Entrepreneurism Center At UC San Diego Funds New Projects From All Five Engineering Departments And School Of Medicine

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The William J. von Liebig Center for Entrepreneurism and Technology Advancement at the University of California, San Diego (UCSD) has awarded more than $300,000 to eight projects led by faculty members of the Jacobs School of Engineering. The technologies under development range from a non-invasive, handheld device to measure deep-lung gases that could save lives, and photodetectors based on nanowire technology to make better digital cameras, to a new type of 'amorphous steel' that could be used in everything from tennis rackets and armored vehicles to biomedical implants (see below for project details).

"For the very first time, each one of the five engineering departments of the Jacobs School is represented among the innovative projects selected in a single round of funding," said Steve Halpern, managing director of the von Liebig Center. "All of the projects demonstrated great promise, and while we are only able to make eight cash awards at this time, the Center will continue to work with all of the applicants to develop commercialization strategies for their technologies, and if possible, help them secure other types of funding for their projects."

This is the sixth round of funding since the Center was set up in 2001 to foster entrepreneurism education and to provide funding and advisory services to internal technology projects that have strong commercial potential. Including this round, the von Liebig Center has awarded a total of nearly $1.8 million to 39 projects led by Jacobs School faculty.

Once again, the Center received a large number of competitive applications in response to its latest solicitation. All of these applicants went through a rigorous screening process, which included reviews by an external committee of industry experts. Of the eight new grants, two each went to researchers in the Electrical and Computer Engineering, Structural Engineering and Bioengineering departments (including an adjunct professor whose primary appointment is in the UCSD School of Medicine). One award each went to faculty in the Mechanical and Aerospace Engineering and Computer Science and Engineering departments.

For more information on the von Liebig Center, visit http://www.vonliebig.ucsd.edu, call (858) 822-5960 or email vlassist@soe.ucsd.edu. For information previous awardees, go to http://www.vonliebig.ucsd.edu/Projects/current_projects.shtml.

BIOENGINEERING

Geert W. Schmid-Schoenbein, Professor "*Development of a Filter System for Removal of Humoral Cell Activators in Severe Cardiovascular Diseases*"$50,000 Professor Schmid-Schoenbein and his team have completed the examination of several filter devices to remove inflammatory mediators from plasma. The rate of clearance was found to be optimal during use of a glass-fiber filter. Subsequent tests in a rat hemorrhagic shock model showed no improvement in survival, but analysis indicated that (a) there may be complement and prothrombotic enzyme activation in the plasma on the glass filter, and/or that (b) the rate of filtration by collection of individual blood samples from the femoral vein needs to be accelerated and replaced by a continuous plasma filtration process. With the von Liebig Center funding, the researchers will conduct studies they hope will help establish the feasibility of a filtration technology to remove inflammatory mediators from plasma. Schmid-Schonbein's team will filter the plasma in the presence of a protease inhibitor to block complement and thrombotic cascade activation and minimize complement activation during the filtration process. The team will test whether the glass filter still eliminates the inflammatory mediators in the presence of protease inhibitors under in-vitro conditions, and whether filtration with the modified glass filter with protease inhibitor serves to reduce the level of inflammatory mediators in a rodent model of shock, improve blood pressure and survival.

John West, Adjunct Professor, and Professor, UCSD School of Medicine "*Handheld Self-Contained Alveolar Gas Analyzer for Investigating Lung Disease*"$38,000

Measuring oxygen and carbon dioxide in the depths of the lung - so-called alveolar gas - typically requires cumbersome equipment that is not portable. Professor West has already constructed a crude proof-of-concept device with only an oxygen analyzer, and it successfully tracked the changes in alveolar oxygen when a subject traveled to the UC White Mountain Research Station, altitude 3800 meters. The purpose of this new project is to build a full prototype with both O_2 and CO_2 analyzers and the appropriate electronic circuitry. West believes the handheld, self-contained alveolar gas meter has potential commercial value because it would permit non-invasive testing, notably in the hospital emergency room to assist in the diagnosis of various respiratory diseases, and also in a paramedical setting at a road accident where injury of the chest wall is suspected.

ELECTRICAL AND COMPUTER ENGINEERING

Charles Tu, Professor "*Yellow-Amber-Red Light-Emitting Diodes (LEDs) Fabricated from a New Material System and Technique*"$50,000

Solid-state lighting recently has become one of the most exciting subjects of research in the semiconductor technology area. Visible color LEDs are useful for outdoor full-color displays, signaling, traffic lights, automobile lights. White light from LEDs would offer many advantages for general lighting: reduced electrical energy consumption, reduced carbon-related pollution, increased lifetime, and so on. There are numerous research approaches to the problem, especially the best materials and devices. Professor Tu has filed a provisional patent on a new material system and fabrication technique based on gallium nitride phosphide (GaNP) that would replace more traditional yellow-amber LEDs thanks to GaNP's higher luminescent efficiency. Some of its advantages derive from the fact that the material is grown through one-step epitaxy that is much simpler than conventional methods of substrate removal and wafer bonding. With von Liebig Center funding, Tu aims to acquire specialized test and measurement setups for LEDs, and proceed to fabricating prototypes and comparing them to existing commercial high-brightness LEDs.

Deli Wang, Assistant Professor "*InP Nanowire-Based Large-Scale Photo Sensing Array with Ultra-High Sensitivity, Super Low Power Consumption, Wide Bandwidth and High Frequency*"$50,000

Semiconductor nanowires are attractive building blocks for the 'bottom-up' assembly of nanoelectronic systems. The ability to control the electronic properties of nanowires in a predictable manner during synthesis has enabled reproducible fabrication of a number of nanodevices based on single nanowires, such as field effect transistors (FETs). Professor Wang and his colleagues have grown high-quality, indium phosphide (InP) nanowires using metal-organic chemical vapor deposition. They have also fabricated devices such as a photodetector based on nanowires. Wang's research shows these nanowire-based photodetectors exhibit ultrahigh sensitivity and extremely large gain. He foresees great potential for commercialization of high-sensitivity, high-speed, and cost-effective photodetectors enabled by nanotechnology, and Wang's new funding will allow him to further the commercialization and fabrication technology of novel, nanowire-based photodetectors.

STRUCTURAL ENGINEERING

Michael Todd, Assistant Professor "*A Fiber Optic-Based Sensor System for Real-Time Shape Reconstruction of Deformable Objects*"$50,000

During major seismic events, horizontal ground motion can lead to soil liquefaction, and subsequent lateral spreading of the liquefied ground material is the largest cause of structural damage, including cracking, fracture, and even catastrophic failure. In partnership with the U.S. Naval Research Laboratory (NRL), Professor Todd demonstrated a prototype for a novel sensor concept based on fiber optics and a thin flexible beam transducer mounted on a laminar box experiment at UCSD. The simple beam geometry allows for easy conversion of local displacement at each point into an integrated bending displacement profile for the beam. This approach has the advantages of minimal intrusivity, high sensitivity, insensitivity to electromagnetic interference, and easy sensor multiplexing for greater spatial profile resolution. Todd now wants to go several steps further. The Center funds will allow him to investigate design improvements for field ruggedness; to initiate an integrated hardware/software design and a user-friendly interface; and to demonstrate a redesigned prototype in a larger-scale series of tests to establish performance parameters. Ultimately, Todd hopes to present a design to the ground-motion sensor industry.

Bimal Kad, Associate Researcher "*Improved Materials for Heat Exchanger Tubes for Power Plants*"$10,000

Mechanically alloyed oxide dispersion strengthened (ODS) Fe-Cr-Al alloy thin walled tubes and sheets, produced via powder processing and consolidation methodologies, are viable component materials for eventual use at temperatures up to 1200°C in the power generation industry. That is far above the temperature capabilities of conventional alloys. Target end-uses range from furnace components, heat shields in re-usable space vehicles, gas turbine (jet engine) combustor liners, nacelles to high aspect ratio (L/D) heat exchanger tubes in power plants. Recent studies in cross-rolled ODS-alloy sheets indicate that transverse creep is significantly enhanced via controlled transverse grain fibering, and similar improvements are expected for cross-rolled tubes. This project will systematically examine and validate post-extrusion forming methods to create hoop strengthened tubes, which will be evaluated at 'in-service' loads at service temperatures and environments. Kad and his colleagues aim for eventual commercial adoption in the power-generation market.

MECHANICAL AND AEROSPACE ENGINEERING

Ken Vecchio, Professor "*Development of Cost-Effective Amorphous Steels*"$50,000

The aim of this project is to develop a recent invention of an iron (Fe) rich, low-cost alloy possessing an amorphous structure, requiring only a modest cooling rate to make amorphous, thereby constituting what is referred to as a 'bulk metallic glass' material (also known as amorphous steels, when they contain 60 to 70 atomic percent iron). Using an iron composition of 50 to 70 atomic percent, low-cost bulk processed amorphous steels have been created in Professor Vecchio's lab. These materials exhibit tremendous properties as compared to conventional steel, while maintaining a price point and manufacturing process that should model conventional steel. Amorphous steels of the present design will find broad commercial application, potentially enabling civilian and military vehicles of significantly reduced weight (and therefore higher fuel efficiency and/or transportability) without sacrificing structural durability. Likewise, bridge and infrastructure projects will benefit from the greater strength and corrosion resistance provided by amorphous steels, and seagoing vessels could benefit from shallower drafts and non-ferromagnetic hulls to avoid magnetic triggering of mines. Currently, the only commercial bulk metallic glass material is a class of alloys based on zirconium produced by a company called LiquidMetal. It is mainly used in sporting goods (such as tennis rackets, baseball bats, and golf club heads) and in consumer electronics (e.g., cell phone cases and antennas). The material under development by Vecchio at UCSD has substantial potential for these any many other applications, including biomedical implants, transformer cores, and so on. In addition, it is much cheaper than LiquidMetal, because it is iron-based rather than zirconium-based.

COMPUTER SCIENCE AND ENGINEERING

Eleazar Eskin, Assistant Professor in Residence "*HAP: A Software Tool for Identifying the Genetic Basis for Human Disease*"$5,000

With the explosion of genomic sequence data and the completion of the human genome project, much of the progress in understanding the genetic basis of disease relies on computational analysis of the genomic data, including data on the variation in genes associated with a disease for a population of individuals. Understanding the genetic basis of disease involves two steps: determining the functional variants in each gene locus that is linked to the disease and the effect of functional variants on the regulation and gene products of the gene; and understanding how these intermediate phenotypes affect disease outcomes. Using this information, researchers can identify subtypes of the disease which are candidates for different drug response. Eskin's group has developed a powerful piece of software for performing this analysis - inputting genotypes and outputting haplotypes for each individual. The two-year-old HAP Webserver (http://www.calit2.net/compbio/hap) has already processed over 4,000 datasets from researchers around the world. In early 2005, a new version will be released, and articles in several high-profile publications will highlight the project. Eskin sees strong commercial potential among pharmaceutical and biotech companies on top of the public-domain availability of the HAP Webserver for non-commercial and research purposes. The von Liebig Center funding will allow the group to work on potential commercial uses of the software.

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