

Abstracts for the UC Lead's Symposium (UCLA)

Radiation Hardness Studies of Diamond Particle Tracking Detectors from a Test Beam Campaign at CERN

Taylor Barrella, Rainer Wallny, PhD, Physics and Astronomy, University of California, Los Angeles

Particle tracking detectors made out of artificial diamond provide an attractive solution for particle detection in a high radiation environment, such as future upgrades to Large Hadron Collider experiments at CERN. This study examines the radiation hardness of diamond particle tracking detectors from a test beam campaign at the European Laboratory for Particle Physics (CERN) in August 2010. A diagnostic code to aid in validating the analysis of detector data is being developed.

Construction of Ultra-High Vacuum Chamber for Chemical Vapor Deposition (CVD) of Zinc and Antimony on (111) Gold-Plated Silicon Substrate to Grow Zinc-Antimonide Nanowires via Vapor-Liquid-Solid (VLS) Mechanism

Filiberto Colon, Brandon Aust, Yuya Murata, Suneel Kodambaka, PhD, Material Science & Engineering, University of California, Los Angeles

Thermoelectric materials, dominated by easily moving charges being either positive (p-type) or negative (n-type), can produce currents via temperature gradients. Through temperature gradients within the material, a potential is produced through the aggregation of charges in the cold region from the slower moving charged particles present. This potential can be released through electrical connection of a p-type and an n-type thermoelectric, creating a circuit powered by charge differences between the two materials. The growth of Zinc-Antimonide nanowires has particular interest, owing to its high density of charge carriers and poor thermal conductivity; the latter allowing temperature gradients to remain present. Though production is complex, the plan is to grow the wires in a vacuum chamber to reduce external effects on wire composition, and utilize the very reliable VLS mechanism. Preliminary testing has proven the chamber capable of maintaining the necessary vacuum, and the needed settings for components involved in production of the nano-wires have been found. Upon successful production, this material's nano-structure wire could be applied to the medical and energy production fields; thus allowing internal microsensors and probes to be powered off temperature gradients in the human body, and allowing wasted heat to be recycled and reused.

Learning about Collective Memory from Query Bursts

Anthony R. DeCino, David A. Meyer, PhD, Mathematics, University of California, San Diego

Query logs provide startlingly detailed, and useful, insight about individual users, but they also provide an unprecedented level of detail about the collective behavior of user communities. Quantitative analysis of such collective behavior can inform search engine design, web content provision, and social scientific theory development. We are specifically interested in collective memory, namely memory that is common to the members of a community and often encoded in social artifacts and public discourse. Event-driven query bursts can be identified even in the highly aggregated, and approximate, publicly available Google Trends data. We compare several possible models for the decay of these bursts using Bayesian model selection and find overwhelming support for asymptotic decay that follows the power law model rather than the exponential model. As some memory of an event is necessary to frame a relevant query, we interpret our results as the "forgetting functions" of collective memories.

Role of the MAM-domain proteins MLT-9 and ZC13.3 in the Molting Cycle of *Caenorhabditis elegans*

Beatriz Ortiz, Alison Frand, PhD, Microbiology, Immunology, and Molecular Genetics, University of California, Los Angeles

Caenorhabditis elegans periodically sheds/remakes its exoskeleton in order to grow. During this molting process, epidermal cells renovate local extracellular matrices (ECM) and related cell-ECM and cell-cell attachments. Because the *C. elegans* exoskeleton is a collagenous ECM similar to human skin, findings about the regeneration of the nematode exoskeleton will likely apply to ECM homeostasis in vertebrates, which is critical for development and wound repair. This study investigates the *mlt-9* and *zc13.3* genes, which were previously identified in an RNAi-based screen for larvae unable to shed cuticles. Both genes encode annotated secreted proteins with MAM domains characteristic of adhesive molecules. It's expected that interactions between the MAM domains of MLT-9 and ZC13.3 contribute to dynamic changes in adhesion among epidermal cells and the ECM critical for molting. Genetic and cell biological analysis will be used to test this hypothesis. Specifically, *mlt-9* and *zc13.3* null mutants are being examined for defects in the cyclic detachment and reattachment of epidermal cells to the cuticle and each other during molting. Thus far, several distinct mutations in *mlt-9* and *zc13.3* have been obtained, confirmed by PCR-based genotyping, and out-crossed to wild-type *C. elegans*. Specific phenotypes observed to date are consistent with the hypothesis that MLT-9 and ZC13.3 regulate cell-ECM adhesion during the molting cycle.

PhuZ, the First Known Bacteriophage Tubulin

Duy Stephen L. Pham, James A. Kraemer, PhD, and Chris Waddling, PhD,
Biochemistry and Biophysics, University of California, San Francisco

Tubulins are cytoskeletal proteins that form nucleotide-dependent filaments in order to perform various integral functions in both eukaryotic and prokaryotic cells, such as DNA segregation and cytokinesis. PhuZ, a bacteriophage homologue of tubulin, was recently identified, making it the first known bacteriophage cytoskeletal protein. PhuZ is encoded on the *Pseudomonas chlororaphage phage201φ2-1*, and the cellular function is unknown. In order to understand the structure and mechanism of PhuZ filaments, we utilized x-ray crystallography, electron microscopy, and polymerization assays. We attempted to crystallize PhuZ-GTP γ S to visualize PhuZ in a filament conformation, but instead we solved the crystal structure of PhuZ-GDP to 2.35Å, improving the previous resolution from 2.75Å and elucidating binding motifs in the tertiary structure. Through characterization of PhuZ polymerization, we will create a model and compare other tubulin-like proteins to further comprehend the different cellular functions of cytoskeletal proteins.

Production of Biodiesel in a Homogeneous Reactive Phase

Lauren Quiroz, Vasilios Manousiouthakis, PhD, Chemical and Biomolecular
Engineering, University of California, Los Angeles

Due to environmental concerns, biodiesel has become a more attractive fuel option in today's world. The primary way of making biodiesel is by transesterification of vegetable oil (triglyceride) with an alcohol and catalyst. This transformation creates mono- and diglycerides as intermediates, glycerol as a byproduct, and fatty acid methyl esters (FAME) as the biodiesel product. Since oils and alcohols are immiscible a heterogeneous reactive phase is created, which makes the rate of transesterification slow and also makes it impossible to determine the exact kinetics of transesterification as they are coupled with mass transfer. Performing the reaction in a homogeneous reactive phase can eliminate the effect of mass transfer. At a certain composition of FAME a homogeneous reactive phase, which consists of FAME, alcohol, catalyst, oil and other glycerides, and a non-reactive phase, which consists of glycerol, alcohol, and catalyst, emerge. The homogeneity of the reactive phase provides the premise of an accelerated overall reaction rate and reduced catalyst use. Furthermore, conducting the reaction in a homogeneous reactive phase can help identify the intrinsic kinetics for the transesterification reaction.

Vascular Endothelial Growth Factor Retains Cellular Activity While Bound to a Polystyrene Surface

Shayne Siegman, Tatiana Segura, PhD, Biomolecular Engineering, University of California Los Angeles

Understanding properties of bound Vascular Endothelial Growth Factor (VEGF) may lead to the manipulation of blood vessel growth in desired locations within the body, which can be used in the fields of medicine and engineering. The Segura laboratory has previously shown that covalently and electrostatically bound VEGF leads to VEGF receptor-2 (VEGFR-2) phosphorylation. We compare the migration of Human Umbilical Vein Endothelial Cells (HUVEC) and endocytosis of 300nm, 3 μ m and 10 μ m diameter particles that contain covalently bound VEGF on their surface. VEGF was covalently bound to amine-modified polystyrene beads through a Schiff base reaction and then characterized by an Enzyme-linked immunosorbent assay (ELISA), which confirmed that VEGF bonded specifically to both 3 μ m and 10 μ m diameter beads with a density of 400 pg/ml, and to 300nm beads with a density of 600 pg/mL. To confirm VEGF activity, the VEGF-bound beads were incubated with HUVEC cells for 5 minutes, and western blots confirmed phosphorylation at the p1175 tyrosine. A migration assay tested the ability of the VEGF-beads to guide wound closure and cellular migration. The distance of the wound was measured and normalized, and the data indicated that covalently and electrostatically bound VEGF induced 2.5 times more cell migration than in a normal media setting. A CAM assay was then performed to observe blood vessel formation in an *in vivo* environment, suggesting VEGF-beads increase blood vessel formation.

Interaction Mapping of Novel Autophagy Protein

Earl J. Yoon, Weiliang Fan, and Qing Zhong, PhD, Molecular and Cell Biology,
University of California, Berkeley

Autophagy is a regulated cellular process that is responsible for the degradation of cytoplasmic components and organelles. This process is important when cells experience nutrient starvation, where non-essential cellular elements are degraded and scavenged for reuse. When autophagy is induced, organelles and regions of the cytoplasm are sequestered by double membrane-bound structures called autophagosomes, which then fuse with lysosomes to degrade the contents. Research has revealed the role of autophagy in human health, linking it to cancer, aging, and neurodegenerative diseases. We are studying a recently discovered protein, named p40, which was identified in a tandem affinity purification of two proteins, Beclin 1 and Barkor. These three proteins associate together in a large complex called the class III phosphatidylinositol 3-kinase (PI3KC3) complex, which is required for autophagy. Barkor is responsible for recruiting Beclin 1, a key regulator of autophagy, to the autophagosome. The function of p40 is unclear; however, we know that the interaction between Barkor and p40 increases in a stress-inducible manner. This interaction may be important for the formation of the PI3KC3 complex; therefore, it is vital to understand how p40 interacts with Barkor. We are using interaction mapping to determine which portions of p40 are required to interact with Barkor and vice versa. Ultimately, through this interaction mapping, we will attempt to find the role of p40 in autophagy.