

UC LEADS Scholar Abstracts

LOS ANGELES



Jesse Zamudio, Maria Mouchess, Laura Martinez, Nonye Alozie, Denise Yanez, Giselle Galang

Photo not available: Ephrem Asfaw, Jason Minamora, Rosemary Rohde, Franky Telles

Using the Branched Silkless Gene to Construct a Phylogenetic Tree for Eight Different Grasses

Nonye Alozie, George Chuck, PhD, and Sarah Hake, PhD, UC Berkeley

Americans are dependent on maize for many day-to-day items. Maize development depends on meristem activity. Meristems are indeterminate cell populations that give rise to different parts of the plant. Spikelets are the fundamental flowering unit in all grasses, whose position on the branch of the plant reflects the fate of the meristems that are produced during inflorescence development. The branched silkless gene (*bd1*) mutation changes the identity of the spikelet meristem, causing branches to form in the place of spikelets. *BD1* encodes a transcription factor that is expressed in a region between the spikelet meristem and the glume (the leafy covering around the spikelet). The *BD1* gene is found in many grasses. In this project, the *BD1* gene was isolated from eight grass species and sequenced. The sequences were aligned and a phylogenetic tree was constructed in order to understand the function of the *BD1* gene. Regulation of the Expression of *argC*, *argE* and *argH* Genes of *Escherichia coli* in Response to Oxygen and Nitrate



Back Row: Tina Lam, Yihong Sui, Julie Garchow, Jeniffer Hernandez, Jamie Burke
Front Row: Geoffrey Garcia, Omid Noorani, Benny Ng

Regulation of the Expression of *argC*, *argE* and *argH* Genes of *Escherichia coli* in Response to Oxygen and Nitrate

Ephrem Asfaw, Kirsty Salmon, PhD, and Robert P. Gunsalus, PhD, Microbiology, Immunology and Molecular Genetics, UC Los Angeles

To study the regulation of the expression of *argC*, *argE* and *argH* genes in *E. coli*, transcriptional *lacZ*-based fusions were created. The promoter elements were fused to the *lacZ* reporter gene, generating plasmids pEF2, pEF4 and pEF5. These were used to create a l-based single copy fusion whose expression can be assayed by b-galactosidase activity in a variety of environments including aerobic, and anaerobic in the presence of nitrate. Aerobic and anaerobic regulatory systems such as the ArcAB two-component system, the global regulator FNR and the nitrate response system (encompassed by NarXLP and Q proteins) will be studied for their effect on regulating the expression of these genes. The results should shed light on the *in vivo* regulation of expression of the *argC*, *argE* and *argH* genes in *E. coli*.

Localized Network Sensors for the 21st Century

Jamie Burke and Deborah Estrin, PhD, Computer Science, UC Los Angeles

Imagine the possibilities when sensors are very cheap, available in large quantities, and loaded with memory and wireless communications capabilities. Now imagine that these sensors have the ability to talk to each other, regardless of placement, and are able to locate where they were in space, using a localized algorithm. Three models for localization, one distributive, one iterative, and the last centralized, have been compared. In all models a grid of sensors with known locations has been implemented. For the distributed model, each unknown is solved separately using the known positions of sensors that are in its range. Literally, given an unknown a and the set of known positions in its range, find a . In the iterative method, the known and unknown sensors are used, at different weights, to solve for the unknown nodes. In the centralized model, all of the unknown positions are solved for simultaneously, using a series of equations $\|a - x_i\| = R$.

The ARG13 Gene of *Neurospora crassa*

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The role of *Neurospora crassa arg-13* gene product in arginine biosynthesis is not understood. The sequence of the cloned gene revealed homology with the mitochondrial carrier family (MCF) proteins. These proteins are localized in the inner mitochondrial membrane and participate in metabolic trafficking. To better understand the role of ARG13, we are characterizing two mutant alleles. The mutants grow slowly and can be restored to normal growth by the addition of arginine, citrulline and to a lesser extent ornithine. This suggests that ARG13 may be exchanging ornithine and that the need for arginine is a result of the unregulated movement of ornithine out of the mitochondrion. We are constructing strains to test this hypothesis. Additionally, we are cloning and sequencing the two *arg-13* mutant alleles using PCR amplification. A comparison of the mutant, wild-type, and other known MCF proteins will enable us to identify important residues for ARG13 function.

In Vivo Folding of Simian Virus 40 Major Coat Protein Vp1: Identification of Vp1 Associated Proteins

Julie Garchow, Peggy Li, PhD, and Harumi Kasamatsu, PhD, Molecular, Cell, and Developmental Biology, UC Los Angeles

Simian virus 40 (SV40) is a DNA tumor virus that assembles in the host's cell nucleus. Assembly requires the synthesis and correct folding of viral coat proteins in the cytoplasm. In order to understand the cytoplasmic folding processes for the major coat protein, Vp1, cytomegalovirus promoter based expression plasmids have been constructed encoding wild-type and mutant Vp1s with carboxy-terminal polyhistidine tags allowing the Vp1s to bind to a metal affinity resin. These plasmids are transfected into mammalian cells; cell lysates are assayed for Vp1-associated proteins using the affinity resin under native conditions. By probing with specific antibodies, the chaperone protein, Hsc70, has been found to be present in the bound resin fraction together with Vp1. Using this approach, we plan to identify a set of proteins that assist in Vp1 folding in the cell.

Less Abstraction in a Complex Plane

Geoffrey Garcia and Evelyn Silvia, PhD, Mathematics, UC Davis

In standard geometry the Euclidian plane appeals to many mathematicians because of its portrayal of the physical world. This study is concerned with transformations from the Euclidean to the Complex plane for simplicity in describing and solving difficult functions. We turn to imaginary qualities of the Complex plane and gradually discover the distinguishing properties inherent in these quantities to develop alternate theories about Euclidean space. The effect is markedly different than with real functions; these functions are much more rigidly constrained, and it is possible to make very definite comments about their global behavior. These Complex-variable techniques have great use in applied areas including applications in conformal mapping, particularly, in aviation engineering using Joukowski transformations. Illustrative graphical examples are given comparing both planes, and history is cited suggesting that this development provides a great impetus toward the acceptance of the Complex Plane as a means of solving certain problems difficult in the Euclidean Plane.



Effects of Oleylethanolamide on Streptozotocin Diabetic Rats

Jeniffer B. Hernandez, Ahmad Samsamshariat, and Ping H. Wang, PhD, Medicine, UC Irvine

Oleylethanolamide (OEA) is a naturally occurring compound in plants and animals that may help prevent Diabetes mellitus. Diabetes is a disease in which there is little or no production of insulin due to beta cell malfunction or destruction by the immune system. Without insulin, the body's tissue cannot take in glucose, which is a source of energy. This study tested if OEA suppresses apoptosis of beta cells in streptozotocin diabetic rats. OEA was administered to non-diabetic rats with an average baseline glucose level of 114 mg. One hour after OEA injection, streptozotocin, a chemical that rapidly induces beta cell necrosis, was administered to the rats to induce diabetes. Four and seven days after OEA and streptozotocin administration, the blood glucose level of the streptozotocin diabetic rats was over 500 mg. Although further studies are necessary, the results suggest that OEA does not suppress apoptosis of beta cells in streptozotocin diabetic rats.



SolidWorks and the Design of a High Sealing Lobe Pump

Tina T. Lam, Jia Yan, and Daniel C. H. Yang, PhD, Mechanical Engineering, UC Los Angeles

SolidWorks, a Computer Aided Drafting (CAD) software program, is used worldwide by product designers in fields ranging from electronic and machine design to the medical and entertainment fields. Many universities have added design courses using CAD to their curriculum. This project applied the software to a complex design project. The rotor profile of a lobe pump follows a mathematical expression called the deviation-function method. Using a powerful application of SolidWorks, we created curves with the input of data files of coordinate points. We used SolidWorks to visualize the behavior of automated machinery assemblies, which can reduce design errors and cut production costs. With SolidWorks, after the design is fabricated, files can be saved in different formats so that the information can be transferred to Computer-Numerical-Control (CNC) machines, rapid prototype machines, etc. and the designed parts can be created into a physical entity.

Potential Contribution of Human Herpesvirus-8 in the Development of AIDS-associated Malignancies

Laura Martinez, Otoniel Martinez-Maza, PhD, and E. C. Breen, PhD, Microbiology, Immunology and Molecular Genetics, UC Los Angeles

Human herpesvirus 8 (HHV-8) contributes to the development of Kaposi's sarcoma and some B-cell lymphomas. Normal human B cells are also potential targets for stimulation and perhaps even increased activation by the HHV-8-encoded cytokine viral interleukin 6 (vIL-6). vIL-6 can mimic the proliferating factor actions of its human counterpart. The presence of vIL-6 is dangerous as it would cause a faster spread of the disease. Sera samples for the detection of vIL-6 were taken from participants of the Multicenter AIDS Cohort Study (MACS). Standard western immunoblotting assessed protein expression of vIL-6. A cold competition technique demonstrated that our primary antibody was specific for the vIL-6 present in samples of participants positive for Kaposi's sarcoma. Further studies will explore the sensitivity of this vIL-6 assay and expression of its receptor, in the presence of peptide sequences from new samples of recombinant vIL-6.



Search for CP-Violation in the Rare Decay $B^0 \rightarrow r^0 + K^0$ Using BaBar

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We report a measurement of the upper limit on the branching ratio for the CP-violating decay $B^0 \rightarrow r^0 + K^0$, using 2001 data from the BaBar detector at the Stanford Linear Accelerator Center. A cut-and-count analysis method is presented, with cuts optimized for maximum sensitivity to small signals. We obtain an upper limit of 1.2×10^{-5} at 90% confidence, for this mode, which beats the 2002 result of 3.4×10^{-5} (CL = 90%), reported by the Particle Data Group.



Perturbation of Homeobox-containing Transcription Factor Six3 During Chicken Retinal Development Using Retroviruses

Maria Mouchess, Kristin Schmidt, and Xian-Jie Yang, PhD, Ophthalmology and Neurobiology, UC Los Angeles

Molecular mechanisms responsible for the differentiation of multipotent neural progenitor cells in the retina remain to be determined. The chicken homeobox-containing gene, Six3, is a vertebrate homologue of the Drosophila eye determining gene, optix, and may be critical in retinal development. We have designed a retrovirus-based strategy to perturb Six3 function during chick retinal neurogenesis. RT-PCR has been used to generate partial chick Six3 cDNAs. Both sense and antisense viral vectors have been constructed by molecular cloning. Viral stocks have been generated by transfecting producer cell lines and collecting supernatants. Following injection of concentrated viruses into chick embryos at various developmental stages, the expression and biological effects of the viruses will be characterized by Western blots, RT-PCR and/or in situ hybridization assays. Disruption of Six3 expression during chicken retinal neurogenesis using retroviruses may cause developmental perturbations and elucidate the roles of homeobox-containing transcription factors during eye development.



Synthesis of Gold Nanorods and Self-assembly Monolayer in Solution Phase Using Langmuir-Blodgett Technique

Benny C. Ng, Franklin Kim, and Peidong Yang, PhD, Chemistry, UC Berkeley

Nanoscale materials can provide very small devices with a wide range of optical, electrical, and magnetic properties. The ultimate goal of synthesizing nanoscale materials is to create useful devices in an orderly and rationally assembled manner. Gold nanorods were prepared via an electrochemical method. The nanorods were then used to form a two-dimensional monolayer on the water surface using Langmuir-Blodgett technique. Isotropic nanorod distribution was observed. The results agree with previous theoretical simulation results. This suggests that long gold nanorods can achieve higher order structures.

Quantum Cryptography

Omid Noorani and Vwami Roychowdhury, PhD, Electrical Engineering, UC Los Angeles

Classical cryptography employs various mathematical techniques to restrict eavesdroppers from learning the contents of encrypted messages, but absolute security of information cannot be guaranteed. The Heisenberg uncertainty principle and quantum entanglement can be exploited in a system of secure communication, often referred to as "quantum cryptography." Photons are polarized in one of horizontal/vertical or diagonal direction in a random order and passed from sender A to receiver B. B uses a random detector for each photon and records the results and publicly, via classical channels, announces the types of detection it used. A confirms the correct measurements with B. A and B keep the correct measurement and translate it into the cipher. This type of quantum cryptography, so-called QKD, provides means for two parties to exchange an enciphering key (one time pad) over a private channel with complete security of communication. One can use a "one time pad encryption" along with QKD to achieve complete security of communication.



A Carborane Containing Human α -Thrombin Inhibitor

Rosemary Rohde, Andreas Maderna, PhD, and M. Frederick Hawthorne, PhD, Chemistry and Biochemistry, UC Los Angeles

Serine proteases are widely distributed in the human body and are the cause of many life-threatening diseases. Thrombin, for example, plays a central role in thrombosis and hemostasis. Thrombosis, or excessive blood clotting, is the major culprit of numerous cardiovascular diseases. The goal of this work is to design and produce a selective and orally active thrombin inhibitor by synthesizing a boronated trans-lactam that will specifically bind to the active site of the enzyme. The thrombin inhibitor, FE-1, has been designed and optimized using molecular modeling and protein-ligand docking calculations to determine the correct size, orientation, and stability needed for the inhibitor. The aim of this project is to create a highly potent, safe, selective and bioactive thrombin inhibitor via a 22-step synthesis. FE-1 is a unique and unprecedented molecular assemble that represents a new class of boronated enzyme inhibitors and a potentially new thrombin inhibitor.



Mapping of Hippocampal Deficits in Childhood-Onset Schizophrenia

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The hippocampus is believed to be involved in both neuropsychology and pathophysiology of childhood-onset schizophrenia (COS). In this study, the hypothesis that COS patients have smaller hippocampal volumes than normal controls was tested; 3-D maps of the hippocampus were then generated to localize deficits and differences. Twelve COS patients and twelve controls were scanned using magnetic resonance imaging (MRI). The hippocampus was traced manually on the images and 3-D maps were created based on the traces. Patients and controls were not found to differ significantly in hippocampal volume. However, from the 3-D maps, significant structural differences between groups were observed at the anterior portions of hippocampus. These findings suggest that the hippocampus differs structurally between patient and control groups, but that volume may not be a strong indicator of psychosis. This work is currently being extended in a longitudinal study to detect any progressive changes in the hippocampus of COS patients.



The Use of Banded Iron Formations to Study the Redox Chemistry of the Early Earth

Franky Telles and Pamela G. Conrad, PhD, Jet Propulsion Laboratory, UC Berkeley

The Precambrian banded iron formations (BIFs) may contain the recorded remnants of the Earth's early environmental conditions. These rocks have yielded the largest iron deposits in the world. Generally, observations of these rocks have been the same: they consist of sedimentary layers, predominantly of millimeter to centimeter reddish iron-rich minerals, such as hematite and magnetite, with gray to black laminae of chert. A suite of sedimentary BIFs have been analyzed using XPEEMS (x-ray photoelectron emission microscopy), ESEM (environmental electron scanning electron microscopy), and an ion microprobe. XPEEMS was used to determine the charge distribution of the common elements, such as Fe and Mn, within these rocks. XPEEMS can show the redox chemistry between magnetite and hematite. ESEM has been used to image the rocks at high magnifications.

Effects of Striatal Lesions on Habit Learning

Denise Yanez, Henry Yin, and Barbara Knowlton, PhD, Psychology, UC Los Angeles

The dorsolateral striatum is believed to be involved in habitual responses; in contrast, the dorsomedial area of the striatum is implicated in anticipatory actions. Using a T-maze, response versus place learning was examined in rats to test the hypothesis that dorsolateral striatal lesions would reduce response learning, and that dorsomedial striatal lesions would have no effect. Long-Evans rats, with either dorsolateral or dorsomedial lesions to the striatum, were trained using a South start arm and West arm food reward and then tested using a North arm start position to determine if they were place or response learners. Rats with dorsolateral striatal lesions tended to choose the West arm, whereas rats with dorsomedial striatal lesions did not show a preference for either arm. The findings suggest that the dorsolateral group tend to be place learners and the dorsomedial group tend to have an increase in response learning compared to the dorsolateral group.

Investigation of Ovarian-dependent Growth of Rat Mammary Epithelial Tumor Cells

Jesse Zamudio, Gudmundur Thordarson, PhD, and Frank Talamantes, PhD, Molecular, Cell and Developmental Biology, UC Santa Cruz

Breast cancer is a leading cause of death among women. Human breast cancer cells initially depend on ovarian hormones for growth, but are capable of transition to ovarian hormone independent growth (OI). Ovarian hormone dependent (OD) growth is characterized by high expression of estrogen receptor (ER) and cyclin D1. OI cells exhibit low expression of ER and cyclin D1, but high levels of mitogen-activated protein kinase (MAPK). We propose that the OD to OI transition is facilitated by a change in regulatory pathways. We used Western blotting to measure the expression of ER and cyclin D1. We also introduced hormonal treatments to verify a growth rate increase. Immunoblotting proved unsuccessful and contradictory results were obtained for the hormonal treatments. The procedure must be revised to optimize the growth rate in the new media and obtain new probes for Western blotting.