UWMRF Bradley Catalyst Grants
Round III Awards (Spring 2010, Announced in Summer 2010)

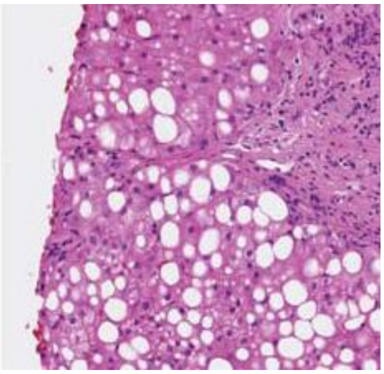
Bradley Catalyst Phase 3 Awards ($475,000 awarded in summer 2010)

The Research Foundation has selected eight new projects for funding in the third round of the Bradley Catalyst Grant Program. This is being funded by $400,000 from the Lynde and Harry Bradley Foundation and $75,000 from the Richard and Ethel Herzfeld Foundation. A total of $475,000 will be awarded to support these projects starting in the summer of 2010.

Software Tools to Automate Liver Biopsy Analysis

Joseph Bockhorst, Ph.D., Assistant Professor, Department of Electrical Engineering and Computer Science

Project Overview: Current practice for liver biopsy analysis is based on manual pathologist readings, which include semiquantitative assessment of key histological features such as the degrees of steatosis (fat), hepatocyte ballooning, inflammation and fibrosis. These quantifications play a critical role in subsequent diagnosis and staging of liver disease. Recent development of high quality scanners has opened the door to semi-automated analyses, but software tools are needed to make this possible.

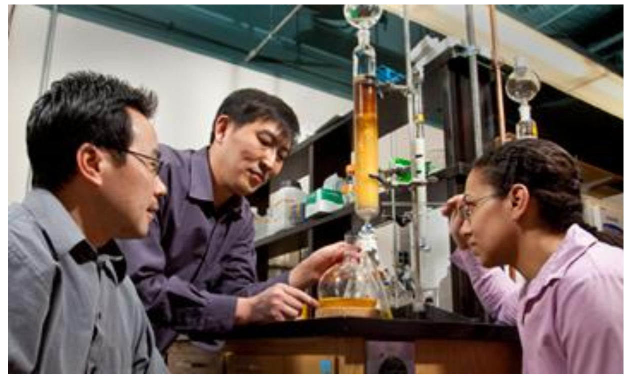


Bockhorst is developing tools to automate analysis of liver biopsies by segmenting images and providing quantitative data to the pathologist.

The objective of this project, "An Automated System for Quantification of Histological Features of Liver Biopsies," is to create software for automatic quantification of key histological features of liver biopsies. This tool has the potential to eliminate the significant variability associated with human annotation currently done by expert pathologists. This system can lead to more accurate diagnosis and staging of liver disease, quick and accurate assessment of potential donor livers in transplant settings, increased statistical power of clinical trials involving liver biopsies, more efficient use of pathologist time, and the ability to search and index large liver biopsy image databases

New Compounds to Fight Cancer

Yi-Qiang Cheng, Ph.D., Assistant Professor, Biological Sciences



Dr. Yi-Qiang "Eric" Cheng (left) directs postdoctoral research associate and graduate student as they extract chemical compounds from bacterial culture.

Project Overview: By mining the genes of a bacterium commonly found in soil in tropical areas, Cheng has discovered two cancer-fighting chemical compounds, named by him as thailandepsins A and B which are similar to FK228, a potent anticancer drug recently approved by the FDA. These compounds were tested recently by the National Cancer Institute (NCI) against a set of 60 cell lines used to screen cancer compounds and found to be effective against about 20 different kinds of cancer. It is the first time an anti-cancer compound from a UWM lab has been tested by the NCI with such encouraging results.

This project, "Preparation of Lead Anticancer Compounds for Preclinical Evaluations," will enable Dr, Cheng to prepare a sufficient amount of thailandepsins for advanced preclinical testing by the NCI. Development of new drugs for human clinical use is a long and rigorous process designed to ensure the safety and efficacy of drugs. The specific goal of this project is to develop new bacterial fermentation strategies in order to obtain sufficient amount of thailandepsisns for the next set of preclinical studies including acute toxicity assays, anti-proliferation assays and tests on experimental animals.

The UWM Research Foundation (UWMRF) is pursuing patent protection on both the method for producing these compounds as well as specific novel compounds.

Next Generation Memory Storage Device Based on Graphene

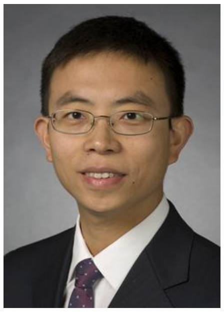
Lian Li, Ph.D., Professor, Physics Department

Project Overview: Dr. Li is among a group of scientists working to create the next generation of computers based on graphene, to extend and eventually replace the current Si-CMOS technology. Taking advantage of the extraordinary electronic properties of graphene, Dr. Li will integrate it with a ferroelectric material, which affords the hybrid hysteretic and therefore nonvolatile character. Binary "0"s and "1"s can be stored as one of two possible electric polarizations in each data storage cell made of the hybrid, achieving non-volatile memory technologies. Computers with non-volatile memories based on graphene offer the potential to store more data, consume less power and process data more quickly. In the same way that vacuum tubes led to individual transistors and eventually to integrated circuit chips with billions of transistors, scientists such as Dr. Li are taking the first steps toward demonstrating graphene transistors and memories that may revolutionize computing.

In this project, "Graphene Ferroelectric Tunnel Junction for Non-Volatile Memories," Dr. Li will attempt to demonstrate a memory device based on graphene. The first step will be to create a one bit device; if successful, he will scale up the device to a 100 x 100 array that will lead the way to large scale memory devices based on this innovative technology.

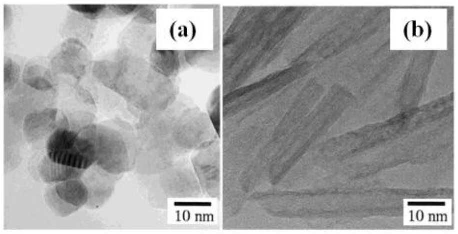
Photocatalysts to Capture CO2 and Create Fuels from Sunlight

Ying Li, Ph.D., Assistant Professor, Department of Mechanical Engineering



Project Overview: The climate change due to increased greenhouse gas concentrations in the atmosphere has created global urgency to control carbon dioxide (CO2) emissions from fossil fuel consumption. The commercial technology to capture and sequester CO2 in geological formations is extremely costly and has many uncertainties in the long-term.

In this project, "Novel TiO2 Nanotubes for Simultaneous CO2 Reduction and Solar Fuel Production," Dr. Li seeks to use solar energy to recycle CO2 as a fuel feedstock. The key to this technology is the design of photocatalysts which can convert CO2 and water to hydrocarbons and alcohols (such as methane and methanol) under solar radiation. The goal of this research is to fabricate advanced photocatalysts with novel nanostructures – in particular, copper and iodine co-modified titanium dioxide (TiO2) nanotubes.



Transmission electron microscope images show titanium dioxide nanoparticles (a) and nanotubes (b) that will form the basis for innovative new photocatalysts.

Tools to Manage Large Scale Software Development

Ethan Munson, Ph.D., Associate Professor, Dept. of Electrical Engineering and Computer Science

Project Overview: Computer software is an integral part of an increasing number of products and systems. Beyond traditional software companies, such as Microsoft or Oracle, other companies like Rockwell Automation create and maintain software code databases that can contain millions of lines of code. Software represents an enterprise asset to these companies, and the ability to fix problems and upgrade modules is critical to evolving products and staying competitive. To manage large scale software developments, companies use source code control tools. These tools not only track changes, but they allow a developer to focus on one area of code while others continue work in other areas. If not properly managed, this simultaneous development can lead to problems when parts eventually come together. Existing source code control tools track and manage changes at a very high level, but they don't provide the tools to manage more granular changes within a given file and have no understanding of the real content of the files.

The long-term goal of this project, "Platform for Structure-Based Software Configuration Management," is to create a new paradigm for configuration management in software development. This work may lead to tools that can track finer levels of change as well as identify likely areas of code impacted by changes so that developers can focus their testing on parts of the system most likely to have defects.

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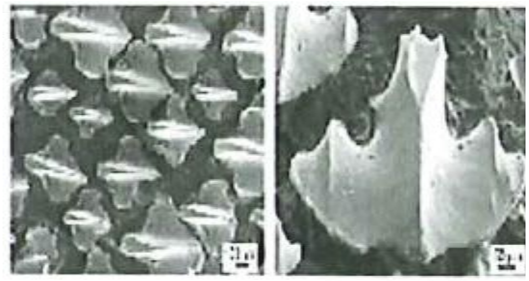
Novel Coatings to Prevent Underwater Biofouling

Michael Nosonovsky, Ph.D., Assistant Professor, Department of Mechanical Engineering

Project Overview: In this project, Dr. Nosonovsky turns his expertise in theoretical modeling of surfaces to problems underwater, including biofouling and biofiliming where the buildup of microorganisms can clog pipes or slow down ships. Conventional anti-fouling are toxic, so they are not suitable for use in water distribution systems and use of anti-fouling coatings on ships has created problems in harbor due to the leaching of these toxic coatings.

The starting point for this project is the observation during major oils spills that bird feathers are usually most affected, but fish scales are not. This project, “Environmentally Benign Biomimetic Antifouling Coatings Using Underwater Oleophobicity,” will seek to use the microstructure of fish scales to design oleophobic surfaces, or those that repel oil, for use as underwater antifouling surfaces.



Scanning electron microscope images show the microstructure of fish scales that will point the way toward designing antifouling surfaces for use underwater.

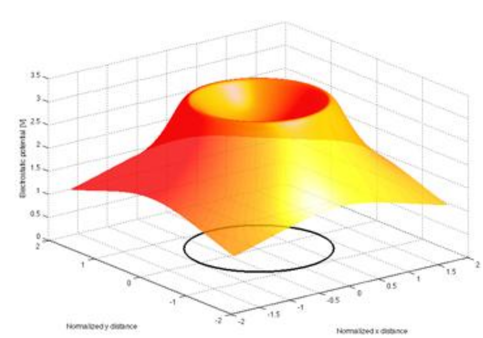
New Tool for Genetic Studies by Manipulating Single DNA Fragments

Jorg Woehl, Ph.D., Assistant Professor, Department of Chemistry and Biochemistry

Project Overview: Genetic profiling is mostly concerned with the detection of single base variations in the human genome. These so-called single nucleotide polymorphisms (SNPs) can predispose individuals to disease, influence their response to disease, to environmental factors (bacteria, viruses, toxins, chemicals), and to drug treatments, or are even known to cause disease. A major limitation of most SNP detection technologies is the need for DNA amplification through polymerase chain reaction (PCR) and the associated use of high amounts of expensive probes and reagents.

Jorg Woehl and graduate research assistant, Christine Carlson, are developing tools to manipulate and image single molecules.

The long-term goal of this project, “Development of a Single Molecule Analyzer for Genetic Profiling,” is to improve SNP detection by reducing the amount of necessary target DNA to the level of single molecules. The near-term goal of the project is to prove that single DNA fragments can be classified according to their electrical charge. The project utilizes an innovative “electrostatic corral trap” developed by Dr. Woehl which is the subject of a patent application through the UWM Research Foundation (UWMRF). If the concept works for a single DNA fragment, it can potentially be extended to a microscopic array which includes thousands of corral traps.

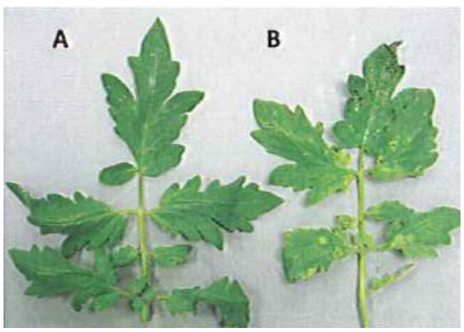


“Electrostatic corral trap” captures particles charged at a certain level while allowing others to pass over.

New Antibiotic Compounds that Minimize Antibiotic Resistance

Ching-Hong Yang, Ph.D., Associate Professor, Department of Biological Sciences

Project Overview: Current antibiotics eradicate bacterial pathogens by targeting cellular processes that are essential for microbial survival; unfortunately, because of selection pressure, this strategy has contributed to a growing crisis in agriculture and healthcare: antibiotic resistance. Dr. Yang's studies of the type III secretion system (T3SS) have helped identify a pathway that is important to bacterial virulence. Dr. Yang has found a way to reduce the virulence of bacteria and hence the harmful effects on the host organism without impacting the survival of the microbe. This has allowed him to create novel compounds that can combat bacterial pathogens and will be less likely to give rise to antibiotic resistance.



Initial testing has shown that bacterial spec disease was suppressed in tomato plants treated with Yang's compounds (A) as compared to plants not treated (B).

This project, "Novel Approaches for Developing Virulence-specific Therapeutics," will allow Dr. Yang and his colleagues to synthesize a range of compounds based on their initial success and screen these compounds to identify a subset of compounds for further testing.