UC Los Angeles LEADS

Detection of Phospho-AKT by ELISA Assays

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The epidermal growth factor receptor (EGFR) is a cell surface receptor that can be activated by the binding of EGF and other growth factors. Activation of EGFR triggers a network of signaling pathways, which can lead to various changes in cellular metabolism related to tumor growth. The phosphorylation state of AKT, a downstream molecule of the EGFR pathway, can be used as a marker for the detection of EGFR activation. In this study, we establish the quantitative detection of phospho-AKT using an ELISA assay. Preliminary results demonstrated a linear correlation between phospho-AKT levels and ELISA signal. The results will be beneficial for the quantification of EGFR signaling and the drug effect of EGFR inhibitors.

Direct Pyroelectric Energy Conversion

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The objective of this research project is to develop a direct energy conversion device converting time-dependent thermal energy directly into electricity using pyroelectric materials. Pyroelectric materials are commonly occurring materials whose spontaneous polarization **P** presents strong temperature dependence. A dynamic pyroelectric measurement was carried out on a sample of Triglycine Sulphate (TGS) crystal. This pyroelectric crystal was subjected to flashes of light which resulted in small changes in the temperature of the crystal.This, in turn, caused the polarization of the crystal to vary with time thus generating an electrical current. An experimental circuit directly measured the pyroelectric response. This could have a wide range of applications such as (1) harvesting and sensing nanoscale radiation generated in microelectronic applications (2) powering wireless sensor networks used for monitoring and controlling plants, resources, and infrastructures, (3) converting solar radiation or heat generation into electricity onboard satellites and other spacecrafts, or (4) in combination with existing rotary power generation systems such as wind mills and enthalpy wheels.

Simulated Waveguide Effects in a Free Electron Laser

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The free electron laser (FEL) generates tunable radiation and a micro-bunched electron beam, which have applications in medicine, industry, and science. A standard FEL amplifies a seed field by an electron beam in an alternating magnetic field, or undulator. However, radiation

diffracts and escapes the beam, which reduces amplification and thus efficiency. We hypothesized that a waveguide should provide a channel to counteract diffraction. Two styles of waveguides were studied, a cylindrical guide and an iris-loaded waveguide. Genesis 1.3 was modified to simulate a FEL with these types of waveguides. To model an iris waveguide, the radiation was clipped at a specified radius at regular intervals. The benefit of an increased interaction length (Rayleigh length) should be indicated by less input power required to cause the beam to bunch. The iris showed some interference as expected. The cylindrical waveguide has a different mode analysis, so the field calculations had to be modified.

Synthesis of Silver Sulfide Nanocrystals

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Nanocrystals are an interest of study because their physical and optical properties lie between that of atomic species and bulk materials. Size-tunable properties make nanocrystals promising candidates for diode lasers, biological sensors, and solar cells. In a recent article by Lim et al, a basic protocol for synthesizing silver sulfide nanocrystals of various sizes and shapes was demonstrated. This was accomplished by altering reaction conditions such as reactant ratios, temperature, and duration of reaction. In our study, we repeated the article's experiment, tested novel reaction ratios, and identified the crystalline structure of the nanocrystals. The materials were characterized with Ultraviolet-visible spectroscopy, Transmission electron microscopy, and X-ray crystallography. We were able to produce sub-10 nm particles when the reaction was done at a temperature of 80°C for 10 minutes using a ratio of 6:1 HDA: precursor. This research has widened our knowledge of the limitations of the reported silver sulfide nanocrysals synthesis and the crystalline structure produced by this method.

Nutrient Limitation Analysis in Rodeo Lagoon, San Francisco

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Algal blooms that typically occur during the summer and early fall decrease the dissolved oxygen concentrations, increase ammonia and can be toxic. Fish die offs are associated with these changes to the aquatic environment, therefore it is important to monitor the cause of the algal blooms. Nitrogen and phosphorous are the nutrients that most commonly limit algal productivity. To determine if nitrogen or phosphorous are the limiting nutrients in Rodeo Lagoon, a sample of lagoon water was split into four treatments: nitrogen addition, phosphorous addition, nitrogen and phosphorous additions and no addition (control). Algal growth was measured using chlorophyll-a extraction, total suspended solids and a SCUFA fluorometer. All measurements indicated co-limitation of nitrogen and phosphorous (92-118% difference from control). Additionally, total suspended solids indicates a possible phosphorous limitation in Rodeo Lagoon.

Effects of Pickleweed Plants on Redox Potentials: Implications for Mercury Methylation Control in Iron Amended Wetlands

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Methylmercury (MeHg) is the organic and the most toxic form of mercury, capable of biomagnifying within our food chain. Since mercury sulfide complexes ($Hg(HS)_2^0$ and $HgS_{(aq)}^0$) are the most abundant in the natural environment, sulfide chemistry affects mercury methylation. Consequently, it is hypothesized that ferrous iron [Fe(II)] can control sulfide activity, which indirectly decreases the bioavailability of mercury. Previous work has shown a 70% MeHg reduction in iron amended environmental slurries, but no experiments were performed in the presence of plants. To better understand natural wetland conditions, Pickleweed plant microcosms were constructed. Preliminary results suggest that sulfide concentrations are lower at depths closer to the sediment surface and in the presence of plants, which is an implication of lower mercury sulfide complexes. Future work includes measuring MeHg in order to test the hypothesis that iron amended plant microcosms can decrease mercury methylation.

Clathrin-Mediated Interaction of Gga2p and Ent5p Adaptor Proteins in Cell Cargo-Transport

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In eukaryotic cells, each organelle processes different proteins. The limiting membrane of organelles precludes protein diffusion into the leumen of organelles, thus cells have developed mechanisms to transfer proteins and lipids from one organelle to another. One way for such cargo to be delivered is through clathrin-coated-vesicles (CCVs). Clathrin coats form on cellular phospholipid-bilayer membranes, a complex mixture of many types of proteins and lipids. The protein clathrin forms the soccer-shaped coating around a budding vesicle of the membrane. Clathrin does not bind to the membrane directly; it requires other helper proteins, or adaptor proteins, to bring it to the membrane. Two of the three families of adaptor proteins are Epsin-like proteins and Gga's (Golgi-localized, γ-ear-containing, Arf-binding proteins). The proteins Gga2p and Ent5p have been purified. The affinity between Gga2p and Ent5p with the presence of clathrin will be examined using clathrin antibody pull-down technique.

Miniature Vapor-Compression Refrigeration Cycle

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The compressor is a critical component in the development of an efficient miniature vapor-compression refrigerator (VCR). This miniature VCR design utilizes a prototype Wankel rotary compressor in order to increase the refrigerator's coefficient of performance. The Wankel rotary

compressor deviates less from the ideal isentropic case than does a standard refrigeration compressor. The first phase of the design process entails the construction and testing of a miniature VCR with a standard compressor. The second phase of the design makes use of the same hardware from the first phase, except the standard compressor is swapped with a Wankel rotary compressor. Thus far, only the first phase of the design is complete, the miniature VCR has a cooling capacity of 125 Watts through a coefficient of performance 0.63. If the miniature VCR with the Wankel rotary compressor indeed outperforms the first design phase, than the system can be further scaled down without a decrease in performance.

The Effects of Oxygenated Zinc Dialkyldithiocarbamate Complexes on Glyceraldehyde-3-Phosphae Dehydrogenase (GAPDH): A Model System for the Elucidation of the Mechanism of Novel Anticancer Agents

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The alcohol abuse deterrent drug, disulfiram (1-diethylthiocarbamoyldisulfanyl)-N,N-diethyl-methanethioamide) (DSF), which is known to inhibit aldehyde dehydrogenase, which causes nausea. Additionally, DSF has now been observed to have specific toxicity against melanoma cells. The actions of DSF are attributed to its S-oxygenated derivatives and their ability to modify protein thiols. Our research investigates whether zinc dithiocarbamate complexes and their S-oxygenated forms function as pro-apoptotic agents via their ability to modify select protein thiols. The enzyme, glyceralehyde-3-phosphate (GAPDH), which possesses an active site thiol, is used as a model system in order to study the biochemistry of these complexes. The mechanisms of thiol modification caused by these dithiocarbamate complexes in GAPDH may provide clues to understanding the mechanistic intricacies involved in the apoptotic response of melanoma cells and may eventually lead to new therapeutic strategies for the development of novel drug therapy treatments for cancer patients.

Characterizing the Role of the Novel *Drosophila* Gene *Blimp-1* in Eye Development

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B lymphocyte-induced maturation protein (*Blimp-1*) was recently identified in *Drosophila melanogaster*. Previous research indicated that Blimp-1 affects *Drosophila* eye development. Mutation of *Blimp-1* results in a unique raised glossy eye phenotype, reduced head size and bristle defects in adult flies. Staining with various developmental markers revealed that the *Blimp-1* mutation leads to cone cell defects and disrupted patterning of bristle and tertiary pigment cells during the pupal stage. The raised glossy adult eye may indicate overexpression of the lens protein, Crystallin (Cry). *In situ* hybridization demonstrated varying expression in *Blimp-1* mutant pupal eye discs, suggesting that *Crystallin* expression may be regulated by Blimp-1. A *Cry-LacZ* transgenic fly line is being used to further investigate the interaction

between Blimp-1 and Crystallin. Preliminary results show that crystallin is up-regulated in *Blimp-1* mutant tissues compared with the neighboring wild-type tissue.