component of a common theoretical framework that links together physiology, aerodynamics, acoustics, and perception, to explain how tissue movement finally results in the perception of speech sounds. However, voice production, perception, and acoustics in the past have been studied as nearly independent disciplines, with little cross-fertilization of ideas and virtually no theory to link levels of description. A unified approach to the study of voice could have many potential benefits, including theoretically motivating surgeries to improve voice quality, allowing prediction of post-surgical voice quality given a patient's particular findings, motivating objective measures of voice, specifying which aspects of a voice are essential to its identification, and so on. Development of such a theory (in collaboration with other faculty members in Head and Neck Surgery, Engineering, and Linguistics) is the ultimate goal of this ongoing research.

## Landaw, Elliot Ph.D., M.D.

Department: Biomathematics
Academic Title: Professor
Email Address: elandaw@biomath.medsch.ucla.edu
Field(s): Biosystem Science and Engineering(BSSE)

**RESEARCH:** Compartmental modeling, nonlinear estimation and optimal design in Pharmacokinetics, physiology and molecular biology.

# BIOMEDICAL ENGINEERING IDP FACULTY


## Lee, Min PhD

Department: Dentistry
Academic Title: Assistant Professor
Email Address: leemin@ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** Research in the Lee group focuses on the development of biomimetic polymer systems for tissue regeneration and drug delivery applications. Our research interests are:

i) Photopolymerizable hydrogel systems. We are developing injectable formulations of cells and bioactive molecules using photopolymerization techniques, which allow processing in situ at physiological conditions in a minimally invasive manner. This system is currently being tested in vitro and in animal models for the repair of cartilage defects.

ii) Controlled release. Direct therapeutic applications of drug molecules require high doses and repeated injections of protein drugs due to their rapid degradation in the body. Our research interests are in the development of injectable/implantable systems for the delivery of growth factors in a sustained, combinatorial, or sequential manner. We are currently applying these systems to engineer a variety of tissue types, including bone, cartilage, smooth muscle, and maxillofacial tissues.

iii) Customized biomimetic scaffolds. We are developing a novel computer-designed, biomimetic scaffolding system to maximize bone regeneration. This system consists of three-dimensional polymer scaffolds with well-defined geometries on the macro- and micro-scales created from a printing technique in conjunction with biomimetic processing strategy to confer bone mineral-mimicking apatite microenvironment and osteogenic signaling molecules.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Levi, Daniel MD


Department: Pediatrics (Division of Pediatrics Cardiology)
Academic Title: Associate Professor
Email Address: dlevi@ucla.edu

Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** Dr Levi has an M.D. from UCSF and trained at UCSF and UCLA in pediatric cardiology, molecular biology, biomedical engineering and interventional catheterization/device design. He presently has several collaborations in Dr Greg Carman's Active Materials Laboratory which focus on biomedical device design with Dr Carman's novel thin film nitinol technology. He has designed by transcatheter heart valves and covered stents for cardiac and neuro applications with thin film nitinol.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Liao, James Ph.D.

Department: Chemical Engineering
Academic Title: Professor
Email Address: liaoj@ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** DNA microarray technology
Understanding how the genes work at the genomic scale is essential for biomedical research and applications. Achieving this goal involves genome sequencing and determining the role of each gene in the cell. Most commonly, the function and regulation of the genes are studied one at a time, with tedious and time-consuming methods. The DNA micro-array technology promises to greatly improve the speed of this process. With proper DNA probes, this technology allows the detection of mRNA levels at the genomic scale. The purpose of this project is to develop DNA micro-array technology for prokaryotic systems, particularly for microbes with unknown genome sequence, and apply it to problems of biomedical interest. Specifically, we will use this technique to identify genes in new pathways, to determine roles of unknown genes, and to uncover new roles of known genes. These results will be useful in metabolic engineering, bioconversion, biosynthesis, and biodegradation. In particular, we will develop data analysis tools for interpreting data generated using this technology.

Regulation of Nitric Oxide degradatation and production in Human
Nitric Oxide (NO) is a recently identified biological signal molecule that plays an important role in vascular regulation, immune responses, and neuronal signal transduction. This molecule is produced from a common amino acid, arginine, in many cell types. The regulation of NO in physiological systems is complex and involves many aspects in term of its production and degradation. We are currently investigating the following two problem: (i) degradation of NO in blood and tissue, and (ii) the competition between NO synthesis and other arginine-ulitizing pathways. The first problem is crucial to the design of an artificial blood substitute, whereas the second pertains to therapeutic strategies for diseases

involving NO, such as atherosclerosis, septic shock, and cancer.

Rapid Detection of Bacteria in Urine
Urinary tract infections are the most common reason for consultation in the female or male patient. The diagnosis can be suspected by urinary examination. In order to confirm the diagnosis, a culture of the urine is performed. If the culture is positive the bacteria must be tested for sensitivity to different antibiotics. This diagnostic process can take more than 48 hours. During this time the patient suffers because he is not treated at all and in many occasions is treated with the wrong antibiotics. The faster the result of a urine culture (positive or negative) is known, the better will be the treatment. The patient will avoid the 48 hours waiting with pain, urinary frequency, burning and bleeding. Also the patient will avoid the 48 hr waiting with pain, urinary frequency, burning, and bleeding. Also the faster we know the appropriate antibiotic to use the better and more effective the treatment will be. We are developing a rapid (1-2 hr) test for bacterial recognition and antibiotic sensitivity for the urine. The technique includes the use of genetic engineering technique. In contact with a specific bacterium the genetic marker will react and emit light proportional to the bacterial concentration. In a similar way, the sensitivity to antibiotics will be quickly unveiled. The development of the system includes the creation of the genetic probes for bacterial recognition and antibiotic sensitivity, and the electronic reader.

Metabolic Engineering of Isoprenoid Pathway in microorganisms
Isoprenoids are a diverse class of compounds that are synthesized from the basic building block, isoprene. These compounds include hormones, vitamin precursors, pigments, antibiotics, and many pharmaceuticals. The biochemical pathways for synthesizing these compounds have just begun to be understood. We are interested in constructing a microorganism, such as Escherichia coli, as a host to produce these compounds in high yield. To this end, we are investigating the pathways involved in this biosynthesis and elucidating the regulation of carbon flow. By manipulating the enzymes at the gene level, we can selectively produce a compound of our interest at high yield. At another level, we are redesigning the enzymes so that they can produce novel compounds. This work is based on the intriguing idea of transferring protein domains among different enzymes. By recombinining these domains, we aim to alter the enzyme activity to produce novel compounds, while elucidating enzyme reaction mechanisms.

## BIOMEDICAL ENGINEERING IDP FACULTY


### Lyons, Karen PhD

Department: Orthopaedic Surgery
Academic Title: Professor
Email Address: klyons@mednet.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** Dr. Lyons investigates cartilage and bone formation using genetically modified mice. Understanding how these tissues form in the embryo is likely to lead to effective therapeutic approaches to treating diseases associated with aging, such as osteoarthritis (degeneration of cartilage) and osteoporosis (loss of bone mass). The laboratory has focused on the bone morphogenetic protein (BMP) signaling pathway, investigating how modifying various components of this pathway affect development of cartilage in the embryo and its maintenance in adults. The laboratory also investigates the mechanistic basis for fibrosis. Fibrosis involves excess deposition of extracellular matrix, and is a common result in adult tissues attempting to repair themselves following damage. By understanding how cartilage and bone form during development, when there is no fibrosis, and how fibrotic responses are generated in the adult, it is hoped that tissue engineering strategies that promote tissue regeneration and prevent excess scar formation can be optimized.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Markovic, Dejan PhD


Department: Electrical Engineering
Academic Title: Assistant Professor
Email Address: dejan@ee.ucla.edu


Field(s): Biomedical Signal/Image Processing (BSIP)
Neuroengineering (BNE)

**RESEARCH:** Professor Markovic's research focuses on algorithms, architectures, and integrated circuits for parallel data processing in future radio and healthcare systems. This includes algorithms and technology for many-channel neural-spike signal processing for use in basic neuroscience research, human epilepsy in particular. His group is also working on processing low-field potential and tetrode data recordings from humans and rats. The objectives are to provide technology for real-time in-vivo signal compression of more than 100 channels simultaneously, and to provide technology for over 1000 times faster processing of existing data records as compared to software simulations. Our activities also include design with post-CMOS devices, optimization methods and supporting CAD flows.

## BIOMEDICAL ENGINEERING IDP FACULTY


### Mason, Thomas G. PhD

Department: Chemistry & Biochemistry
Academic Title: Professor
Email Address: mason@chem.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** We develop novel dispersions that contain both synthetic and natural components, such as virus-like droplets (VLDs)-- capsid protein shells that have assembled around internal oil droplets. In addition, using our advanced stepper UV lithography facilities, we create dispersions of custom-shaped particles that interact with cellular and sub-cellular biological structures. We also develop and apply the basic techniques of bio-microrheology, an optical particle tracking technique for probing viscoelasticity of biomaterials at the sub-cellular level using thermal and athermal excitation of nanospheres.

## BIOMEDICAL ENGINEERING IDP FACULTY


### Maynard, Heather Ph.D.

Department: Chemistry & Biochemistry
Academic Title: Associate Professor
Email Address: maynard@chem.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** We integrate synthetic polymers with biologically-derived molecules, such as peptides, proteins, and sugars, to prepare materials for applications in human therapeutics and nanotechnology. Our approach involves many disciplines including polymer chemistry, protein expression and manipulation, and peptide synthesis. Specifically, we manipulate polymer functionality and architecture using controlled radical polymerization to prepare universal block copolymer scaffolds. Reaction of these scaffolds with amino acids and peptides to produce ligands that function as specific antagonists of proteins and cell-surface receptors are being pursued. Potential applications of the polymeric drugs include anthrax toxin inhibition. Controlled radical polymerization is also used to synthesize polymers with “protein-philic” end groups and narrow molecular weight distributions. We are using these polymers to prepare protein-polymer conjugates with polymers of well-defined length and specific points of attachment. Complexes of proteins and polymers are important commercial therapeutics and may be valuable building blocks of nanostructured materials. In addition, molecular imprinting techniques using glycomonomers are employed to prepare materials that detect tumor markers. The markers are angiogenic growth factors that cause cancer blood vessel growth, and detection of these proteins has diagnostic and prognostic value. These materials may be useful in sensors for noninvasive cancer detection, prognosis evaluation, and therapy monitoring.

http://www.chem.ucla.edu/dept/Faculty/maynard/

## BIOMEDICAL ENGINEERING IDP FACULTY

### McKellop, Harry Ph.D.


Department: Orthopedic/Biomechanics/Biomaterials

Academic Title: Professor in Residence

Email Address: hmckellop@laoh.ucla.edu


Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:** Design and clinical performance of artificial joints. Wear of prosthetic joints and the effects of wear particles on the surrounding bone and soft tissue. Biomechanics of injury and healing of bone, articular cartilage, ligaments and tendons. Interaction of growth factors and mechanical stimulation in healing tissues and grafts. Design and clinical performance of devices for stabilization of fractures.

More details are available at:

http://www.orthohospital.org/research/TribologyLab/McKellop.html

## BIOMEDICAL ENGINEERING IDP FACULTY

### Mody, Istvan Ph.D.


Department: Physiology/Neurology
Academic Title: Professor
Email Address: mody@loni.ucla.edu

Field(s): Neuroengineering (BNE)

**RESEARCH:** My research focuses on the physiology and pharmacology of synaptic transmission in the mammalian brain, and the regulation of intracellular calcium homeostasis. These two themes ultimately converge in the lab through studies of long-term alterations in the excitability of nerve cells and circuits responsible for offsetting the frail balance between excitation and inhibition. When this balance is tipped, either acutely or chronically, the brain cells' behavior becomes abnormal and may eventually lead to specific brain disorders. We use many experimental approaches including patch-clamp recordings (whole-cell, single channel and perforated patch) in brain slices, in acutely isolated animal and human neurons, or in cultured neurons/slices; chronic recordings in vivo to monitor long-term changes in the excitability of circuits; infrared and fluorescent video microscopy and simultaneous recordings in live brain tissue; neuroanatomical and immunohistochemical techniques; measurement of intraneuronal calcium; and molecular biological approaches aimed at reducing specific brain proteins by using antisense oligonucleotides and genetic knockout approaches.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Monbouquette, Hal Ph.D.


Department: Chemical Engineering
Academic Title: Professor
Email Address: hmonbouq@ucla.edu

Field(s): Molecular & Cellular Bioengineering (MCB)
Neuroengineering (BNE)

**RESEARCH:** Biosenosrs, biocatalysis, biotechnology of extreme thermophiles. We are conducting research in three general areas: Electronic coupling of redox enzymes to electrodes for biosensing and chiral synthesis; Extremophile biotechnology; and Use of lipid vesicles as models of cell membranes for selective metal ion extraction and detection. By electronically coupling redox enzymes to electrodes, a current flow provides an unlimited source of or sink for the electrons needed in the reaction thereby eliminating the need for expensive, often unstable electron-transfer coenzymes. This technology can be exploited both for biosensing and for the selective synthesis of chiral organics, e.g., drug intermediates. We investigate microbes that grow optimally in extreme environments of temperature, pH and salt concentration, i.e., extremophiles, principally as a source of new redox enzymes. Finally, we are working to engineer phospholipid vesicles, i.e., liposomes, that resemble cell membranes for the rapid and selective uptake of toxic metal ions from aqueous solution and for the quantitation of these same ions at sub-ppb levels.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Murray, Samuel MD


Department: Medicine
Academic Title: Professor in Residence
Email Address: Samuel.Murray@va.gov

Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Our currently funded projects focus on proteins and peptides that interact with bone morphogenetic proteins (BMPs). Our initial research, done in collaboration with Marshall Urist, M.D. (late, UCLA Department of Orthopaedics), found that the protein which was Urist's candidate for "BMP" was in fact, a fragment of a previously isolated protein, spp-24. This protein lacked osteogenic (bone forming) activity. Because spp-24 has a cystatin domain, as does fetuin, a protein known to bind TGF-beta and BMP-2, we are testing the hypothesis that spp-24 and its fragments bind BMP. Furthermore, we hypothesize that different size forms of spp-24 will bind BMP differently and thus have different effects of the activity of BMPs both in physiological situations and in clinical applications.

Thus far we have demonstrated that:
1.A 19 amino acid peptide (BBP, Bone Morphogenetic Protein Binding Peptide), the sequence of which is derived from the cystatin domain of Urist's BMP, binds rhBMP-2 and that it enhances the osteogenic activity of BMP-s in several models of bone formation.
2.Full-length spp-24 [spp-24 (24-203)] inhibits BMP-2 induced ectopic bone formation and bone formation in transgenic animals.

Specific Research Questions:
1.Does the shorter form (18.5 kD) of spp-24 bind to BMP-2? What are the relative KD values for BBP, full-length spp-24, and 18.5 kD spp-24 in relation to rhBMP-2?
2.What effect does spp-18.5 kD have on BMP-2 induced bone formation?
3.How can BBP be combined with various biomaterials to produce products which enhance clinical bone healing?
4.What proteolytic enzymes are involved in the processing of spp-

24 to spp-24 18.5 kD? How are these enzymes regulated in bone turn over and fracture healing?

## Narins, Peter Ph.D.

Department: Physiological Science
Academic Title: Professor
Email Address: pnarins@ucla.edu
Field(s): Biosystem Science and Engineering(BSSE)

**RESEARCH:** The study of the neural and biophysical mechanisms underlying sound and vibration reception in the vertebrate ear, using laser doppler vibrometry, patch clamp and extracellular recordings.

## BIOMEDICAL ENGINEERING IDP FACULTY


### Nishimura, Ichiro Ph.D.

Department: School of Dentistry
Academic Title: Professor
Email Address: inishimura@dentistry.ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)
Neuroengineering (BNE)
Biomaterials, Tissue Engr., & Biomechanics(BMT)


**RESEARCH:** 1.Title and focus of all current research projects.

Patients with head and neck cancer are often treated with surgery, which can leave a complex facial defect removing multiple layers of different tissues. Our long-term goal is to implement new reconstructive and regenerative treatments for the patients with facial defects and for better wound healing. The field of study is molecular biotechnology and tissue engineering. Fully differentiated adult tissues contain a small population of less differentiated stem cells. It has become increasingly clear that these adult stem cells may be redirected to express various useful phenotypes for tissue regeneration. The current research projects address the new genetic factors responsible for the molecular differentiation mechanism for adult tissue regeneration potential. A novel therapeutic gene transfer technology has been designed and is currently undergoing the initial validation process for various adult tissues such as peripheral nerves, bone, and skin/mucosa. The molecular biotechnologies developed in our laboratory will be directly applicable to the better genome-based diagnostic system of chronic and debilitating diseases such as osteoporosis, syndromic neuralgia, facial growth discrepancy and wound tissue contraction. The clinical gene therapy will be further developed for guided wound healing and ultimately for facial tissue engineering.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Ozcan, Aydogan PhD


Department: Electrical Engineering
Academic Title: Assistant Professor
Email Address: ozcan@ee.ucla.edu


Field(s): Biomedical Signal/Image Processing (BSIP)
Medical Imaging Informatics (MII)
Biomedical Instrumentation (BMI)

**RESEARCH:** Prof. Ozcan's research group focuses on photonics and its applications to nano- and bio-technology.

Broadly defined, his group uses the power of photonics for:
(1) Imaging the nano-world, especially in bio-compatible settings;
(2) Providing powerful solutions to global health related problems such as measurement of the cell count of HIV patients in resource limited settings;
(3) Rapid and parallel detection of hundreds of thousands of molecular level binding events targeting microarray based proteomics and genomics;
(4) Monitoring of the biological state of 3D engineered tissues.

For more information on his research group, please visit:
http://aozcan.net

## BIOMEDICAL ENGINEERING IDP FACULTY


### Pellegrini, Matteo

Department: MCDB
Academic Title: Associate Professor
Email Address: matteop@mcdb.ucla.edu
Field(s): Biosystem Science and Engineering(BSSE)


**RESEARCH:** Our lab is interested in developing computational approaches to reverse engineer molecular networks. These network models allow us to elucidate the mechanisms of signal transduction, transcription and metabolism. Our approach is to build models that integrate varied data including measurements of gene expression, protein binding, phosphorylation and genome sequences. For example, we use genome sequence data to infer networks of co-evolving proteins, which allow us to study the function of most proteins. Currently, we are also developing methods to reconstruct dynamical networks of transcriptional regulation. Our long-term goal is to build network models that allow us to quantitatively predict the outcome of perturbations in cells.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Pilon, Laurent PhD

Department: Mechanical and Aerospace Engineering
Academic Title: Associate Professor
Email Address: pilon@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** RESEARCH: The general theme of Dr. Pilon's group is in radiation transfer in absorbing and scattering media. Our activities in biomedical optics focus on non-invasive sensing of biological tissues and in particular skin. In vitro and in vivo Experimental investigations are performed as well as the development of simulation tools. Special attention is paid steady-state and time-resolved autofluorescence of human skin with applications to the detection and monitoring of diabetes, oxidative stress, and photoaging.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Pouratian, Nader PhD

Department: Neurosurgery
Academic Title: Assistant Professor
Email Address: npouratian@mednet.ucla.edu

Field(s): Biomedical Signal/Image Processing (BSIP)
Biomedical Instrumentation (BMI)
Neuroengineering (BNE)

**RESEARCH:** My research will integrate my two areas of expertise: brain mapping and neurosurgery. My research is multidisciplinary, involving collaborations in bioengineering, computer science, neurophysiology, neuroimaging, and brain mapping. I work on four major areas of research, all of which center on the concept of using advanced brain mapping technology to advance the field of restorative neurosurgery. The four projects include:

1.Design of a population-based Parkinson's Disease atlas - Despite an excellent understanding of the subcortical changes that occur in the setting of Parkinson's disease, there has been little attention paid to the more widespread changes that occur in the brain, especially cortical changes. This project uses patient-derived imaging data and sophisticated image analysis algorithms to develop a population and disease-based atlas of Parkinson's disease

2.Developing and testing fMRI algorithms to individualize restorative interventions – Despite tremendous advances in the surgical treatment of movement disorders, stereotactic targeting is based on atlas-based coordinates and anatomic-imaging. The motivations behind this project is to develop functional imaging and mapping paradigms to develop function-directed surgical interventions for patients with neurodegenerative disorders.

3.Mapping the functional reorganization of the brain after stroke – Stroke is one of the leading sources of disability in the United States. Still, interventions to promote or enhance recover after this acute insult are limited. This project will provide a comprehensive picture of the compensatory and repair mechanisms at a network level and provide a critical foundation for future studies to monitor

and promote functional recovery and restoration after stroke. The results of these studies will also lay groundwork for the informed design and implementation of Brain-Computer interface solutions for stroke patients with residual disability.

4.EEG and ECoG based brain-computer interface and real-time intraoperative mapping – This project will develop algorithms and models for real-time decoding of electrophysiological brain signals for development of Brain-Computer interface solutions.

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## Qu, Zhilin

**PhD**

Department: Medicine-Cardiology
Academic Title: Associate Professor in Residen
Email Address: zqu@mednet.ucla.edu
Field(s): Biomedical Signal/Image Processing(BSIP)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Dr. Qu's basic research interests are mathematical modeling and computational simulation of biological systems using multi-scale and systems biology approaches, and theories of nonlinear dynamics and statistical physics. His main research fields are: 1) Cardiac electrophysiology and arrhythmias, with models from single ion channel to whole heart; 2) Cardiac metabolism and its coupling with cardiac electrophysiology; and 3) Protein-protein interactions, including modeling of cell cycle control and signal transduction.

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## BIOMEDICAL ENGINEERING IDP FACULTY

### Ringach, Dario Ph.D.


Department: Neurobiology
Academic Title: Associate Professor
Email Address: dario@ucla.edu


Field(s): Biomedical Signal/Image Processing (BSIP)
Neuroengineering (BNE)

**RESEARCH:** We perceive the world around us as a collection of identified objects and surfaces, not as a collection of pixels with different values. How the brain generates such sensory percepts remains elusive. In the laboratory, we are using microfabricated electrode arrays in conjunction with intrinsic and voltage sensitive dye imaging to study how visual cortex processes the signals arriving from the retina. Our goal is to undestand how the brain functions normally, what happens when it doesn't (as in cases of central visual disorders), and how we can fix it. For example, we are in the process of developing novel methods to stimulate visual cortex through microelectrode arrays in an effort to restore sight in blind subjects. Our work relies heavily signal processing, systems identification and neural prostheses.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Ruan, Dan


Department: Radiation Oncology

Academic Title: Assistant Professor in Residen

Email Address: DRuan@mednet.ucla.edu


Field(s): Biomedical Signal/Image Processing(BSIP)

Medical Imaging Informatics (MII)

**RESEARCH:** My research interests includes medical imaging, tomography, parametric and nonparamatric estimation, dynamic systems, and general inverse problems in medical signal processing. I am interested in physics system modeling and characterization, algorithm development and performance analysis, as well as software-hardware system integration and validation. I am particularly interested in understanding the mathematics and physics in diagnostic radiology and radiation oncology.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Schmidt, Jacob Ph.D.

Department: Bioengineering
Academic Title: Associate Professor
Email Address: schmidt@seas.ucla.edu
Field(s): Biomedical Instrumentation (BMI)

**RESEARCH:** The central theme of the Schmidt group is to combine physical and biological nanofabrication techniques with protein engineering to make new kinds of hybrid devices. To perform this research, we have a highly multidisciplinary laboratory, drawing upon biology, physics, and nanofabrication— capable of performing all aspects of protein production and engineering as well as biophysical measurements of proteins and cells integrated with fabricated structures. My laboratory applies engineering design principles and techniques to create unique biologically functionalized materials. Potential applications are also driven by relationships with industry and medicine.

Lab Group URL: http://schmidtlab.seas.ucla.edu

## BIOMEDICAL ENGINEERING IDP FACULTY

### Segura, Tatiana PhD


Department: Chemical and Biomedical Engineering
Academic Title: Assistant Professor
Email Address: tsegura@ucla.edu


Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Research. Our research focuses on nucleic acid delivery strategies for tissue regeneration and adult stem cell differentiation applications. Non-viral gene delivery, which can be used to deliver any gene in the genome, is a safe, yet robust way to induce up-regulation of desired angiogenic signals; however, inefficient gene transfer has hindered the wide applicability of this approach. Our research investigates novel approaches for gene delivery, which exploit the tissue-engineering matrix as a key player in the process of gene transfer. We use the principles of engineering, chemistry, and life sciences to develop biomaterials that can be used simultaneously as scaffolds to guide tissue regeneration, stem cell differentiation and guide efficient and controlled gene transfer. http://tsegura.bol.ucla.edu/home.htm

## BIOMEDICAL ENGINEERING IDP FACULTY

### Shams, Ladan PhD

Department: Psychology
Academic Title: Assistant Professor
Email Address: ladan@psych.ucla.edu
Field(s): Neuroengineering (BNE)

**RESEARCH:** We study how information from different sensory modalities gets combined to lead to the multisensory yet monolithic experience of the environment that we have. The research in our lab as well as several other labs has shown that interactions among sensory modalities are ubiquitous and start at early stages of perceptual processing. We investigate multisensory perception at three different levels: a) phenomenology (what kind of interactions exist) using behavioral experiments. b) Brain mechanisms underlying these interactions using fMRI, ERP and MEG. c) theory (what the governing principles are) using statistical modeling of behavioral data. We have recently found that crossmodal interactions play an important role in perceptual learning and other kinds of learning and adaptation. We are investigating the nature and mechanisms of these multisensory learning mechanisms.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Smith, Desmond Ph.D.


Department: Molecular & Medical Pharmacology

Academic Title: Associate Professor

Email Address: dsmith@mednet.ucla.edu


Field(s): Molecular & Cellular Bioengineering (MCB)

Biomedical Signal/Image Processing(BSIP)

Biomedical Instrumentation (BMI)

Neuroengineering (BNE)

**RESEARCH:** We are developing experimental tools to extract biological meaning from the flood of information being produced by the genome projects. One major effort is devoted toward creating comprehensive atlases of gene and protein expression in the mammalian brain. Other projects are aimed towards identifying behavioral genes in the mouse and dissecting regulatory networks in mammalian cells.

Lab website: http://labs.pharmacology.ucla.edu/smithlab/

## BIOMEDICAL ENGINEERING IDP FACULTY

### Sofroniew, Michael Ph.D.

Department: Neurobiology
Academic Title: Professor
Email Address: sofroniew@mednet.ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)
Neuroengineering (BNE)

**RESEARCH:** Injuries to the brain or spinal cord do not repair spontaneously. Our work is directed at understanding the role of specific cell types in the response to injury in the brain and spinal cord, and how the functions of these cells may be modified to improve outcome. In one project, using genetically modified mice, we have shown that one cell type, the astrocyte, has essential roles in protecting nerve cells after injury. We are currently investigating how these roles might be augmented to improve outcome after injury. In another project, in collaboration with Dr. B. Wu and his laboratory, we are studying the potential of microspheres of synthetic biopolymers to promote axon regeneration after CNS injury by presenting extracellular matrix molecules and/or releasing growth factors. In another project, we are investigating properties of neural stem cells that are present in the adult brain, and how these cells might be harnessed for repair after brain injury.

### Spigelman, Igor Ph.D.

Department: Denistry-Orthopedics
Academic Title: Professor
Email Address: igor@ucla.edu
Field(s): Neuroengineering (BNE)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:**

# BIOMEDICAL ENGINEERING IDP FACULTY


## Sun, Ren PhD

Department: Molecular and Medical Pharmacology
Academic Title: Professor
Email Address: rsun@mednet.ucla.edu
Field(s): Biomedical Signal/Image Processing (BSIP)
Molecular & Cellular Bioengineering (MCB)


**RESEARCH:** Virus infection:
Integration of Biology, Nanotechology and Medical Application

Lymphotropic-herpesviruses, including Epstein-Barr virus (EBV) and human herpesvirus-8/Kaposi's sarcoma-associated herpesvirus (HHV-8/KSHV), are associated with malignancies. The tumorigenic nature of these herpesviruses originates from their capacity to establish latent infection and their ability to evade immune surveillance. We are integrating biology and nanotechnology to define the underlying mechanism, and develop new diagnostic and therapeutic approaches, with murine gamma-herpesvirus 68 (MHV-68) as an in vivo model.

We have previously identified Rta, a molecular switch that disrupts latency and initiates the lytic cycle. Using genomic approaches, we are identifying the the upstream cellular signal transduction pathways that control the expression and function of Rta. Using herpesvirus reactivation as a modle system, we will determine the optimal combination of these cellular factors/pathways to most efficiently regulate cellular functions with multiple inputs, in collaboration with Dr. Chih-Ming Ho, CJ Kim, Jeff Shamma, and Ming Wu. We will also apply the method to optimize multiple drug combination therapy for AIDS and cancer.

Herpesvirus is unique in carrying tegument, proteinous structure between capsid and envelope. After having identified the major tegument proteins in virions, we combine genetic and structural biology approaches (cryo electron microscopy and tomography in collaboration with Dr. Hong Zhou, Coherent X-ray diffraction in collaboration with Dr. John Miao) to define the relationship between structure and functions.

We use MHV-68 as an in vivo model to define the interactions between virus and host, especially the immune system. We have created a library of viral mutants, each carrying a sequence-tagged transposon. The function of every viral gene can be analyzed in vitro and in vivo, and their effect on viral pathogenesis (tumorigenesis and fibrosis). We are examining the function of these virally encoded cytokines (IL-6 and MIP1 of KSHV, IL-10 of EBV). We have constructed a latency-deficient virus, which can potentially be used as vaccine to prevent herpesvirus-associated malignancies. We are initiating clinical trials by intentionally activating viral lytic gene expression in tumor cells to destroy tumor lesions in the presence of ganciclovir. We are using molecular imaging technologies (PET, CT and CCD) to monitor viral replication and immune responses in mice and patients.

We are taking high throughput genetic approaches to define the replication mechanism of the SARS coronavirus and HCV. Since the virus infections impose the challenge of sensitive detection, therefore, we are interested in applying nanotechnologies in pathogen detection. We plan to build linkers between proteins and nano-devices, which will allow us to detect various viruses simultaneously. While the method will be applicable to pathogen detection (including biodefence agents), another application is to monitor the cellular changes during viral infection.

## BIOMEDICAL ENGINEERING IDP FACULTY

# Taira, Ricky


Department: Radiology
Academic Title: Professor in Residence
Email Address: rtaira@mii.ucla.edu
Field(s): Medical Imaging Informatics (MII)


**RESEARCH:** Research interests have included development of picture archive and communication systems (PACS), medical knowledge bases (the KMeD project), and currently, natural language processing (NLP) of medical corpora and formal ontological representations of disease entities. He is the co-PI and investigator of several NIH-funded grants. Dr. Taira teaches the Medical Knowledge Representation class that is part of the NLM training program in imaging-based medical informatics.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Tang, Yi — PhD


Department: Chemical Engineering
Academic Title: Associate Professor
Email Address: yitang@ucla.edu

Field(s): Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** The long term goal of our research group is to understand and engineer the biosynthetic machineries of microorganisms towards the production of important pharmaceuticals. Through fundamental analyses of the genetics and biochemistry of metabolic pathways, we will be able to reprogram the essential cellular components towards tailored synthesis of novel drugs, enzymes and biomaterials. Our current research is focused on two classes of compounds: 1) natural products that displays a wide spectrum of biological activities, including antibiotics, anticancer and cholesterol-lowering; 2) protein-based biomaterials that can be programmed to yield novel physical and biomedical properties. These materials can be used in tissue engineering and drug delivery applications.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Teitell, Michael MD, PhD


Department: Pathology and Laboratory Medicine and Pediatrics

Academic Title: Professor

Email Address: mteitell@mednet.ucla.edu


Field(s): Biomedical Instrumentation (BMI)

Biomaterials, Tissue Engr., & Biomechanics(BMT)

Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** We have several areas of active research at the engineering-biology interface, with the main goal being improved understanding and manipulation of stem cells and cancer cells. Collaboratively, a biophysical cell analyzer (BCA) has been developed through the modification of a Michelson interferometer and adaptation of fluid live-cell and reference chambers. The BCA is being used to interrogate mechanical signatures of normal and cancer cells before and after stimulation, to identify those cells that can initiate cancer, or so-called cancer stem cells, and those cells that are resistant to single and multi-agent therapies. Collaboratively, a single cell surgery device based upon nanoparticle fabrication and pulse laser excitation has been developed for the introduction or exchange of large DNA fragments, including whole chromosomes, or organelles, such as mitochondria and possibly nuclei, into stem cells. Together, these and several smaller bioengineering projects are available for students with strong interest in technology development and applications at the interface of engineering and biology, with special emphasis on stem cells and cancer.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Thomas, Albert PhD


Department: Radiological Sciences
Academic Title: Professor in Residence
Email Address: athomas@mednet.ucla.edu

Field(s): Medical Imaging Informatics (MII)

**RESEARCH:** Development of Multi-dimensional Magnetic Resonance Spectroscopic Imaging (MRSI) Techniques on the whole body 3T and 1.5T MRI scanners - Implementation of MRSI and EPI-based MRS sequences using the Siemens and GE pulse sequence compilers, namely IDEA and EPIC - Development of MR post-processing algorithms using MATLAB and IDL - Clinical Evaluations of MRI and MRS in prostate and breast cancers, and liver disease with neurological disorders.

## BIOMEDICAL ENGINEERING IDP FACULTY

# Thompson, Paul


Department: Neurology
Academic Title: Professor in Residence
Email Address: thompson@loni.ucla.edu

Field(s): Biomedical Signal/Image Processing (BSIP)
Biosystem Science and Engineering(BSSE)

**RESEARCH:** RESEARCH INTERESTS:

Neuroimaging and Brain Mapping

We have a very active laboratory focusing on the neuroscience, mathematics, software engineering and clinical aspects of neuroimaging and brain mapping. Our team includes biomedical engineers, neuroscientists and clinicians, and we develop and apply new mathematical and computational approaches for analyzing human 3D brain image data. We use these approaches to investigate the major diseases of the human brain, to better understand brain structure and function in health and disease. Our laboratory is an NIH-funded national neuroimaging Resource, which serves as the hub for over 40 collaborative projects with imaging centers and drug companies worldwide. Using MRI, PET, and fMRI scans, we are examining how the human brain changes in populations of subjects with Alzheimer's Disease, schizophrenia, HIV/AIDS, epilepsy, in methamphetamine users, tumor patients, and several other neurological disorders. We recently developed the first maps of growth patterns in the developing brains of children, and the first maps to show how Alzheimer’s disease and schizophrenia spread in the living brain. These engineering methods provide exceptional power to understand how the brain varies in health and disease, and how these changes are affected by medication (in drug trials), by age and gender, and by genetic and cognitive differences among individuals. Other large-scale MRI projects map how the brain develops in childhood, and in psychiatric disorders such as autism, bipolar disorder, and Williams syndrome. Our ongoing mathematical work is creating population-based brain atlases to encode and represent patterns of anatomic variation, and to detect structural differences in health and disease.

## BIOMEDICAL ENGINEERING IDP FACULTY

Our work draws on mathematical methods from medical image processing, continuum mechanics, neural networks, signal processing, partial differential equations, level set methods, computational anatomy, and advanced algorithms for image analysis. A broad range of projects are possible for Ph.D. and M.S. students and postdoctoral researchers in the lab. These vary in the level of mathematics, engineering, neuroscience, and medical content, depending on students' interests. For ongoing projects, please see: http://www.loni.ucla.edu/~thompson/thompson.html

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## Tidball, James **Ph.D.**


Department: Physiological Science

Academic Title: Professor

Email Address: jtidball@physci.ucla.edu


Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:** Research is directed toward identifying and characterizing the mechanisms through which mechanical information is transduced to chemical information in cells. Mechanical signal transduction in cells. Living organisms can continuously react and remodel in response to changes in their physical environment. Many observations show that the mechanical environment provides information that is converted to chemical information by cells, that results in changes in cell structure, behaviour, protein synthesis and gene expression, although the mechanisms that transduce mechanical signals to chemical signals are not well-understood. One of the areas of investigation in my lab concerns identifying these mechanical signal transducers in muscle cells, because muscle is especially responsive to changes in the mechanical environment. We have found that the enzyme nitric oxide synthase (NOS) acts as a mechanical signal transducer in muscle, and that the chemical information generated by NOS can cause changes in cell structure and gene expression. Continuing investigations are directed to characterizing fully the signaling system.

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## BIOMEDICAL ENGINEERING IDP FACULTY


### Ting, Kang Ph.D.

Department: Den-Orthopedics
Academic Title: Professor
Email Address: kting@dent.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)


**RESEARCH:** My current research interest is in tissue regeneration and reconstruction. Post surgical and radiation therapy complication in head and neck cancer include extensive soft tissue scarring and craniofacial bone defects. The current treatment is maxillofacial prosthesis with tissue graft and implant. However, the result depends greatly depends on the quality and quantity of the tissues available.

We are currently working on the scarless tissue repair and regeneration post surgical injuries. We have identified several key molecules that are associated with scarless repair.

We are also working on the bone regeneration. We have identified a novel molecule - Nell-1. This molecule has the potential function of bone regeneration. We are currently conducting translational and tissue engineering research to further explore the function of Nell-1 in bone regeneration.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Toga, Art Ph.D


Department: Neurology
Academic Title: Professor
Email Address: toga@loni.ucla.edu

Field(s): Biomedical Signal/Image Processing (BSIP)
Neuroengineering (BNE)

**RESEARCH:** I am interested in the development of new algorithms and the computer science aspects important to neuroimaging. New visualization techniques and statistical measurement are employed in the study of morphometric variability in humans, subhuman primates and rodents. My laboratory(Laboratory of Neuro Imaging) has been working on the creation of three dimensional digital neuroanatomic and functional neuroanatomic atlases for stereotactic localization and multisubject comparison. Specific programs include the development of local deformation techniques to equate brain data sets from different modalities and different subjects and the development of electronic data bases for the archival, interaction and distribution of brain data.

Projects

Activities in the laboratory also include the development of new acquisition systems for the collection of anatomic and physiologic data such as a cryomacrotome for the whole head sectioning of human and subhuman primate specimens. High resolution, digital imagery is collected to measure the size, shape and location of specific anatomic structures and compare those with tomographically acquired data sets. In addition, there is a research program using visible and infrared signals to measure cortical activation. We measure optical intrinsic signals and thermoencephaloscopic signals of animals and humans with an open craniotomy to measure local cerebral blood flow changes and other correlates of cortical activation during stimulation. The current focus in this work is presently in the examination of the somatosensory cortex of the rodent using whisker barrel fields as a model to study the specificity and temporal components of these vascular and enzymatic changes.

## BIOMEDICAL ENGINEERING IDP FACULTY

More information can be found at www.loni.ucla.edu

### Tseng, Hsian-Rong PhD

Department: Molecular and Medical Pharmacology
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Field(s): Biomedical Signal/Image Processing (BSIP)
Biomedical Instrumentation (BMI)
Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:**

### Tu, Zhuowen PhD

Department: Neurology
Academic Title: Assistant Professor in Residen
Email Address: ztu@loni.ucla.edu
Field(s): Biomedical Signal/Image Processing (BSIP)
Medical Imaging Informatics (MII)

**RESEARCH:** Zhuowen Tu's research has been on the interface of medical imaging, machine learning, statistical modeling/computing, and computer vision. More specifically, his interest is in studying the relationship between discriminative and generative models, which is a central problem in a wide range of fields.

# BIOMEDICAL ENGINEERING IDP FACULTY


## Van Dam, R. Michael PhD

Department: Molecular & Medical Pharmacology
Academic Title: Assistant Professor
Email Address: mvandam@mednet.ucla.edu
Field(s): Biomedical Instrumentation (BMI)
Molecular & Cellular Bioengineering (MCB)


**RESEARCH:** Research:

My group investigates novel microfluidic technologies and automated systems for solving problems in cancer research and molecular imaging. We focus not only on microfluidic devices, materials, sensors and actuators, but also on system-level integration and user-interface issues to ensure their solutions are practical, robust, and user-friendly so they can ultimately be translated to other users. Our work is very multidisciplinary in nature and the lab collaborates extensively with academic and industrial partners. Major research projects include: 1) development of inert microfluidic platforms for chemical reactions; 2) plug-and-play chemistry platforms for multi-step radiosynthesis of positron emission tomography (PET) probes; 3) a microfluidic biomolecule radiolabeling system to enable PET probe discovery from libraries; 4) an automated robotic platform for multiplexed, high-throughput genomic and proteomic analysis of cell cultures and patient samples; and 5) design of standardized fluidic interfaces and components to simplify application development and increase accessibility of microfluidic technologies.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Wang, Danny JJ PhD

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Email Address: jjwang@loni.ucla.edu
Field(s): Biomedical Signal/Image Processing(BSIP)
Biomedical Instrumentation (BMI)
Medical Imaging Informatics (MII)

**RESEARCH:** The past decade has seen an exponential growth in the applications of functional Magnetic Resonance Imaging (fMRI) in cognitive and clinical neuroscience. Yet existing fMRI methods, primarily based on the blood-oxygen-level-dependent (BOLD) contrast, have limitations in terms of spatial and temporal resolution, as well as quantitative measurements of brain activity. In the clinical diagnosis of brain disorders, measurement of brain physiology and metabolism still require injection of contrast agents or radioactive tracers, such as contrast enhanced MRI and positron emission tomography (PET). Often, these radiographic methods bear risks or side effects to patients with relatively high cost.
Dr. Wang's research focuses on the development of novel, noninvasive, economical, and quantitative fMRI methods for assessing the function, physiology and metabolism of the brain. Through close collaboration with clinicians and neuroscientists, we actively translate these novel fMRI technologies into applications in clinical and cognitive neuroscience. Currently we are developing quantitative MRI methods for measuring cerebral blood flow (perfusion), cerebral blood volume, blood-brain barrier permeability, tissue oxygenation and resting states of the brain, all without the use of contrast agent or radioactive tracer. We are also developing rapid image acquisition and reconstruction algorithms that allow millisecond (~100-500ms) temporal resolution and millimeter (~1-5mm3) spatial resolution of fMRI, so that human brain activity can be observed dynamically in 4D space. Some of these technologies can also be adapted for body organ imaging, such as myocardium and skeletal muscle.
Representative publications
1.Yan L, Wang S, Zhuo Y, Wolf RL, Stiefel MF, An J, Ye Y, Zhang Q, Melhem ER, Wang DJ (2010) Non-contrast dynamic MRA with high spatial and temporal resolution using TrueFISP based spin

tagging with alternating radiofrequency (TrueSTAR). Radiology 256(1):270-9

## Wang, Jeffrey

Department: Orthopedic Surgery
Academic Title: Professor
Email Address: jwang@mednet.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Currently as the Chief of the Spine Service my research concentrates on the use of novel methods including gene therapy and growth factors to enhance the formation of spinal fusion and bone growth. We are also applying these modern techniques to design a iological intervertebral disc replacement. Currently degenerative disc disease is a major problem requiring significant morbidity with surgical treatment that typically consists of fusion versus mechanical disc arthroplasty. Our laboratory is seeking novel methods to biologically grow the disc cells and incorporate them on a biomechanical bio-engineered tissue engineered matrix, which would allow for the cells to survive, proliferate and promote the healing or reconstitution of the disc material. I believe that this is a very exciting area with significant benefits to potential patient care.

# BIOMEDICAL ENGINEERING IDP FACULTY

## Wong, David

**D.M.D./D.M.**

Department: Dentistry
Academic Title: Professor
Email Address: dtww@ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** David T. Wong DMD, DMSc is Professor and Associate Dean of Research in the Division of Oral Biology & Medicine at the UCLA School of Dentistry. He is also the Director of the UCLA Dental Research Institute (DRI). Dr. Wong is a leading scientist in oral cancer and saliva diagnostics research. He has authored 140 peer reviewed scientific publications. His research is funded by the NIH since 1986. He is the program director of the UCLA comprehensive T32 training program and chaired the NIDCR Special Grant Review Study Section from 2002-2005. Currently he is a member of the NIH CSR Cancer Genetics Study Section and a fellow of the American Association for the Advancement of Sciences (AAAS).

## Wong, Gerard

**PhD**

Department: Bioengineering
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Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)

**RESEARCH:**

## BIOMEDICAL ENGINEERING IDP FACULTY


### Wu, Benjamin DDS., Ph.D.

Department: Bioengineering/Material Science & Engineering
Academic Title: Professor
Email Address: benwu@ucla.edu


Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:** Functional biomaterials for tissue engineering

# BIOMEDICAL ENGINEERING IDP FACULTY


## Wu, Lily Ph.D.

Department: Urology
Academic Title: Professor
Email Address: lwu@mednet.ucla.edu
Field(s): Biomaterials, Tissue Engr., & Biomechanics(BMT)
Molecular & Cellular Bioengineering (MCB)


**RESEARCH:** Research Statement:

Cancer-targeted Gene Therapy and Imaging

Our laboratory is focused on development of effective gene therapy protocol from the basic molecular and virology research at the bench level to ultimately apply to treat cancer patients. Current ongoing research topics are:

1. Improving tissue- and cancer-specific gene expression at the transcriptional level. We have developed several strategies to augment the activity of tissue-specific promoters, using the prostate-specific PSA promoter as our initial model system. One of the most potent approach termed two-step transcriptional activation (TSTA) displays 1000-fold higher activity than native PSA promoter while retaining androgen regulation and cell-specificity. Besides prostate-specific promoters, cancer-specific promoters, breast-specific promoters and vascular growth factor promoters are being investigated.

2. Transcriptionally-targeted gene therapy. The approaches developed in topic 1 will be utilized in therapeutic strategies. Current cancer-directed therapeutic strategies under investigation include expression of cytotoxic genes (HSV-tk and TRAIL), anti-angiogenic genes (TSP-1 and METH-1), cell-cycle control gene (p27) and oncolytic viruses.

3. Cancer-targeted molecular imaging. Non-invasive imaging techniques such as optical charge coupled device (CCD) imaging, micro-Positron Emission Tomography (PET) and microCT are applied to monitor vector-based gene expression in vivo. These

molecular imaging approaches will be coupled to gene therapy developed in topic 2.

4. Cancer metastasis and tumor vasculature. Non-invasive imaging is being applied to facilitate the monitoring of the metastatic process in living animal. Active investigation is underway to delineate the contribution tumor blood and lymphatic vessels to cancer metastasis. The goal is to develop better therapy to manage this advanced stage of cancer through a better understanding of tumor and vascular biology.

## Xiao, Xinshu PhD

Department: Physiological Science
Academic Title: Assistant Professor
Email Address: gxxiao@ucla.edu
Field(s): Molecular & Cellular Bioengineering (MCB)
Biosystem Science and Engineering(BSSE)

**RESEARCH:** Our lab studies gene regulation by integrating computational and experimental approaches. This includes investigations of the process of pre-mRNA splicing, microRNA regulation and other post-transcriptional (or co-transcriptional) mechanisms. We use a combination of techniques and approaches in systems biology, bioinformatics and molecular biology, such as ultra-high-throughput sequencing (Illumina, ABI), microarray-based gene expression, comparative genomics and biological network modeling. A long-term goal of our research is to better understand the involvement of splicing and post-transcriptional regulation in gene expression programs of different disease models.

## BIOMEDICAL ENGINEERING IDP FACULTY

### Zhou, Hong PhD


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Academic Title: Professor
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Field(s): Biomedical Signal/Image Processing (BSIP)
Medical Imaging Informatics (MII)
Biomedical Instrumentation (BMI)
Molecular & Cellular Bioengineering (MCB)

**RESEARCH:**