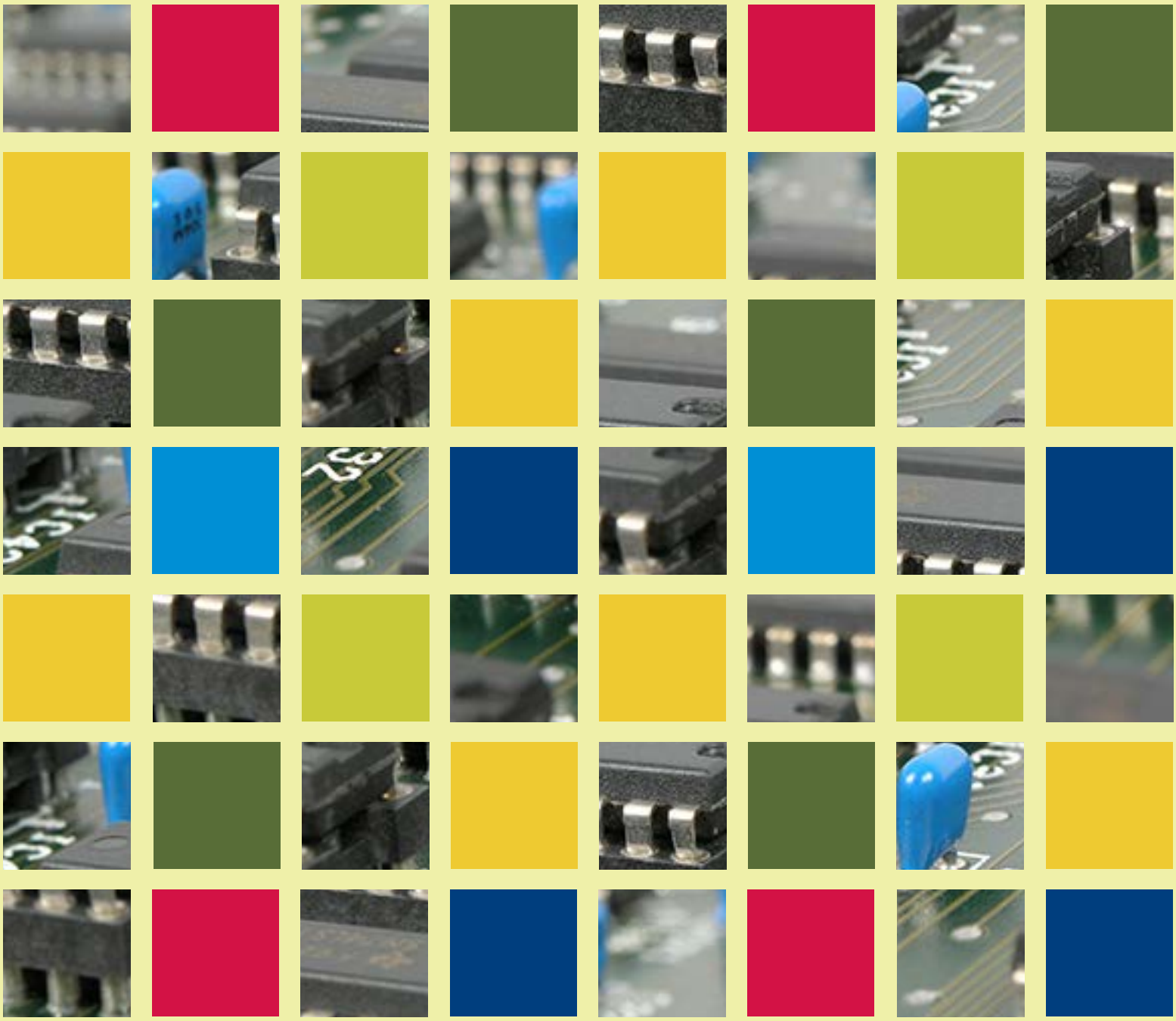


July 27-28, 2015

8th Annual

Wisconsin Science & Technology Symposium

Today's breakthroughs, tomorrow's partnerships

Welcome

It is a pleasure to welcome the 8th Annual Wisconsin Science & Technology Symposium participants to the UW-River Falls campus. The university has a commitment to partnering with local businesses and the community to advance economic development in the region. UW-River Falls and WiSys Technology Foundation organized this event as an opportunity to connect Wisconsin's many accomplished researchers, innovators and students with industry. I truly hope you enjoy this event and use your time on the UW-River Falls campus to expand upon and enhance the incredible work you are doing.

~ Dean Van Galen, Chancellor
University of Wisconsin-River Falls

The overall initiative of the UW System in terms of cutting-edge research and technology development has been essential for the economic growth of this state. This event showcases successes across the state at each UW institution partnering with WiSys. It exemplifies what is possible when academic institutions and industry professionals join forces. I encourage you to make the best of this opportunity to build your network and advance scientific research for the state.

~ David Ward, Chair
WiSys Technology Foundation Board of Trustees

I am pleased to welcome you to the 8th Annual Wisconsin Science & Technology Symposium. The UW campuses have made tremendous progress in increasing research capacity, leading to increases in intellectual property and economic benefit from the state. As we go forward, the Wisconsin Alumni Research Foundation is pleased to collaborate with WiSys to support UW campus researchers achieve even greater success.

~ Carl Gulbrandsen, Managing Director
Wisconsin Alumni Research Foundation

The annual Wisconsin Science & Technology Symposium wholly exemplifies UW System efforts to advance technology development and transfer in Wisconsin. This conference provides the opportunity for networking and collaboration within the science and business communities, and allows both of these sectors to expand their understanding of the innovative work being done across the state. Every relationship formed between the UW System campuses and businesses is crucial to the expansion of technology commercialization and economic growth in Wisconsin. I wish every participant a successful and productive gathering.

~ Tom Still, President
Wisconsin Technology Council

Welcome

The Wisconsin Science & Technology Symposium shines a spotlight on the critical role played by academic research and development. Given our growing understanding that innovation is the key to future economic competitiveness and progress, the collaborative efforts between campuses as well as partnerships with Wisconsin industries have never been more essential.

~ Ray Cross, President
University of Wisconsin System

Effective partnerships between researchers and businesses are essential for economic growth within our state. Innovative research and technology fuel this growth, and I applaud WiSys Technology Foundation for fostering collaboration between academia and industry. The Wisconsin Science & Technology Symposium is a wonderful opportunity to highlight innovative projects that are enhancing the business climate in Wisconsin.

~ Reed Hall, CEO & Secretary
Wisconsin Economic Development Corporation (WEDC)

It is exciting to see an invention move from a simple idea to a commercially relevant and viable product. Luckily for Wisconsin, there are dozens of resources committed to fostering an entrepreneurial environment and helping the commercialization process transpire. Faculty and students across the UW System continue to inspire me with their research and innovation. It is events like this that are instrumental in showcasing all that Wisconsin has to offer. I hope that all attendees at the 8th Annual Wisconsin Science & Technology Symposium have the chance learn, connect and grow as a result of this gathering, and then contribute their invaluable work to the Wisconsin economy.

~ Lorrie Keating Heinemann, Vice President
BrightStar Wisconsin Foundation, Inc.

I am impressed with the number of talented students, faculty and staff on the UW campuses around the state. It is a pleasure working alongside these innovative minds, and we at WiSys are proud of the progress the campuses have made in fostering such an innovative and entrepreneurial culture. WiSys plays a critical role in advancing awareness of the intellectual potential residing in our campuses and bridging the gap between academia and industry. The 8th Annual Wisconsin Science & Technology Symposium showcases the scientific discoveries and entrepreneurship taking place throughout Wisconsin.

~ Arjun Sanga, Executive Director
WiSys Technology Foundation

Schedule

Monday, July 27

8:00 - 9:00 am **Registration & Breakfast**

9:00 - 9:45 am **Welcome & Keynote**
Arjun Sanga, *WiSys*
Dean Van Galen, *UW-River Falls*
Quentin Schultz, *Eurofins BioDiagnostics, Inc.*

9:45 - 10:45 am **Scientific Presentations: Session 1**
Regent Scholar Presentations
Tim Higgins, *Moderator*
Timothy Lyden, *UW-River Falls*
Junhong Chen, *UW-Milwaukee*
Jennifer Dahl, *UW-Eau Claire*
Heather Schenck, *UW-La Crosse*

10:45 - 11:30 am **Innovation Assessment Discussion**

11:45 - 12:50 pm **Luncheon and Networking**
Christal Sheppard, *USPTO*

1:00 - 2:00 pm **Scientific Presentations: Session 2**
WiSys & UW System Supported Projects
Lorrie Keating Heinemann, *Moderator*
Laura Knoll, *UW-Madison*
Lynn Gilbertson, *UW-Whitewater*
Mohammad Rabbani, *UW-Platteville*
Yijun Tang, *UW-Oshkosh*

2:00 - 3:30 pm **Poster Session and Networking**

3:30 - 4:30 pm **Scientific Presentations: Session 3**
Up and Coming Innovators
Jennifer Cook, *Moderator*
Ozgur Yavuzcetin, *UW-Whitewater*
Andrew Koob, *UW-River Falls*
Dmitry Kadnikov, *UW-Stout*
Drake Bortolameolli, *UW-Eau Claire*
Aaron Emmert, *UW-Eau Claire*

4:30 - 5:30 pm **Spoon Wars Ice Cream Challenge**

6:30 - 9:00 pm **Evening Reception and Dinner**
St. Croix Boat Cruise
(Bus Transportation Available)

Tuesday, July 28

8:00 - 9:00 am **Breakfast & Networking**

9:00 - 9:50 am **Scientific Presentations: Session 4**
WiSys & UW System Supported Projects
Robert Wise, *Moderator*
Gokul Gopalakrishnan, *UW-Platteville*
John Droske, *UW-Stevens Point*
Robert McGaff, *UW-La Crosse*

10:00 - 10:30 am **Break & Networking**

10:30 - 11:30 pm **Wisconsin Innovation & Entrepreneurship Resources**

11:45 - 1:00 pm **Luncheon & Networking**
Cathy Sandeen, *UW Colleges and UW-Extension*

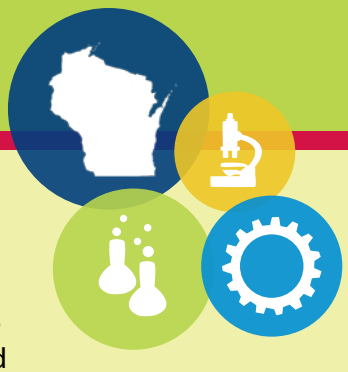
1:10 - 2:15 pm **Company Presentations**
David Linz, *Moderator*
Craig Davis, *NovaScan, LLC*
Dan McGuire, Eric Hellstrom, *Innovative Foundry Technologies, LLC & Foundry Solutions LLC*
Mark Mueller, *Botanic Innovations, LLC*
Eric Wenz, *Ashlynn Industries, LLC*

2:15 - 2:30 pm **Closing Remarks**
Fernando Delgado, *UW-River Falls*

Research and technology development are vital to the economic growth of Wisconsin. To encourage interdisciplinary research in the state, WiSys Technology Foundation and UW-River Falls have jointly organized the 8th Annual Wisconsin Science & Technology Symposium to bring together innovative researchers and students from the University of Wisconsin System and other public and private organizations.

It is our hope that this symposium will provide the opportunity for critical networking and the formation of partnerships to help further innovative ideas in Wisconsin. Thank you for your participation in WSTS 2015.

General Information



Information
For information and answers to any questions you may have, please visit the WSTS registration desk.

Name Badge
Please wear your name badge at all times. Admission to all presentations and meals is open only to those registered for the conference.

Parking Information
Parking at UW-River Falls is available in the PAY 2 Lot and other parking lots U, Y, T, G or N. For parking issues please see the registration desk.

Transportation
For those who signed up for transportation to the evening cruise we will board the buses at 5:30 pm and depart at 5:45 pm.

Internet Access
Wireless Internet access is available throughout the UW-River Falls campus guest network. No password is needed. Please see the registration desk with any issues.

Sponsor Booths & Poster Exhibition
Sponsor and poster exhibits will be on display throughout Monday and Tuesday. The main poster session is Monday afternoon.

Meals
Beverages and various snacks will be available throughout the conference.

Cell Phones
Please turn off your cell phone while inside the presentation hall.

Presentations
Certain PowerPoint presentations, along with other materials from the symposium, may be made available on the WiSys Web page after the event: www.wisys.org/events.

Social Media
Feel free to post pictures and reach out to us on social media. We are on Facebook and Twitter @wisystto. Use the hashtag #WSTS2015.

Planning Committee:
Earl Blodgett, *UW-River Falls*
Mike Cenci, *WiSys Technology Foundation*
Jennifer Cook, *WiSys Technology Foundation*
Jon Cook, *WiSys Technology Foundation*
Katie Koets, *UW-River Falls*
Bri Maas, *WiSys Technology Foundation*
Elly Pirman, *WiSys Technology Foundation*
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Arjun Sanga, *WiSys Technology Foundation*
Alicia Schiff, *WiSys Technology Foundation*
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UW-Madison Advanced Materials Industrial Consortium
Regional Materials and Manufacturing Network

Monday, July 27

8:00 - 9:00 am Registration & Breakfast

9:00 - 9:45 am Welcome & Keynote

Arjun Sanga, Executive Director, WiSys

Arjun Sanga, Executive Director of WiSys Technology Foundation, is an expert in technology transfer, intellectual property management and commercialization. Sanga has more than 20 years of experience leading research collaborations, managing intellectual property, closing licensing deals and fostering startup companies. A registered patent attorney, Sanga has been involved in every aspect of technology transfer, from operations to management. He has a background in chemistry and computer science.

Dean Van Galen, Chancellor, UW-River Falls

Dean Van Galen is the 18th Chancellor of UW-River Falls, and holds a Ph.D. degree in Analytical Chemistry. Prior to his selection as chancellor, he served as vice president for university advancement at the University of West Florida (Pensacola). Van Galen was elected to the WiSys Board and selected as Chair of the WiSys Advisory Committee in November, 2013.

Quentin Schultz, Owner and President, Eurofins BioDiagnostics, Inc.

Characteristics of Entrepreneurship

Quentin Schultz is President and founder of Eurofins BioDiagnostics, Inc. He graduated from South Dakota State University with Bachelor and Masters degrees in Agronomy. His work experience includes the Peace Corp, Assistant Professor of Agronomy at SDSU, and Quality Assurance Manager at two international seed companies. He founded BioDiagnostics, Inc. in 1996 to provide genetic testing services to the seed industry. That business grew into one of the largest independently owned commercial labs in the world.

9:45 - 10:45 am Scientific Presentations: Session 1, Regent Scholar Presentations

Moderator: Tim Higgins, Regent, UW System

Tim Higgins, of Appleton, WI, is the owner and principal of ChiRho Services, a consulting firm focused on health care payment reform issues and the integration of complementary and traditional medicine. Higgins serves as a member of the Board of IndUS of Fox Valley (Board Chair, 2004-2012), an Indo-American friendship organization organized in 1999 by members of the Fox Valley India Association. He has served on the Boards of Directors of the Family Service Association of the Fox Valley (Chair, 1998-2000); United Way Fox Cities (Board Chair in 2000, Community Campaign Co-Chair 2007-2008); Fox Cities Chamber of Commerce (Chair in 2005); Community Foundation for the Fox Valley Region; and the Local Emergency Assistance Valley Evangelical Network (LEAVEN). Higgins is a member of the Audit and Business and Finance Committees of the Board of Regents and he chairs the Research, Economic Development and Innovation (REDI) Committee and the Committee

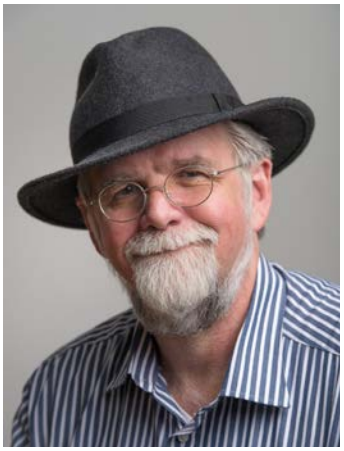
on Student Discipline and Other Student Appeals. He represents the Board of Regents on the Oversight and Advisory Committee of the Wisconsin Partnership Program and is on the WiSys Technology Foundation Advisory Committee.

Tim Lyden, UW-River Falls

Evolution of the "Living Biopsy" 3D Artificial Tissue Technology: From Basic Science to Potential Clinical Applications

Since 2004, the Tissue and Cellular Innovation Center has been focused on application of 3D tissue engineering to model cellular interactions in-vitro. This work has taken two parallel tracks, modeling early histogenesis in normal tissues as well as the development/progression of tumor tissues. Throughout these studies, the TCIC has focused on natural 3D matrix as a primary scaffolding material. Collectively, this work has established that complex artificial tissues (ATs) can be constructed from embryonic brain, heart, liver, lung, eye and bone tissue explants. In addition, a large number of studies have also shown that standard cell lines of both "normal" and pathologic origin can be employed to generate monoculture-based ATs or artificial tumor tissues (ATTs). These constructs have now been employed to model specific and significant tumor cell and tissue behaviors in-vitro. Among these have been cell-to-cell dynamics as well as cell shedding and metastasis during artificial tumor progression. In addition to these basic science studies, the TCIC has also collaborated with Marshfield Clinic in the development and application of 3D ATTs from individual patients in an effort to evolve a new and dynamic approach to tumor diagnosis and eventually treatment design. This latest innovation, called the "living biopsy" approach to personalized cancer medicine and based partly on collaborations with Microscopy Innovations LLC., is expected to open new avenues for research and treatment design as well as developing new targets for monitoring and treating cancer going forward. This phase of research is funded by a UW-System Regents Scholar Award.

Dr. Timothy Lyden relocated to UW-RF from The Ohio State University Medical School in 2001. For the previous 11 years, Dr. Lyden had worked as a biomedical researcher focused on the normal human placenta at both Ohio State and Wright State University. He held positions as a Senior Post-Doctoral Fellow, Research Scientist and Research Assistant Professor serving as co-investigator for $4 million in NIH research grant projects. Upon arriving at UW-RF in 2001, Dr. Lyden shifted focus to modeling cellular aspects of developmental and tumor biology using 3D tissue engineering methods. This work involves collaborative interactions with Microscopy Innovations, LLC., BRTI, LLC. and Marshfield Clinic as well as several UW campuses. Most recently, Dr. Lyden received a UW-System Regents Scholar Award in 2015 to work on the development of a new miniature bioreactor system-based approach to study cancer in both the basic science and applied clinic contexts.



Junhong Chen, UW-Milwaukee

Smart Phone-Supported Sensors for Real-time Monitoring Heavy Metal Ions in Water

Heavy-metal ions are poisonous and may lead to serious damage to human organs, tissues, bones, and nervous system. Real-time and onsite detection of heavy-metal ions is desired for water quality monitoring and for early warning of water contamination to protect public health. This Regent Scholar project focuses on engaging four undergraduate students in developing smart phone-supported water sensors for real-time heavy metal ion detection. Expected outcomes of the project include a prototype smart phone-supported low-cost and real-time water sensor to monitor heavy metal ions in water and well-trained undergraduate students through hands-on experience in smart phone-enabled electronic device engineering and rich entrepreneurship activities. The project will also potentially benefit water industries/smart phone companies by enabling additional real-time sensing capabilities with smart phones to increase product performance, market share, profits, and most importantly, to create or retain jobs in the state of Wisconsin.

Dr. Chen is currently a Professor of Mechanical Engineering and Materials Science and engineering and Excellence in Engineering Faculty Fellow in Nanotechnology at the University of Wisconsin-

Milwaukee (UWM). He is also the Director of NSF I/UCRC on Water Equipment & Policy and the founder of NanoAffix Science, LLC. Dr. Chen received his B.E. degree (in Thermal Engineering) in 1995 from Tongji University, and his M.S. and Ph.D. degrees (both in Mechanical Engineering) in 2000 and 2002, respectively, from University of Minnesota. Prior to joining UWM in 2003, he was a postdoctoral scholar in Chemical Engineering at California Institute of Technology. He was promoted to Associate Professor and Professor in 2008 and 2011, respectively. His current research focuses on nanocarbon-based hybrid nanomaterials for sustainable energy and environment. His research excellence was recognized by the 2008 Graduate School/UWM Foundation Research Award, the 2012 UWM College of Engineering & Applied Science Research Excellence Award, and as an elected Fellow of American Society of Mechanical Engineers (ASME) in 2013.

Jennifer Dahl, UW-Eau Claire

Customized Chemistry of Nanoparticle Films via Stabilizing Chelation

Covalently crosslinked gold nanoparticle films were created as a platform for the facile design of Janus nanoparticle systems with customized surface chemistry. Regioselective ligand exchange reactions allow for the introduction of ligands bearing either hydrophilic or hydrophobic functional groups, but the crosslinking molecule is also subject to exchange, reducing the regioselective nature of these reactions. We have created a new crosslinking system that utilizes bisdithiol groups, which are unlikely to be displaced by simple incoming molecules. This system will be extended to photocleavable bisdithiol crosslinkers to yield both 2-d Janus networks, as well as free, unconstrained Janus particles.

Jennifer A. Dahl is beginning her sixth year as an associate professor of Materials Science and Engineering at the University of Wisconsin-Eau Claire. Dr. Dahl's interest in surface science began as an undergraduate research assistant at the University of Wisconsin-Oshkosh, where she completed a B.S. in Chemistry. Her work with nanotechnology continued as a Ph.D. student in Chemistry at the University of Oregon, and as a postdoc at Trinity University in San Antonio, Texas. Dr. Dahl's research program at UWEC has been focused on chemical modification of nanoparticles to better enable solid state applications, and the development of spectroscopic methods to probe surface composition on the nanoscale. Her work was recognized by the UW System Board of Regents, designating her as a 2015 Regent Scholar.

Heather Schenck, UW-La Crosse

Optimization of Hydroxamic Acids for Applications in Medicine and Industry

Hydroxamic acids (HAs) are small clusters of atoms that bind metals. HAs are in clinical use as iron chelators and anti-cancer drugs, and are being examined in industrial applications for removal of trace metals from mine ores. HAs favor two shapes, only one of which can bind metal effectively. Little is known about the energy barrier for switching between shapes. A recent publication from this lab with an undergraduate researcher as lead author (Magn. Reson. Chem. 2013, 51, 72-75) showed that HAs favor the metal-incapable shape in water. This article corrected an error that stood in the literature for 19 years, and shows the importance of studying energetic properties of HAs. A molecule with too high an energy barrier may be "stuck" in a metal-incapable form. Our prior and current studies use nuclear magnetic resonance (NMR) spectroscopy to examine molecular shape and energy barriers. Our latest work provides the first picture of energetics of a small HA in water. We are now testing the impact of nearby atoms on HA structural preferences. These insights will contribute to design of HAs to perform specific tasks. We believe HA designers can leverage this work by tailoring HA switching behaviors to specific settings.

Heather Schenck is an Associate Professor of chemistry at UW – La Crosse. She teaches organic chemistry and spectroscopy, and has mentored research students every

semester since 2007. Prior to joining UW – L, Heather worked for 8 years at Kimberly-Clark Corporation in Neenah as a Research Scientist and Patent Facilitator. Her graduate studies were done at UW – Madison in the labs of Samuel Gellman, where she designed peptides to form specific structures. Her research efforts at UW – L include optimization of organic chemistry pedagogy and structural studies of molecules called hydroxamic acids. The laboratory studies use nuclear magnetic resonance (NMR) spectroscopy, which is built on the same principles as medical magnetic resonance imaging (MRI). Heather works with research students to synthesize new hydroxamic acids and then study the molecules by NMR.

10:45 - 11:30 am Innovation Assessment

Join us for an engaging discussion examining the role universities play in economic development through this interactive session.

11:45 - 12:50 pm Lunch

Christal Sheppard, Director, USPTO Midwest Satellite Office

Resources for Small Inventions & Small Business

Christal Sheppard is the director of the United States Patent and Trademark Office Midwest Satellite Office located in Detroit, Michigan. She leads the USPTO operations, policy and community outreach efforts throughout the Midwestern United States.

Prior to joining the USPTO, Sheppard was an assistant professor at the University of Nebraska where she co-founded a program of concentrated study in intellectual property law at the Law College.

Sheppard has master's and doctoral degrees in cellular and molecular biology from the University of Michigan and a juris doctor degree from Cornell University Law School. She has more than two decades of science and intellectual property law and policy experience including as practicing attorney at Foley & Lardner and the United States International Trade Commission and through internships with Judge Radar at the Court of Appeals for the Federal Circuit and the Executive Office of the President's Office of Science and Technology Policy. In 2005, Sheppard completed Harvard University's John F. Kennedy School of Government's Executive Education for Senior Managers in Government program, and in 2014, she completed a George Mason University Law and Economics Institute program.

Her successful career in intellectual property law and policy includes her tenure as chief counsel on patents and trademarks for the United States House of Representatives Committee on the Judiciary where she was integral in many endeavors including the Leahy-Smith America Invents Act, the most comprehensive change to this nation's intellectual property laws in more than 60 years.

1:00 - 2:00 pm Scientific Presentations: Session 2

Moderator: Lorrie Keating Heinemann, Vice President, BrightStar Wisconsin Foundation, Inc

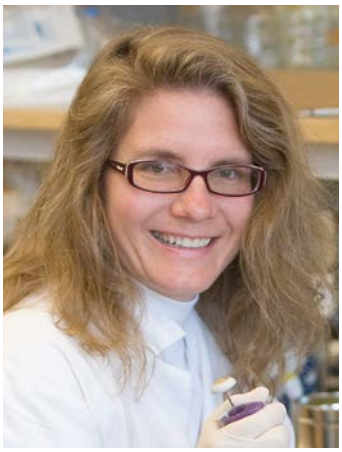
Lorrie Keating Heinemann co-founded the Wisconsin Angel Network with the Wisconsin Technology Council in 2004. From 2003 to 2010, she served as the Cabinet Secretary overseeing the Wisconsin Department of Financial Institutions which included banking, securities, and corporate registrations. Heinemann also serves on the Wisconsin Technology Council Board and the Springboard Enterprises Advisory Board. Heinemann was elected to the WiSys Board in 2008. In January, 2014 she was elected Secretary of the Board and Chair of the WiSys Finance, Audit and Administration Committee.

Laura Knoll, UW-Madison

Using Microbial Proteins to Develop New Broad-Spectrum Immunotherapeutics

The need to develop antimicrobial agents with novel mechanisms is characterized as a crisis by the National Institute of Medicine. Targeted stimulation of the

immune response represents a fundamental new direction in the treatment of infectious diseases, but only a few immune strategies have been deployed thus far to fight infection. Combining immune enhancement strategies with traditional antibiotics will be highly effective and less likely to produce resistant microbes. To discover new immunotherapeutics, we investigate how microbial infections naturally stimulate the host's immune response. We have found that the microbial proteins that stimulate an immune response during a natural infection can be recombinantly expressed, purified, and given as a post-exposure treatment. For example, a recombinant protein from the parasite *Toxoplasma gondii* called profilin stimulates an immune response that kills the bacterium *Listeria monocytogenes* when given either pre- or post-exposure. Through collaborations with the UW Carbone Cancer Center, we are also currently examining if the immune response to these microbial proteins can reduce tumor size and enhance the activity of adaptive immune response immunotherapeutics.



Laura Knoll graduated from St. Olaf College with a BA in Chemistry and Biology. Her PhD thesis research was in Biochemistry with Dr. Jeffrey Gordon at Washington University in St. Louis. Laura did her postdoctoral research with Dr. John Boothroyd at Stanford University where she used molecular genetic techniques to study the parasite Toxoplasma gondii. In 2001, she moved to the University of Wisconsin-Madison to join the faculty of Medical Microbiology and Immunology in the School of Medicine and Public Health. Laura is also a member of the Food Research Institute, the UW Carbone Cancer Center and the Morgridge Institute. She teaches the Emerging Infectious Diseases course to undergraduate and graduate students as well as parasitology to the medical students. Research of the Knoll lab analyzes how the parasite Toxoplasma gondii forms a chronic infection and the consicentes of that infection on the host.

Lynn Gilbertson, UW-Whitewater

Development of a Novel Method for Measuring Occupational Noise Levels in the Ear Canal

Evidence has been accumulating towards the impact of noise induced hearing loss among employees in occupations that are not traditionally monitored for occupational noise exposure. Many of these non-traditional occupations are exposed to intermittent doses of noise on duty and involve two way communication devices. Traditional noise dosimetry and sound level measurements are conducted at the level of the shoulder or through personal hearing protection. There is nothing commercially available that will measure the noise in the ear canal when there is a communication output device in place. Without this type of device and consequent measurement there is no way to accurately sample the noise levels that are reaching the auditory system. Our study team (Lynn Gilbertson, Donna Vosburgh, and Tim Klein) is working to develop a prototype that will measure noise levels in the ear canal regardless of the type of earpiece, headset, or hearing protection an employee is wearing.

Lynn Gilbertson received her Ph.D. from the University of Wisconsin-Madison in 2013 with a specific focus on speech perception in noise. Her research continues to focus on how human factors, cognitive functions, and noise impact speech perception and hearing health. She is currently an assistant professor at the University of Wisconsin-Whitewater in the Department of Communication Sciences and Disorders. Since Dr. Gilbertson's hire at UW-Whitewater she has developed an interdisciplinary collaboration with assistant professor Donna Vosburgh in the department of Occupational & Environmental Health and Safety. Dr. Gilbertson and Dr. Vosburgh have combined their expertise in hearing science and work-place safety to investigate hearing conservation issues in less traditionally monitored occupations, specifically public safety workers. This partnership has led to funding for their current prototype development project.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Mohammad Rabbani, UW-Platteville

Preparation of Nanoporous Membrane Composites for Landfill Gas Separation Applications

Landfill gas which is produced from the municipal solid waste in landfills under anaerobic digestion has recently attracted considerable attention as a source of renewable energy because it offsets the need for non-renewable resources such as oil, coal and gas. However, the separation of carbon dioxide is a big challenge for the landfill gas to become a widely used energy fuel. Membrane-based gas separation is a promising technique and competes with conventional methods like distillation, absorption, adsorption on the basis of overall economics, safety, environmental and technical aspects. The aim of this study is to develop a nanoporous membrane composite using nanoporous organic polymers and membrane matrixes in an effort to separate carbon dioxide (CO2) from landfill gas. A nanoporous organic polymer was successfully synthesized using commercially available and economically cheap starting monomer, melamine. Resultant polymer showed significant CO2 gas adsorption over methane. This property makes this melamine-based polymer a promising candidate to construct a membrane composite for separation of CO2 from landfill gas.

Dr. Rabbani completed his undergraduate degree in Chemistry with honour from the University of Dhaka, Bangladesh and then he completed his PhD in Materials Science from Osaka City University, Japan. He spent several years as a post-doc in Japan. His PhD and post-doc research in Japan was synthesis of Porphyrin derivatives and studies of their photophysical properties. Dr. Rabbani joined in the group of Prof. El-Kaderi at Virginia Commonwealth University in 2009 as a senior research scientist. His research work at VCU on the design and synthesis of porous materials for gas storage and separation application was highlighted by the American Chemical Society during the ACS meeting in 2012. He joined at UW-Platteville in 2014 as an Assistant professor in the department of Chemistry. He published 20 articles so far in peer reviewed journals. And he has more than 600 citations. His main research focus at UW-Platteville is the synthesis of porous materials and their applications.

Yijun Tang, UW-Oshkosh

Using Ionic Liquids in Direct Methanol Fuel Cells

Fuel cell is a device to generate electricity from a chemical reaction of the fuel. A fuel cell has three main components: positive terminal, negative terminal and electrolyte. The electrons continuously flow from the negative terminal to the positive terminal as long as the fuel is supplied. The electrolyte is necessary to harness the electron flow so that it can be used to power an electric device. The function of the electrolyte is to prevent the electrons from flowing to the positive terminal inside the fuel cell. The electricity cannot be utilized if that happens. On the other hand, the electrolyte should conduct ions to maintain the neutrality of both terminals. The popular proton-exchange membrane fuel cell (PEMFC) uses polymer membrane as the electrolyte. The polymer is not perfect although it has many advantages over other materials currently used as the fuel cell electrolyte. Its thickness in the fuel cell makes it vulnerable to mechanic impacts. Ionic liquids are a relatively new material. They are a promising candidate for the electrolyte due to their physical and chemical properties. Using ionic liquids as the fuel cell electrolyte will improve the performance and reduce the cost in the long run.

Yijun Tang is Assistant Professor of Analytical Chemistry at UW Oshkosh. He received his BS in Chemistry from Beijing University, China in 1994, MS in Chemistry from Michigan State University in 2000 and PhD in Biomedical Science: Health and Environmental Chemistry from Oakland University, Michigan in 2009. Tang has been trained

to be an expert in electrochemistry, of both theories and techniques. His interest of research is in the efficient and effective energy conversion and energy storage. Tang has published 4 peer-reviewed papers with his undergraduate students since he joined the faculty of chemistry at UW Oshkosh. He has also reviewed several research papers. His current research of fuel cells aims to improve the efficiency of the fuel and reduce the cost of operation. The UW System Board of Regents has granted Tang tenure and promotion to Associate Professor effective September 1, 2015.

2:00 - 3:30 pm Poster Session

3:30 - 4:30 pm Scientific Presentations: Session 3, Up and Coming Innovators

Moderator: Jennifer Cook, Associate Director, WiSys Technology Foundation

Jennifer Cook is Associate Director for WiSys Technology Foundation. Jennifer joined WiSys in October 2014 from the University of Ulster in Northern Ireland where she worked as a technology commercialization manager responsible for the University's life and health science portfolio. At WiSys, Jennifer helps lead technology transfer operations across the UW System including WiSys' patenting and licensing initiatives, the student ambassador program as well as other outreach efforts aimed at promoting research and collaboration across system campuses.

Jennifer holds a Bachelor of Science in biology and chemistry, an MBA and has over 10 years of experience in R&D, Intellectual Property management, and commercialization of intellectual capital developed out of the academic base.

Ozgur Yavuzcetin, UW-Whitewater

Lithium Niobate Based Piezoelectric Transducer

Strain gauge is a device which can measure stress or strain and converts it into electrical signal. Current strain gauges are widely used in civil engineering, automotive technology and research. However in addition to their low sensitivity, they are also vulnerable to electrical and mechanical noise. Lithium Niobate (LN) is a crystal that can convert vibrations into electrical signals. It also exhibits optical properties and has been used in optical data communication for decades. In this work, we have demonstrated a highly sensitive piezoelectric transducer consisting of a LN based sensor and a signal conditioning circuitry which can pick up small vibrations and output these as electrical signals. For noisy environments, fiber optical strain gauges have proven their reliability since signals are measured optically and are not affected by electrical noise. We can therefore use a LN sensor to pick-up strain signals electrically and optically improving its overall sensitivity. We have done market size research in fiber optic and conventional gauges to see if our product has feasibility.

Ozgur Yavuzcetin is an assistant professor at UW-Whitewater, in the department of physics. His current research interests focus on sensor/instrument design and development and nanofabrication. He is an executive committee member of the Center for Functional Nanomaterials at Brookhaven National Lab. He has nanofabrication experience at clean-room labs nationwide, including University of Illinois Urbana Champaign, Northwestern University, Harvard University and Brookhaven National Lab. He has published more than 20 articles on his work in nanophotonics, nanofabrication, self-assembly, sensors, brainwaves and fuel-cell membranes. He holds several issued patents in the areas of nanophotonics and EEG. He worked on many DARPA projects and he has received the NSF Innovation Corps (I-CorpsTM) grant where he served as the entrepreneurial lead. He and his team founded their company NeuroFieldz based on a system of measuring and analyzing electric fields of the brain at higher resolution where he served as the president of the company.

Andrew Koob, UW-River Falls

Dissecting the Cell Out of the Brain, But Not the Brain Out of the Cell

One of the challenges in the study of the nervous system is understanding the function of specific cell types within their environment. In the human brain, there are

numerous cell types, all with unique essential roles that contribute to cellular communication at the basis of our cognition. With laser microdissection, researchers can excise a single cell for analysis from tissue. Using DNA amplification techniques, this has previously enabled researchers to understand the genetic expression of any cell type. However, the study of expression proteomics from specific cell types has proven more elusive. Protein interaction and signaling is the foundation of cellular function, and the quantification of protein expression levels from specific cell types has important and beneficial implications in understanding the origin of disorders and disease. Here, a technique will be discussed to combine laser microdissection with antibody-bound nanoparticle 'biobarcoding' to reliably recognize and measure protein levels from an aggregation of cell specific tissue excised from the human brain. The viability of these techniques for biomarker discovery, with special emphasis on the study of neurodegenerative disease, will also be considered.

Andrew Koob graduated from Northwestern University with a degree in psychology in 1998 and from Purdue University with a Ph.D. in biology and neuroscience in 2005, specializing in cellular degeneration after head injury. After graduation, he worked as a postdoctoral research fellow in pediatric neurosurgery at Dartmouth College. He then studied molecular mechanisms in neurodegenerative disease as a postdoctoral fellow for research in Parkinson's Disease at the University of California, San Diego, and as a researcher in molecular neurogenetics at the University of Munich, Germany. He has been a lecturer in the Biology Department at the University of Wisconsin – River Falls since 2010.

Dmitry Kadnikov, UW-Stout

Towards Regulation of Cholesterol Homeostasis via Small-Molecule-Controlled Gene Transcription

Rapid increase in cases of atherosclerotic cardiovascular disease and type 2 diabetes is probably the biggest current health crisis in the Western world. Various metabolic risk factors, such as obesity, insulin resistance, hypertension and hyperglycemia, known collectively as a metabolic syndrome or syndrome X, are presumed to be main cause of these diseases. Disbalance in transport of cellular cholesterol is one of the underlying causes of the metabolic syndrome.

We are developing small molecule ligands targeting a protein transcription factor, liver X receptor, which activates expression of genes encoding the proteins that transport cholesterol out of the cells. Activation of these genes has been shown to increase high-density lipoproteins (HDL-C) and decrease low-density lipoproteins (LDL-C) levels in cellular and animal models. The design of our small molecule ligands is based on the structure of Riccardin C, a natural product obtained from liverworms, which exhibits unusual selectivity in activation of the liver X receptor, but, on the other hand, possesses highly strained structure making it a poor starting point for the development of such agents. An efficient multi-gram synthesis of these analogs that utilizes a modular approach to provide entry points towards a variety of second generation analogs has been developed.

Dmitry Kadnikov is beginning his third year as an Assistant Professor of Chemistry at the University of Wisconsin – Stout. He received his undergraduate degree in Chemistry at Higher Chemical College of Russian Academy of Sciences and PhD in Organic Chemistry from Iowa State University, where his work focused on development of novel palladium-catalyzed reactions. He then spent four years as a postdoctroral scholar at the Department of Pharmaceutical Chemistry of the University of California – San Francisco studying new small molecule anti-prostate cancer agents. His research at UW-Stout focuses on design and synthesis of biologically-active small molecules to regulate transcription of pharmacologically-important genes, specifically those involved in regulation of cellular cholesterol levels, as well as development of new reactions to synthesize these molecules.


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Drake Bortolameolli, UW-Eau Claire
WiSys Quick Pitch Winner

A Search for Industrial Waste and Buried Logs in Rib Lake: A Ground Penetrating Radar Test Using Ice as a Platform

Between the years of 1882 and 1948 industrial waste from the local timber mill was deposited into Rib Lake. In addition, Rib Lake was used as a holding pond for logs. Occasionally, logs would break away from the cluster and sink to the bottom. Today the organic waste is responsible for deteriorating the health of the lake, due to the excess amount of algae blooming in the lake, absorbing much of the oxygen. Using Sensors & Software ground penetrating radar equipment; we shot multiple lines using 50 and 100 MHz antennae frequencies spanning over 200 meters in length. Earlier studies on the lake have been conducted by towing the equipment behind a boat in the open water. Our study involves towing the equipment across the frozen lake surface on a custom-made dual toboggan transport. We captured data containing information about the thickness of waste and location of sunken logs. After processing the data, we will create maps showing: water depth, thickness of waste, locations of submerged logs, and areas of high organic industrial waste deposits. This information will help aid in future planning of extracting logs, dredging and cleanup of the Rib Lake.

My name is Drake Bortolameolli; I was born and raised in Appleton, WI. And now am currently living in Eau Claire. I am going into my senior year of undergraduate studies at the University of Wisconsin- Eau Claire. My major is Environmental Geography with a geospatial certificate specializing in Geographic Information Systems. With this major I look at many different spatial, yet environmentally impacting issues. At the university I am a member of the Men's Lacrosse team, and have been since my freshman year. Outside of geography, I enjoy math and geology. After college I am hoping to go to graduate school, and later get a job in environmental cleanup, particularly in aquatic settings.

Aaron Emmert, UW-Eau Claire
WiSys Quick Pitch Runner-Up

Dynamic User Interactions with Evolving Artificial Intelligence and Environment

The problem with existing technology for video game development is that game environments are static meaning they do not change, in that they provide for little or no interaction with the player. As a result once the player beats the game, they become bored and are unlikely to play the game again.

Interaction is one of the most important features in video games because it keeps the player active, engaged and challenged. As long as interactions are designed to be unique, the player is more likely to continue playing as they will be immersed in a constantly challenging environment. The technology I am developing uses dynamic interaction which will guarantee fresh gamer experience, without the need to release updated content in order to keep the players entertained.

Essentially the goal of my research is to create the butterfly effect where the decisions of both the individual NPCs and the player affect the environment at large. Which means the player in no longer the only agent of change in a video game.

I am Aaron Emmert and am originally from Superior, Wisconsin. Some of my memorable achievements during my years at High school were: becoming an Eagle Scout, being a part of the Superior delegation to Ami-machi Japan and being a youth representative on the city council.

I chose to pursue a B.S Computer Science degree at the University of Wisconsin-Eau Claire because I want to create video games. I have been a gamer most of my life and I felt most of the games I played were lacking something and I would like to understand how to fix it by being a computer scientist. It wasn't until my 5th year at college where I got my idea rolling. Professor Mike McMann was my research advisor who helped me get a student-faculty research grant and Dr. Robert Greene gave me insight into treating the English Language in a systematic way.

I am happy that my job hunt went well and I look forward to working with eIntern at Reston, Virginia in August. Perhaps, I may complete my software there.

4:30 - 5:30 pm **Spoon Wars**

5:30 - 5:45 pm **Board the Buses**

6:30 - 9:00 pm **St. Croix Boat Cruise**

Tuesday, July 28

8:00 - 9:00 am **Breakfast & Networking**

9:00 - 10:00 am **Scientific Presentations: Session 4**

Moderator: Bob Wise, Regional Associate, WiSys Technology Foundation

Bob Wise holds a B.S. in biology from UW-Stevens Point and a PhD in plant physiology from Duke University. He has been a faculty member at UW-Oshkosh since 1993 and served roles as Interim Grants Director and Chair of the Faculty Development Program. Bob joined WiSys in the fall of 2014 as the organization's first Regional Associate. His primary responsibilities are to interface with faculty, staff and students at UW-Green Bay, UW-Stevens Point and UW-Oshkosh and help manage Intellectual Property, projects and grants.

Gokul Gopalakrishnan, UW-Platteville

Silicon Nanomembranes for Piezoresistive Pressure Sensors

Silicon nanomembranes are suspended single-crystal sheets of silicon, tens of nanometers thick, with areas exceeding thousands of square micrometers. Challenges in fabrication arise from buckling instabilities induced strains in the silicon-on-insulator (SOI) starting material. I recently developed a simple technique to fabricate flat nanomembranes using an elastically metastable configuration. This ability to cheaply produce flat nanomembranes beyond the buckling threshold expands opportunities to study nanoscale physics free from the influence of a nearby substrate, but also provides a technology platform for smaller and more sensitive micro-electromechanical systems (MEMS) devices. My focus is on MEMS pressure sensors, which currently match the sales of the seemingly ubiquitous MEMS accelerometer, with applications in portable electronics, aviation, automotive, and medical industries.

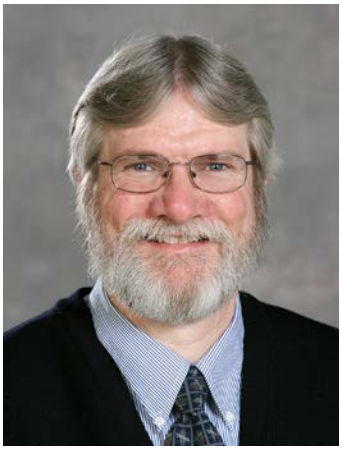
Gokul Gopal's doctoral work at the Ohio State University involved studying phonon mediated quantum Hall phenomena. He went on to a postdoctoral fellowship at the School of Engineering and Applied Sciences at Harvard University, where he investigated the metal-insulator transition in thin film vanadium dioxide, a technologically interesting material for high-speed opto-electronic devices. As a research associate at UW-Madison, Dr. Gopal developed x-ray scattering tools to probe phonons in nanoscale crystalline solids. Currently an assistant professor at UW-Platteville, he is developing techniques to fabricate and characterize freestanding semiconductor nanostructures, important for the science and technology of micro- and nano-electromechanical systems.

John Droske, UW-Stevens Point

Green Thermosets: Phase II

Recent work in our group has focused on the synthesis of thermosetting polymers that can be reused or composted at the material's end-of-life. Thermosets, such as automobile tires and epoxy resins, are known for their durability, insolubility, and thermal resistance. These desirable properties contribute to thermosets being among the most challenging polymeric (i.e., plastic) materials to recycle and reuse. We have synthesized thermosetting polymers of mercapto-succinic acid (MSA) and various aliphatic diols that offer unique properties. The approach we have taken employs disulfide linkages, the crosslinking groups found in proteins. These "green" thermosets can be made from renewable monomers and are expected to degrade to low toxicity, environmentally acceptable products after use. Sulfur linkages were incorporated into pre-polymers by employing a solventless, "green" synthesis and the crosslink density in cured materials was controlled by modifying the monomer feed ratio during synthesis or by adjustment of the processing conditions. The cured "plastic" resins

have been characterized and processed materials degraded fully (<2 mm particle size) under industrial compost conditions. Further characterization of these unusual thermosetting resins with a focus on technology transfer towards applications will be presented.



John is Professor of Chemistry at UW-Stevens Point and Director of the POLYED National Information Center for Polymer Education which is housed at UW-SP. His current work focuses on the synthesis and characterization of "green" degradable thermosets for sustainable technologies. His group also has prepared advanced composite matrix resins in collaboration with NASA-Glenn Research Center. He has assisted the Smithsonian Institution's National Air and Space Museum with their efforts to preserve the Apollo and Gemini spacesuits and to restore the Saturn V rocket at Johnson Space Center. More than 100 undergraduates have worked in his research lab. John's research has been funded by grants from WiSys Technology Foundation, the National Science Foundation, Wisconsin Institute for Sustainable Technologies, NASA, and the Smithsonian Institution. John received his B.S. and M.S. in Chemistry from DePaul University and his Ph.D. in Organic Chemistry from Colorado State University.

Robert McGaff, UW-La Crosse

From "Basic" Research to Commercially Viable Chemical Transformation Methodologies: A Case Study in Applied "Green" Chemistry

Research in our group over the course of the past several years has centered on catalytic organic oxidations such as the conversion of alkanes into alcohols, the synthesis of epoxides from olefins, and the preparation of aldehydes and ketones from primary and secondary alcohols, respectively. Our focus over approximately the past two years has been on alcohol oxidations that are important in a commercial sense due to their utility in the production of end-use organics and precursors for commodity chemicals and pharmaceuticals. More specifically, we have endeavored to discover alcohol oxidation methodologies that could hold economic advantages over those that have been commonly employed in industrial settings over the past several decades. My presentation will briefly touch upon the basic research that was the genesis of our currently active applied investigations, but greater emphasis will be placed upon the process of focusing chemical research in an applied sense by recognizing specific "niche" applications and developing these into commercially viable methods. More specifically, I will present a brief synopsis of our general strategies for discovering economically superior technologies for alcohol oxidations through the reduction or elimination of production costs associated with the use and disposal of environmentally harmful and expensive organic solvents and large amounts of expensive and dangerous oxidants. Potential applications of new technologies that are specific to the Wisconsin economy will be discussed briefly, and a projected longer-range timeline, including possibilities for collaboration with both private and public entities will be presented.

Rob McGaff earned his undergraduate degree in chemistry at UW-Eau Claire where he conducted research under the direction of Professor John R. Pladziewicz. He then attended UW-Madison, where his major Professor was Donald F. Gaines, and earned a Ph.D. in inorganic chemistry in 1995. Rob then began a post-doctoral fellowship at Northwestern University under the direction of Professor James A. Ibers, followed by a return to UW-Madison for another post-doctoral appointment under Professor Paul M. Treichel. He then joined the faculty at UW-La Crosse in 1998, where he has conducted research in collaboration with undergraduate students for the past seventeen years. His group currently focuses on the discovery of commercially viable green methods for catalytic organic oxidations.

10:00 - 10:30 am **Break & Networking**

10:30 - 11:30 am **Wisconsin Innovation and Entrepreneurship Resources**

Moderator: Jennifer Cook, Associate Director, WiSys Technology Foundation

See page 14 for Jennifer's biography and headshot.

Mike Cenci, Intellectual Property & Contracts Associate, WiSys Technology Foundation

Mike Cenci has 8 years of experience in Intellectual Property protection, market research and portfolio management. He oversees the patent process for WiSys from disclosure to issuance; including analyzing incoming technologies and performing all docketing and file maintenance both paper and electronic. He also performs contract managment for licenses, grants and researcher contracts including CDAs, MTAs and IIAs, and also manages the WiSys website among other roles. Cenci graduated with his Bachelors from UW-Madison, and has been working for WiSys ever since.

John Fick, Product Development Engineer, 3DC

John Fick graduated with a degree in mechanical engineering from UW-Platteville and has 10 years of experience working for a variety of engineering firms including TVI corp, Avon Protection and Rosenbauer America. In his current role at the Center for Device Design and Development (3DC), John spearheads the program's prototyping efforts. He works closely with external innovators and small Wisconsin based companies as well as UW System faculty, staff and students connecting them with the resources they need to further develop, prototype, test, patent and market their ideas.

3DC is a partnership between UW-Fox Valley and UW-Platteville and serves an invaluable prototype development resource for the state.

Derek Riley, Co-Founder, App Factory

Derek Riley grew up in Onalaska, WI and studied computer science and mathematics at Wartburg College in Waverly, IA. He earned his PhD in computer science from Vanderbilt University in 2009. Derek is currently an Assistant Professor of Computer Science at the University of Wisconsin- Parkside and does research in biochemical modeling, mobile computing, and software engineering. He is a co-founder of the App Factory at UW-Parkside, which is a creative, professional, interdisciplinary group on the UW-Parkside campus that develops mobile apps for community clients. We provide conceptual designing and prototype mobile app development services to help find solutions and strategies for technology challenges.

Students, both graduate and undergraduate, and faculty from computer science, business, art, and other disciplines collaborate to create these apps in a "startup company" environment. Students gain real world experience working with clients and working on live projects as part of internships or course credit.

David Linz, Associate Director, Center for Technology Commercialization

David Linz has a varied professional background as an engineer, manager, research program manager, software business development executive, management and technical consultant, and entrepreneur. He currently is Associate Director for the Center for Technology Commercialization (CTC), providing technology

businesses assistance with business model development using Lean Startup best practices, business plans, investor presentations, and Small Business Innovation Research grant proposal preparation. In 10 years with CTC and its predecessor organization, Linz has provided strategic guidance and assistance for over 500 companies, and helping several technology companies secure over $20M in competitive SBIR/STTR funding. Before joining CTC, he had 30+ years professional experience includes managing senior engineering and scientist staff at a Fortune 20 technology company and a major research Institute, an executive position in business development for a high tech software company, and organizing and leading multimillion dollar R&D projects and industry consortia. His education background includes B.S in Chemical Engineering and a M.S. in Nuclear Engineering, both from the University of Arizona, and an MBA from Webster University.

Aaron Hagar, Technology Investment Manager, Wisconsin Economic Development Corporation

Aaron's primary role with the WEDC is to work directly with entrepreneurs, investors, economic development professionals, government officials, and other parties to address the funding needs of early-stage, high-tech businesses. Aaron's professional career started in bio-medical research where he performed research on the immune response to brain tumors. A desire to work in a more dynamic environment led him to graduate school and to work as an independent economic development consultant. This diverse background provides him with a unique perspective on technology, entrepreneurship, and economic development. Aaron has a master's in Urban and Regional Planning with a specialization in Economic Development from the University of Minnesota and a B.S. from the UW – Madison in Medical Microbiology and Immunology.

As Wisconsin's lead economic development agency, with more than 600 regional and local partners, the Wisconsin Economic Development Corporation (WEDC) fosters the cooperation necessary to support job creation. Our collaborative, customer-centric approach aligns resources, partners and industries to accelerate long-term, sustainable growth. As a public-private entity formed to drive business development in Wisconsin, we are uniquely positioned to deploy funds where they are most needed to maximize economic opportunity.

11:45 - 1:00 pm Luncheon

Cathy Sandeen, Chancellor, UW Colleges and UW-Extension

New Face of the Wisconsin Idea

Cathy Sandeen, Ph.D., began her appointment as the third chancellor of the University of Wisconsin Colleges and University of Wisconsin-Extension on December 15, 2014. Sandeen previously was vice president for education attainment and innovation at the American Council on Education (ACE), the nation's largest and most visible association representing all sectors of higher education. From 2006 to 2012, Sandeen served as dean of UCLA Extension at the University of California Los Angeles. Serving more than 50,000 students per year, UCLA Extension is one of the nation's largest programs reaching nontraditional students with a variety of innovative programs. Sandeen has more than 22 years of leadership experience at three University of California campuses. Prior to joining UCLA, she served for six years as vice provost and dean of University Extension and the summer session at University of California Santa Cruz. Prior to UC Santa Cruz, she held several positions at University of California San Francisco. Nominated to the WiSys Advisory Committee by President Ray Cross, she is serving a two-year term that began January, 2015.

1:00 - 2:15 pm Company Presentations

Moderator: David Linz, Associate Director, Center for Technology Commercialization

See page 21 for David's biography and headshot.

Craig Davis, CEO, NovaScan, LLC

Cellular electrical impedance has a lengthy, mixed history in cancer and cancer detection. Impedance does vary with cancer, but it also varies with mass and other variables. To address this, several companies have measured other variables alongside impedance in order to improve the accuracy of their determinations.

NovaScan's breakthrough was in realizing that one

parameter that is a part of impedance, the Cole relaxation frequency, is several orders of magnitude different for cancerous cells than it is for normal cells. The relaxation frequency does not vary with mass or other variables, only with the presence of cancer. Moreover, given the magnitude of the difference, using this parameter to detect the presence of cancer results in extremely high sensitivity and specificity. Finally, a device that measures this can be small and inexpensive to produce; the vast majority of the complexity is in the associated software. NovaScan has developed IP around this and is the only company that can leverage the Cole relaxation frequency to detect the presence of cancer.

In more than 350 patients across both breast and skin cancer, NovaScan has had 100% sensitivity and nearly perfect specificity.

NovaScan is commencing discussions with the FDA on the Colrel device for Mohs surgery. After a pivotal trial, the company estimates that it will obtain clearance by late 2017 or early 2018.

NovaScan's CEO Craig Davis has deep experience in medtech startups, and its CSO / founder is Dr. William Gregory, the former Dean of the Engineering school at the University of Wisconsin Milwaukee. NovaScan has received more than $2MM financing from NSF. The Company has a diverse investor base; the largest investor is Aurora Health Care.

Craig Davis is an experienced executive with an extensive background in both entrepreneurial concerns and medical device companies. Currently, Craig is the CEO of NovaScan, an oncology diagnostics firm that leverages technology developed at the University of Wisconsin Milwaukee in producing a unique method of cancer detection that is compact, highly accurate, instantaneous, and extremely low cost. Previously, he a partner at LaSalle Investments and an Associate Partner at Healthios, a healthcare-focused merchant bank and advisory firm founded by former Baxter CEO Vern Loucks, where he led firm practices in gynecology, urology, and cardiology. Before joining Healthios, Mr. Davis was a member of a senior management team that raised $350MM in private equity capital from Bruce Rauner at GTCR in support of a rollup of gynecological and urological device companies.

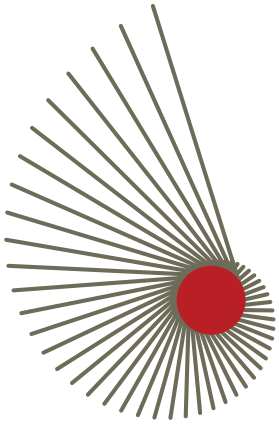
Previous to this, Craig was employed as an Associate, Manager, and then Principal at Strategic Leverage Consultants, a boutique strategy consulting firm focused on developing strategies and opportunities for profitable growth, and worked for Herbst LaZar Bell, where he led the firm product strategy practice. Over the course of his career, Craig has led engagements with both small and large medical technology companies including Abbott, American Medical Systems, Analyte Health, Baxter, BioSphere Medical, Celsion, EM Kinetics, MD Technologies, Urologix, and many, many others.

Mr. Davis currently serves on the Board of Directors of Design Integrity. Craig obtained a BS in mechanical engineering from Washington University, and MBA and MS Engineering Management degrees from the Kellogg and McCormick Schools at Northwestern. He lives in Chicago with his wife and young son.

Dan McGuire, Eric Hellstrom, Innovative Foundry Technologies, LLC & Foundry Solutions LLC

Over the course of 13 years, university researchers Eric Hellstrom, Dan McGuire, and Charlie Olson have worked closely through WiSys to collaborate with industrial foundries in order to perfect and transfer class room inventions into commercially viable practices. The researchers will share applied WiSys technologies and discuss their experiences commercializing these modern metal casting practices. This body of applied research was made possible due to all three researchers working with students in the class room, as well developing long-term trusted relationship between the researchers and industry.

Eric Hellstrom is Professor Emeritus of Materials Science and Engineering at UW-Madison, Madison, WI; Professor of Mechanical Engineering at Florida State University, Tallahassee, FL. and Co-Partner



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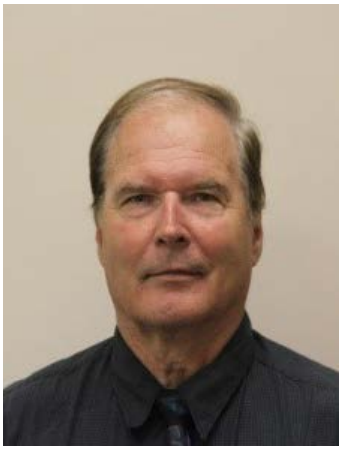
with Dan McGuire in forming Foundry Solutions LLC; out of the Whitewater Innovation Center, Whitewater, WI.

Daniel S. McGuire is Professor of Art, UW-Whitewater, Whitewater, WI. He is co-partner with Eric Hellstrom - Foundry Solutions LLC, Whitewater Innovation Center, Whitewater, WI.

Mark Mueller, Founder and CTO, Botanic Innovations, LLC

Botanic Innovations, LLC is a life science company with a broad foundation of technologies and products in natural raw ingredient processing. The company sells its ingredient products to other businesses for inclusion in beauty, skincare and dietary supplement products. Skin lightening, skin tone eveners and hyper pigmentation correcting agents are sold in a great variety of skin care and beauty products. It represents a $16 to $20 billion dollar worldwide market. The primary agent in current use is hydroquinone, however, it has serious side effects. It's use is banned in Europe and in some states. Natural compounds found in fruit and vegetables are potential new sources of therapeutics, and this is currently being explored in collaboration with UW-Oshkosh.



Mark Mueller has combined a career in business and a life long interest in plants to start Botanic Innovations, LLC in 2001, a company focused on "foods as medicines" and based on the exceptional nutrition and health attributes of cold extracted raw botanic seed lipids. He began his career as naturalist with the US National Park Service and then later as a director of a business innovation corporation in Wisconsin and as a director of a technology transfer office with the University of Minnesota Duluth. Mark is a graduate of the University Wisconsin Stevens Point with a Bachelor of science degree and a master of science degree from the University of Wisconsin Madison.

Eric Wenz, CEO, Ashlynn Industries, LLC

The soap revolution is coming. Introducing the non-toxic, biodegradable SoPOD, a multipurpose liquid soap pod that reduces waste and offers a convenient personal care product alternative for travelers around the world. A dissolvable film paired with a plant-based customizable liquid soap creates an easy, convenient way to clean up without all the plastic. As hotels increase their sustainability standards, SoPOD offers a solution for reducing their plastics waste by up to 18%. With applications in body wash, shampoo, conditioner and hand soap, the possibilities are endless with SoPOD. Ditch the plastic and feel fantastic, switch to SoPOD.

Eric J Wenz is the founder and CEO of Ashlynn Industries - the company behind SōPOD - and a 2015 graduate from the UWRF College of Business and Economics. Eric received his bachelor's degree in Business Administration along with several awards including the Rochelle Junkman Seymour Award for the highest GPA and the Dean's Special Recognition Award for his work with SōPOD. Under Eric's leadership, the SōPOD team achieved first place at both the UWRF New Venture Competition and the Wisconsin Big Idea Tournament and were semifinalists at the International Business Model Competition. In his free time, Eric enjoys coaching snowboarding and traveling with his wife and daughter.

2:15 - 2:30 pm Closing Remarks

Fernando Delgado, Provost and Vice Chancellor for Academic Affairs, UW-River Falls

Fernando Delgado currently serves as Provost and Vice Chancellor for Academic Affairs at the University of Wisconsin-River Falls. Prior to his current post, Dr. Delgado served as a Dean at both MSU-Mankato and Hamline University. He began his career as a faculty member and

then as Associate Vice Provost from Academic Programs and Graduate Studies at Arizona State University (West Campus). Dr. Delgado is trained in intercultural communication, having received his Ph.D. in the field from The University of Iowa, and has published widely on issues related to culture, identity, and communication. He has a passion for international education and has lectured, established inter-institutional partnerships, or is responsible for campus education centers on five continents.

Poster Abstracts

1) Inactivation of Sucrose Synthesis in the Cynobacteriam Synechococcus PCC 7002 for Increased Production of Isoprenoid Hydrocarbons

Sara Arafeh, Brandon Brummeyer, Toivo Kallas, UW-Oshkosh

Cyanobacteria are bacteria that obtain energy from sunlight, produce large amounts of oxygen, and consume atmospheric carbon dioxide (CO2) during photosynthesis. Native cyanobacteria synthesize little or no biofuel products such as isoprene, pinene or ethanol. However, some cyanobacteria have been engineered to synthesize bioactive compounds such as bioplastics (Erdrich et al. 2014) and isoprene (Figure 1), which is a precursor for synthetic rubber and high-density liquid biofuels. Because of the deterioration of fossil fuel resources, a focus has been on use of biomass to produce biofuels as alternative sources of renewable energy. A potentially more efficient way to produce liquid biofuels is by genetic engineering of cyanobacteria to produce isoprene and other hydrocarbon fuels.

2) The Development of a Cold Atmospheric Pressure Pulsed Plasma Reactor; To Achieve Surface Modification Using the Plasma Immersion Ion Implantation Method

Marion Titze, Jacob Bogenschuetz, UW-Whitewater

Our research dealt with the design and development of a plasma reactor that is capable of producing cold atmospheric pressure pulsed plasma for the use of modifying the surface of polymer materials, using the plasma immersion ion implantation method. The purpose of the research behind the development of the reactor is to look at improving the biocompatibility of medical implants with plasma immersion ion implantation.

3) Evaluation of the Behavioral Differences Between Physically and Immunologically Castrated Male Pigs

Bailey Post, Andrew Keller, Ben Lemmer, Sam Getty, Megan Nickel, Faith Baier, Dana Wagner and Kurt D. Vogel, UW-River Falls

The standard method of castration for swine in the United States is to physically remove the testes within the first month of life, typically without the use of anesthesia or analgesia. An alternative solution to this welfare issue is to use immunological castration. This pilot study was conducted to evaluate the behavioral differences between male pigs castrated physically or immunologically. The study was conducted on 31 male pigs housed in finishing pens from 11 weeks of age until 24 weeks of age. The 31 pigs were randomly assigned to three pens of eight and one pen of seven. Two pens were physically castrated (PHYSIC) while the other two were immunologically castrated (IMPRO), using a commercially available immunological product that was designed to suppress puberty in male swine (Improvest®, Zoetis, Florham Park, New Jersey). The first injection was administered on day one of the trial; four weeks later, a second injection was administered, both by a trained Zoetis employee. Eight weeks after the second injection, the pigs were sent to slaughter. Behavior was assessed using continuous 24 hour video surveillance that began

on day one of the trial to correspond to the first injection date and repeated at weekly intervals for the duration of the trial. Scan sampling was used on all pigs in all pens at two minute intervals. Time budgets were recorded and analyzed for comparison between treatment groups and behavior sampling dates. Of the behavioral parameters measured (laying, standing exclusively, sitting exclusively, walking, eating while standing, eating while sitting, drinking while standing, drinking while sitting, agonistic while standing, and agonistic while sitting) there were no significant differences between treatments ($P > 0.05$). There was a castration treatment by week on trial interaction effect on expression of mounting behavior ($P = 0.0012$). Although an interaction effect was observed, the exact cause is unclear because significant differences were not recognized on a consistent basis from sampling day to sampling day. The results of this pilot study suggest that additional research is necessary to understand if behavioral implications exist for immunologically castrated swine. A larger sample size is required to fully investigate these effects.

4) Traffic Monitoring App

Blake Kaner, Liquiang Chen, UW-Eau Claire

In this project, we plan to primarily use the programming language Java to create a mobile application for Android devices. The app will take the coordinates of the users and send them to a web service which stores the coordinates in a database. In turn, the web service sends the traffic status back to the app based on its geolocation on the Google Map. The app will have different colors highlighting the road that will correspond with different levels of traffic.

We believe that the development of this app will be able to change almost all users' daily lives. Seeing how bad traffic is at any given time can help them plan how much time it will take them to get to their destination, making it much easier to be on time, but not too early. This app might also be used to show which roads should be avoided when the user plans his/her route, saving lots of time. In addition, the app can report real-time alerts such as tornado warning, car accident if the web service connects to other services.

Once the app is developed, we plan on collaborating with the Marketing department at UWEC for help marketing the app. Additionally, we plan to make updates, changes, and additions to the app as necessary.

We firmly believe that it is a very valuable experience for a student to go through the process of going through the entire process of using programming skills to complete a project that can actually be used and applied in the daily lives of many people. While it may be difficult at times, it will be a very rewarding experience.

5) A Search for Industrial Waste and Buried Logs in Rib Lake: A Ground Penetrating Radar Test Using Ice as a Platform

Drake Bortolameolli, Sean Morrison, Harry Jol, UW-Eau Claire; Arlen Albrecht, UW Extension

The purpose of this collaborative research project is to use ground penetrating radar to detect the amount of organic industrial waste that has accumulated on the bottom of Rib Lake. Between the years of 1882 and 1948 industrial waste from the local timber mill was deposited into the lake. In addition, Rib Lake was used as a holding pond for logs. Occasionally, logs would break away from the cluster and sink to the bottom. Today the organic waste is responsible for deteriorating the health of the lake, due to the excess amount of algae blooming in the lake, absorbing much of the oxygen. Using Sensors & Software ground penetrating radar equipment; we shot multiple lines using 50 and 100 MHz antennae frequencies spanning over 200 meters in length. Earlier studies on the lake have been conducted by towing the equipment behind a boat in the open water. Our study involves towing the equipment across the frozen lake surface on a custom-made dual toboggan transport. We captured data containing information about the thickness of waste and location of sunken logs. After processing the data, we will create maps showing: water depth, thickness of waste, locations of submerged logs, and areas of high organic industrial waste deposits. This information will help aid in future planning of extracting logs, dredging and cleanup of the Rib Lake.

6) BTLE Remote Control Car

Dustin Anderson, Sergei Bezroukov, UW-Superior

The Bluetooth Low Energy Remote Control Car poster will consist of a hardware section which will discuss the MSP430 micro-controller, the RN4020 BTLE module, and the PWM drivers used on the project. This section will also contain a wiring schematic and photo of the project. The poster will also contain a firmware section which will explain the code used within the project, along with the different programs that were used for programming both the MSP430 and the RN4020 module. There will also be an overview section which will provide a high-level abstract view of the entire project along with possible future enhancement ideas. The final section will be devoted to the Android application which was developed to control the car and provide information regarding the development process of Android BTLE applications.

7) Assessing American and Chinese Citizen Support for Joining an International Climate Change Treaty

Helue Vazquez Valverde, David Hahn, UW-Eau Claire

Climate change could be the single most important issue of our time. China and the United States share the highest importance related to potential climate change mitigation policies because they are the world's two largest greenhouse gas (GHG) polluters and the two largest economies. Efforts to address climate change through international cooperation have largely taken place through the United Nation Framework Convention on Climate Change (UNFCCC). These negotiations have been highlighted by tensions between developed and developing countries regarding what actions to take and who should bear the costs. The Kyoto Protocol, passed in 1997 and entered into force by ratifying countries in 2005 did not call for GHG reductions by developing countries, thus placing the burden of change on developed nations. The fact that China was not required to reduce emissions under Kyoto was cited as an important determinant in the United States decision to not ratify this treaty. Despite some successes, the Kyoto Protocol has largely failed as a result of the differential treatment of developed and developing nations and the lack of United States and Chinese involvement. In fact, the interaction between China and the United States with respect to climate negotiations can best be described as somewhat adversarial. Because meaningful climate change action will require the cooperation and participation of both China and the United States, it is increasingly important to understand what Chinese and American citizens think about this issue. Thus, a better understanding of public support for climate policy action in both countries is of great interest. We use data from surveys conducted in the US (n=3,641) and China (n=3,717) between September and November 2013 to explore American and Chinese views regarding whether or not their country should join an international treaty to address climate change. We find significantly greater support for joining an international climate treaty in China (86.5%) compared to the US (68.8%). Support for joining an international climate change agreement drops by approximately 10 percentage points in each country if it is stated that the other country will not also join the treaty. Our analysis also reveals a positive correlation between support for international climate action and acceptance of the substantial scientific consensus regarding the realities of anthropogenic climate change. The results of this study should be interesting and informative to all parties considering the issue of global climate change policy. This presentation leads into a second presentation comparing American and Chinese citizens' willingness to pay for climate change mitigation policy action using the same data.

8) A Contingent Valuation Study Comparing Public Willingness to Pay for Climate Change Mitigation in China and the United States

Brittany Flaherty, Emily Koehn, Gregory Sikowski, UW-Eau Claire

Climate change could be the single most important issue of our time. As the world's two largest greenhouse gas (GHG) polluters, the United States and China are of particular interest in the discussion on climate change. Because the costs/benefits of taking climate action arise in a non-market environmental setting, we employ

a contingent valuation method to estimate public willingness-to-pay (WTP) as a measure of supporting policy action. Specifically, this study employs a double-bounded dichotomous choice (DBDC) framework to elicit WTP values from citizens in both China and the United States. The data used here are from surveys conducted in the United States (n=3,641) and China (n=3,717) between September and November 2013. The DBDC model consists of two WTP questions both of which can be answered yes or no. Respondents were informed that most policies to address climate change involve putting a price on GHG emissions that will likely increase household expenditures on heating, electricity, transportation, food and other goods and services. They were then asked if they would support a policy to address climate change if it increased their average monthly household expenditures by one of three initial bid amounts. Responses of no to that bid amount are followed up with a lower amount, while yes responses are followed up with a higher amount. As a validity check, bid value and acceptance rates were examined. Importantly, a declining acceptance for higher compared to lower bids was found. Specifically, a chi-square test finds a strong statistical relationship between the two variables. This is consistent with economic theory that demand (marginal WTP) is expected to decline with an increase in price. We find that on average, Chinese WTP is about one-third of United States WTP measured in US dollars. However, adjusting for income differences across countries, we find average Chinese WTP is approximately twice the level of United States WTP. Our results also show a positive correlation between climate change and environmental awareness variables and WTP in both countries. In addition, political ideology for United States respondents is found to have a significant influence on WTP even when controlling for other covariates, such as environmental concern and climate change belief. These findings are especially important given the anticipated costs of addressing climate change by putting a price on GHG emissions. This presentation builds on our first presentation exploring American and Chinese citizens' views on whether they think their country should join an international climate change treaty using data from the same survey.

9) Smart Diblock Copolymers for Enhanced Oil Recovery Applications

Elizabeth Stubbs, Elizabeth Glogowski, UW-Eau Claire

Smart polymers have the potential to be used in enhanced oil recovery applications due to their smart properties that allow the polymer to respond to an external stimulus, such as polymer concentration, temperature, or pH. Smart polymer properties depend on polymer molecular weight and architecture. The diblock copolymer, poly(ethylene glycol) -block- poly(2-(dimethylamino)ethyl methacrylate) (PEG-PDMAEMA), was synthesized with varying molecular weights to determine the effect of the polymer structure on the smart properties. Proton nuclear magnetic resonance (1H-NMR) spectroscopy and gel permeation chromatography (GPC) were used to determine the molecular weight and chain length distribution of the polymer. Ultraviolet-visible spectroscopy (UV-Vis) and dynamic light scattering (DLS) were used to determine the aggregation behavior in response to temperature. The viscosity and interfacial tension properties of the polymer were measured using the rheometer and tensiometer, respectively. Results of these measurements show that smart diblock copolymer, PEG-PDMAEMA, has the potential to be used for enhanced oil recovery applications.

10) Synthesis of Furanokurzin: A Biologically Active Compound

Jeremy Schultz, Stacey Stoffregen, UW-River Falls

Furanokurzin is a recently discovered compound that was found to inhibit acetylcholinesterase in vitro. As a result, this compound may have usefulness as a treatment for alzheimer's disease and other ailments. Since only trace amounts of furanokurzin can be extracted from the natural source, a possible synthesis was proposed.

11) Synthesis, Characterization, and Study of Smart Properties of PEG-PDMAEMA Copolymers

Daniel Heinze, Elizabeth Laskowski, Elizabeth Glogowski, UW-Eau Claire

In the world of medicine there is a constant need to make drug delivery more efficient and effective. Smart polymers, or polymers with the ability to change properties in response to external stimuli, can potentially meet this need. The diblock copolymer poly(ethylene glycol)-block-poly(2-(dimethylamino)

ethyl methacrylate) (PEG-PDMAEMA) is a water-soluble smart polymer. The relationship between the PEG-PDMAEMA structure and properties has been studied as a function of temperature, pH, and ionic strength. Using Dynamic Light Scattering, UV-Visible Spectroscopy, and Fluorescence Spectroscopy the smart properties of PEG-PDMAEMA were observed. By understanding the impact of each variable on smart polymer properties, the smart material system can be tuned for applications such as drug delivery or smart gels.

12) Production and Characterization of Lutein-Nano Emulsion

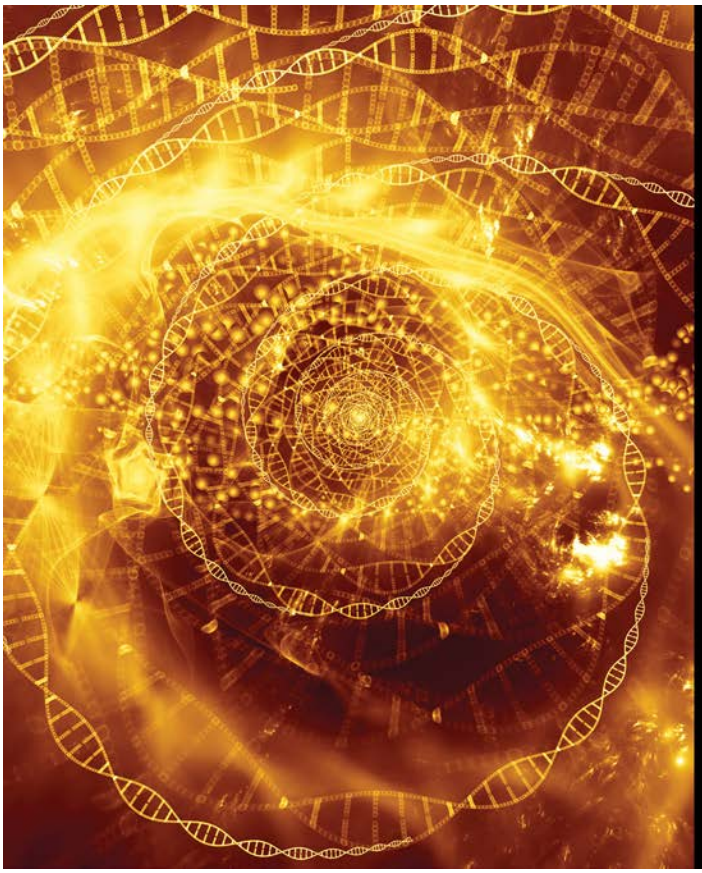
Cindy Vang, Chong Tai Kim, Eun Joo Lee, UW-Stout

Lutein, a lipid soluble bioactive compound, can play an important role in eye health, including age-related macular degeneration and cataracts. Nano-emulsion technology incorporates lipid-soluble bioactive compounds like lutein in emulsion and enables the lipid-soluble compounds in various food matrices, including beverages. In addition, nano-emulsion can improve the functional stability of lutein, which is sensitive to light and oxygen, and deteriorates easily during processing and storage. The objectives of this study were to evaluate (1) the optimal conditions for lutein nano-emulsion production, and (2) the physico-chemical properties of lutein nano-emulsion. Primary emulsions were prepared with varying compositions of lutein, water and surfactants including medium chain triglyceride (MCT), short-chain alcohols (ethanol) and polyoxyethylene sorbitan monooleate (Tween 80). Primary emulsions and water were mixed with 2.5:97.5 (w/w) and then nano-emulsions were produced using the microfluidizer under high-pressure (25,000 psi) and 3 processing cycle conditions added with 0.01% butylated hydroxyanisole and 0.05% sodium azide to prevent oxidation and deterioration. Emulsion stability (particle size distribution and zeta potential), droplet size and lutein contents of nano-emulsion were determined using particle size analyzer, zeta potential analyzer, transmission electron microscopy, and high performance liquid chromatography, respectively. Results showed that the most stable primary emulsion was produced when lutein, MCT, Tween 80, ethanol and water ratio was 0.1:35.2:5.9:11.8:47.0 (w/w). Lutein nano-emulsion appeared semi-transparent with light yellow color and high fluidity. The average particle size of lutein nano-emulsion was 65.8 nm and 77.9 nm at 0 and 7 days of storage, respectively. The zeta potential was -12.45±1.69 and -11.44±2.70 at 0 and 7 days of storage, respectively. In conclusion, lutein nano-emulsion was relatively stable during the 7-day storage and has a high potential to apply in cold-beverage production. However, further study is needed to improve the storage stability of lutein nano-emulsion to be used in beverages that require longer storage time.

13) Sizing Optically Levitated Aerosol Droplets

Elliot Pachniak, Angela Ludvigsen, UW-River Falls

An aerosol is a mix of small liquid droplets or small solid particles suspended in a gas. A naturally occurring example is a cloud. Clouds both reflect and absorb sunlight, but the amount of reflection and absorption depends on the substances in the water droplets of the cloud. To better understand these processes, scientists study individual water droplets in a laboratory environment using Optical Tweezers. Optical Tweezers use a laser beam to catch and hold small transparent objects. In this research, a highly focused argon laser beam is directed into a chamber containing fog. In the chamber, the laser beam catches an aerosol droplet and suspends it. In past observations by other UWRF student researchers, it was discovered that the droplet moves unexpectedly when held in the laser. It is hypothesized that this movement is connected to the droplet's radius relative to the wavelength of the laser light. For specific ratios of the radius and wavelength, the light on the droplet creates a resonance, a sinusoidal wave, about the circumference of the droplet. In order to investigate this process further, light emitted by the droplet is measured using a spectrometer. At the same time the spectrum is being recorded, the droplet's position is also being recorded. This Raman spectrum of intensity versus wavelength exhibits a series of peaks that appear due to the very spherical shape of the droplet (called Cavity Enhanced Raman Spectroscopy). The location and spacing of the peaks are related to the diameter and the optical properties of the droplet.



14) Pi-Expanded Coumarins with Switchable Propeller Geometries

Heather Hintz , Bart Dahl, UW-Eau Claire

Planar conjugated organic molecules have unique spectroscopic and electronic properties and find uses in many applications, including fluorescent dyes for medical applications, molecular electronics, and optical materials. We are interested in pi-expanded coumarins because they should be both planar and conjugated but should also readily switch their geometries in varying pH environments. We describe the progress toward a new soluble propeller-shaped oligophenyl trilactone with C3h symmetry. While planar under acidic conditions, the three lactone side rings are capable of opening under alkaline pH yielding two possible axial diastereomers containing three benzoate anions. The symmetric diastereomer should be preconfigured with the anionic benzoate groups on the same side of the central phenyl ring and thus should be an excellent binding agent. Systems such as these could be useful in switchable molecular recognition, ion and small molecule binding, and drug delivery.

15) Bioconversion of Paper Mill Sludge to Bioethanol in the Presence of Accelerants and Hydrogen Peroxide Pretreatment

Raghu Gurrama, Nicholas Lechera, Shona Duncana, Eric Singsaas Malek Alkasrawi, UW-Stevens Point; Mohammad Al-Shannagb, University of Jordan

In the present study we investigated technical feasibility to convert paper mill sludge into fuel ethanol. We studied the removal of mineral fillers by using chemical pretreatment and mechanical fractionation and their effects on hydrolysis and fermentation. In addition, we studied the effect of cationic polyeclectrolyte (as accelerant) addition and hydrogen peroxide pretreatment on enzymatic hydrolysis and fermentation. Our results showed that removing the fillers content (ash and calcium carbonate) from the paper mill sludge increased the enzymatic hydrolysis performance dramatically with higher cellulose conversion at faster rates. Furthermore, addition of cationic polyelectrolytes and hydrogen peroxide pretreatment improved further the hydrolysis yields by 16% and 25% (g glucose / g cellulose), respectively with the deashed sludge. When using Fermpro yeast for fermentation of deashed sludge sugar with the presence of enzyme accelerants, the process achieved up to 95% of the maximum theoretical ethanol yield and higher ethanol productivities within 9h of fermentation.

16) Analysis of Immunoglobulin Genes in Swine

Emily Stokke, Chris Zeman, Karen Klyczek, UW-River Falls

In 2009, swine flu became a pandemic. Although this is the most well known virus that has been harbored in swine, these animals can transmit several viruses to humans. Through our research analyzing the immunoglobulin genes in swine, we will better understand the immune system of swine and their immune responses to viruses such as influenza, as well as how these compare to the human immune system. Our initial focus is examining the extent of Immunoglobulin G (IgG) subclass gene polymorphism and splice site variation.. We are isolating RNA and DNA from the white blood cells of pigs at the University of Wisconsin-River Falls lab farm, and copying the RNA into cDNA. PCR is being used to amplify the various constant region domains as well as the V-D-J splicing regions. The PCR products will be cloned and sequenced. By comparing the rearranged cDNA to germline DNA, we will be able to identify splicing patterns. Genomic DNA sequences will be compared to determine allotypic difference among these animals as well as with previously studied swine.

17) Effects of Chronic Stress on Nicotine-Seeking Behavior and Reinstatement

Anna Miller, H. Klimek, A. Janke, T. Harman, James Cortright, UW-River Falls

Drug addiction is a major public health and serious economic concern in the United States costing taxpayers billions of dollars annually. Experimental evidence shows that exposure to stress is not only a factor in the development of addiction; but also a trigger for drug relapse, or reinstatement. As tobacco use has been linked

to a number of cancers and represents the leading cause of preventable death in the United States, elucidation of the effects of stress on nicotine-seeking behavior and relapse is critical. A critical role of chronic stress in the compulsion to seek tobacco and other nicotine delivering products has long been suspected. Although many studies have provided compelling evidence for a role of chronic stress in the enhanced sensitivity to cocaine-seeking behavior and relapse, few have assessed the contribution of chronic stress on nicotine-seeking behavior. In fact, stress induced cross-sensitization to nicotine remains controversial. Additionally, there have been no studies investigating the effects of chronic stress on nicotine-seeking relapse, or reinstatement. Thus, these experiments assess the ability of repeated exposure to variable stress to augment nicotine-seeking behavior and relapse in an animal model of drug addiction. Male Long-Evans rats were exposed to variable stress that consisted of the exposure to different stressors twice a day in random order for 14 days. During this period the control group was left undisturbed except for cage cleaning. Rats were allowed to self-administer nicotine (0.03 mg/kg/infusion) under fixed ratio schedules of reinforcement across 15 consecutive daily sessions. Responding under a progressive ratio schedule of reinforcement was assessed over the following six daily sessions. This schedule allows for break points to be analyzed, a measure that reflects the motivation to self-administer nicotine. Following up to 20 days of extinction training, rats were tested for nicotine-seeking behavior reinstatement by a non-contingent injection of nicotine (0.4 mg/kg, IP). Rats exposed to chronic stress acquired nicotine self-administration at a faster rate relative to controls and exhibited enhanced motivation to obtain the drug. Further, we hypothesize that exposure to chronic variable stress will lead to resistance to nicotine self-administration extinction and enhancements in nicotine-primed reinstatement, or relapse. Collectively, these findings indicate that chronic stress can enhance the motivational effects of nicotine.

18) Solvent-Free Oxidation of Benzylic Alcohols Catalyzed by an Iron Phthalocyanine Derivative

Rachel Neve, Brian Peterson, Morgan Herried, Robert McGaff, UW-La Crosse

Four benzylic alcohols—benzyl alcohol, 4-chlorobenzyl alcohol, 1-phenylethanol, and benzyhydrol—were oxidized to the respective aldehydes or ketones using hydrogen peroxide or tertbutyl hydroperoxide as the primary oxidants and an iron (III) phthalocyanine-derived catalyst. The reactions show high high turnover numbers and turnover frequencies and proceeded with excellent selectivity. Significantly, no organic solvents other than the substrates themselves were necessary.

19) Protective Cap for Aquatic Sports

Daniel Weispfenning, UW-Stout

The project's goal is to develop protective headgear for aquatic sport (such as water polo or underwater hockey) athletes. Athletes in aquatic sports face hazards that cannot be addressed with currently available equipment. Currently used caps feature rigid plastic cups which protect ears from contusions which can lead to the condition cauliflower ear, but increase the chances of a burst eardrum when struck. (Drum, 2007) To address both issues, a flexible solution involving layers of rubber and monofilament spacer mesh was developed to both protect the outer ear from impact and provide sufficient drainage to prevent situations where water would rush into the ear canal.

Another injury the cap is designed to prevent is concussions. Due to the unique play environment, foams which provide impact protection for other sports could not be used, (Zylius, 2015) so the cap uses a novel strategy to minimize cranial impact. Instead of cushioning blows to the head, the cap attempts to redirect the force. The shell of the cap is a low-friction nylon textile. The low-friction textile converts direct blows to glancing blows lessening the force exerted on the wearer. The cap also addresses issues of fit so a single size is able to be worn by all athletes and thermal regulation to ensure comfort.

20) Effects of γ-Irradiation on ZnO Thin Films

Seth King, Sarah Lantvit, UW-La Crosse; Sara Chamberlin, UW-Milwaukee

The development of new photovoltaic and photocatalytic devices to offset the need for fossil fuels has led to a scientific race to understand the fundamental properties of new and novel materials which may be employed in such devices. Zinc oxide (ZnO) shows great promise for such photoactive oxide applications [1,2], and is cheap, abundant, and generally

non-toxic. However, little is known about how the properties of ZnO may be altered by prolonged exposure to electromagnetic radiation [3].

To investigate how the properties of ZnO may change with extended irradiation, sputter deposited ZnO thin films were exposed to prolonged gamma radiation in a 400 Ci 137Cs irradiator. After varying durations of exposure, the optical, structural, and electronic properties of the film were examined. UV-Vis spectrometry and spectroscopic ellipsometry shows little variation in the over-all transmittance, optical constants, or optical bandgap of the irradiated films. Continued exposure shows a decrease in the films' resistivity, which, along with supporting x-ray photoelectron spectroscopy data, suggests that O-vacancies are acting as donors within the irradiated films.

21) Properties of Cu Doped ZnO Thin Films Grown by Spray Pyrolysis

Christopher Case, Samantha Coffey, UW-La Crosse

The need for low cost photovoltaic (PV) cells to become available to the mainstream consumer is critical to decrease our dependence on fossil fuels. Thin film solar technology provides a current flexible option to fill this need. Zinc Oxide (ZnO) is becoming a commonly employed transparent conducting oxide (TCO) for use in this capacity due to its low cost, and optical and electrical properties such as: large optical band gap, and high transmittance in the visible [1,2]. Copper Oxides provided some of the earliest environmentally friendly uses as a photovoltaic source due to its low Band Gap energy, high conductivity, abundance, and cost [3,4]. Therefore it is logical to investigate at the fundamental properties of copper doped zinc oxide as a potential TCO.

Cu doped ZnO thin films were deposited on BK7 and Si (001) substrates via spray pyrolysis. Structural and elemental properties were analyzed using X-Ray Diffraction (XRD), X-Ray Photoelectron Spectroscopy (XPS), and Atomic Force Microscopy (AFM). The optical properties, measured using UV-Vis, showed a marked improvement in the optical transmittance for Cu doped films, while no significant change was observed for optical band gap. Finally, films were annealed and properties were analyzed again to investigate at the affects that post-deposition heat treatment for this material.

22) Investigating the Role of Resistance in the Detection Circuitry of Quantum-Dot-Based Single-Photon Detectors

Benjamin Vinz , Eric Gansen, UW-La Crosse

The development of single-photon detectors (SPDs) is critical to advancing low-light measurements in fields such as quantum-information technology, chemistry, and medicine. Single-photon detection can be achieved by using quantum dots consisting of nanometer-sized islands of InGaAs. The quantum dots are elements of a GaAs/AlGaAs high-electron mobility transistor, known as a QDOGFET (quantum dot, optically gated, field-effect transistor). The role of the quantum dots in the transistor is to act as optically addressable floating gates for the transistor channel. When a photon is absorbed by a quantum dot, it becomes photo-charged and screens the electric field produced by the gate voltage, effectively changing it. Since the amount of current is controlled by the gate voltage, the current flowing through the transistor changes. This change in current is measured as a voltage change across a load resistor, connected in series with the QDOGFET channel. These voltage changes are small enough that electrical noise (random variations in the voltage) can obscure measurements of the voltage. The noise in the QDOGFET has been shown to be directly proportional to the temperature of the QDOGFET. As a result, electrical noise has limited the effective operating temperature of QDOGFETs to temperatures near 6 K, where thermal noise is limited. Cooling the QDOGFETs to such a low temperature adds cost and complexity to the overall detection system, making it highly undesirable for real-world applications.

The goal of my research is to optimize the detection circuitry so that QDOGFETs may be operated at higher temperatures. In my presentation I will discuss how load resistance and the resistance of the QDOGFET channel impact the photo-response of the QDOGFET detection system. I will present the results of optical measurements that show explicitly how the sensitivity (quantified by the signal-to-noise ratio) depends on the load and channel resistances, the detection frequency, and the operating temperature. I will also show that by optimizing the resistances, QDOGFETs can detect single photons with a signal-to-noise ratio greater than 3:1 at 77K.

23) U.S. Natural Gas Pipeline System Growth 1960-2015

Jason Blatz, Charles Rader, UW-River Falls

Natural Gas is one the major sources of energy. It accounts for 25% of all the energy used in the US. Natural gas is used for heating buildings, cooking, and outdoor lighting. It is also used as a fuel to create steel, glass, paper, clothing, brick, and electricity. Natural gas production is expected to increase 56% by 2040 due to the increase in shale natural gas production.

Beginning in the late 19th century, natural gas pipelines were used to supply lighting for towns. During the 1920s, pipelines started to expand across state lines. Following World War II, natural gas pipelines spanned the US. This project focuses on growth of interstate pipelines from 1960-2015. It analyzes what increased and/or hindered development in certain regions during each decade. Additionally, it explores which regions produce and consume natural gas.

24) The Effects of P.G. 600 on Follicle Growth and Ovulation Following Controlled Internal Drug Release Device Removal in Ewes

Shelby Springman, Kristina Boss, Kayla Kruckenberg, Morgan Randall, Jenna Newman, Nathalia Santos, Justin Luther, UW-River Falls

Estrous synchronization is a useful technique for timed artificial insemination in sheep. Protocols have traditionally used gonadotropins to ensure ovulation and improve fertilization at CIDR removal. The purpose of this study was to determine the effects of P.G. 600 on follicle growth and ovulation in ewes. Dorset (n=13) and Hampshire (n=5) ewes were used. Ewes were blocked into three groups of six. Each group contained three P.G. 600 ewes and three control ewes. All ewes received a CIDR (300 mg progesterone) device that was removed 14 days later. Upon CIDR removal, control ewes were injected IM with 2 ml of sterile saline solution, and P.G. 600 ewes were injected IM with 2 ml of P.G. 600 (400 IU PMSG and 200 IU hCG). All ewes underwent transrectal ultrasonography starting at 36 h post CIDR removal. Ewes were ultrasounded every eight hours until ovulation occurred. Ovulation was defined as the disappearance of a dominant follicle (>4 mm in diameter) that was present on the ovary during the previous ultrasound. Two Dorset ewes were removed from the study. One being removed due to the loss of a CIDR prior to the 14 day removal date, and the other being removed due to excessive scar tissue buildup in the reproductive tract making access difficult. One of the removed ewes was from the control group and the other from the P.G. 600 group. Treatment with P.G. 600 did not affect ($P > 0.05$) the time from CIDR removal to the first observed ovulation (C, 59.0 ± 2.10 h and P.G. 600, 60.0 ± 3.70 h), and among all ewes the first ovulation occurred between 48 h and 80 h after CIDR removal. In ewes with multiple ovulations, treatment with P.G. 600 did not influence ($P > 0.05$) the interval between the first and last observed ovulation (P.G. 600, 4.8 ± 3.20 h and C, 4.0 ± 1.73 h). When compared to control ewes, treatment with P.G. 600 did not affect ($P > 0.05$) ovulation rate (C, 2.0 ± 0.27 ovulations per ewe and P.G. 600, 2.4 ± 0.38 ovulations per ewe). More ewes ovulated on both ovaries (n=12) versus the right ovary only (n=4), while none of the ewes had ovulation(s) restricted to the left ovary only. Mean follicle diameter at ovulation was similar ($P > 0.05$) between groups (C, 5.8 ± 0.24 mm and P.G. 600, 5.3 ± 0.36 mm). Control ewes had a greater mean follicle diameter when compared to P.G. 600 ewes at 44 h (5.5 ± 0.26 vs. 4.4 ± 0.27 mm, $P < 0.005$, respectively) and 52 hours (5.9 ± 0.25 vs. 5.2 ± 0.32 mm, $P < 0.05$, respectively) after CIDR removal. However, follicular diameter between 52 h and 62 h increased ($P < 0.02$) in P.G. 600 (0.56 ± 0.26) versus control ewes (-0.13 ± 0.22). In conclusion, Dorset and Hampshire ewes will ovulate 58 to 59 hours after CIDR removal, and this observation is not influenced by P.G. 600 treatment. Although treatment with P.G. 600 may influence follicular growth it does not impact ovulation rate. Although further studies are needed, the additional cost associated with using P.G. 600 at CIDR removal does not appear to offer any beneficial outcomes.

25) Cyclic Voltammetry: An Analysis of Screen Printed Electrode Systems

Dylan Windsor, Jeff Rosenthal, UW-River Falls

The purpose of this project was to determine the

feasibility of using a screen printed electrode system to measure the reaction rate of a chemical reaction that follows an electrochemical reaction, an ec-mechanism, using cyclic voltammetry

The screen printed three electrode system consists of a working, reference and auxiliary electrode on a polymer substrate. The screen printed electrode system has found use for a variety of electrochemical methods in undergraduate laboratories as it is economical, convenient to use and does not require the maintenance that a glassy carbon electrode requires. Examples used in the analytical and instrumentation chemistry labs at UWRF include the determination of ascorbic acid and acetaminophen by linear sweep voltammetry and differential pulse voltammeter, and the determination of the diffusion coefficient of an electrochemically species in solution.

Cyclic voltammetry is one of a variety of electrochemical methods that uses an instrument called a potentiostat. A potentiostat can control the electrochemical potential at a working electrode, relative to a reference electrode, and drive an electrochemical reaction at the working electrode by providing current from the auxiliary electrode.

A typical analysis begins with selecting an initial potential in a region that is free of any electrochemical reactions and initiating an increase in the potential at a constant rate. The rate at which the potential is increased is called the scan rate. While the change in potential may be positive or negative depending on the analyte, consider the case of an increase in the positive direction. As the potential reaches a value necessary to drive an electrochemical oxidation of the analyte, the measured current increases. The current continues to increase until the diffusion of the analyte to the electrode surface becomes rate limiting. At this point the measured current reaches a peak and begins to decline asymptotically to a diffusion limited value. At a predefined potential, called the vertex, the direction of the change in potential reverses and the oxidized form of the analyte is electrochemically reduced back to the analyte with a similar behavior in the measured current.

26) Postive Verses Negitive Grade Running, Covering the Most Distance While Maintaing a Constant Vo2

Matt Pechacek, Joseph O'Kroy, UW-River Falls

The strategy to optimize performance while running hills has been discussed by runners and coaches for many years; many times unaware of the accuracy of their claims with the current research. Therefore, we investigated the possibility that the distance lost running uphill (running slower) could be recovered during a faster downhill run while at the same work rate (VO2). PURPOSE: To compare the running speed of running at positive and negative inclines while maintaining VO2. METHODS: fourteen collegiate cross country runners (ten males and four females, all data mean ± Standard deviation; age, 20.12 ± 1.05 yrs; height, 174.14 ± 9.21cm; weight, 68.49 ± 9.47 kg) volunteered for this study and signed an approved IRB. VO2 was measured via Parvomedics metabolic cart while subjects ran on a treadmill at three different inclines: 1% grade, the flat condition; 5% grade, the uphill condition; and -5% grade, the downhill condition. Subjects ran on the flat condition during which VO2 was recorded and matched for the uphill and downhill conditions by altering the running speed. Repeated measure ANOVA was used to determine the differences in running speed, ventilation VE and heart rate (HR) between incline conditions. Additionally, a Duncan Post Hoc was used to analyze significant effects found between the incline groups. All at the $P < 0.05$ level. RESULTS: Significant differences were found between the flat, downhill, and uphill conditions with running speeds: 7.18 ± 0.82 mph, 9.69 ± 1.00 mph, and 5.54 ± 0.76 mph, respectively; ventilation: 60.58 L/min ±14.19; 67.95 L/min ± 16.33; and 64.89 L/min ± 14.85, respectively; and heart rate, 155 ± 11 beats compared to 162 ± 12 beats and 161 ± 12 beats, respectively. CONCLUSION: While maintaining a constant work rate, runners can run 0.87 MPH faster downhill than they slowed down while going uphill. This allows runners to significantly recover and gain distance lost while going uphill if they run faster while going downhill without using any additional energy to do so.

27) Photocatalytic Activity of Non-Stoichiometric Zinc Tungstate

Andrew Stuhr, Matthew Wawiorka, Seth King, UW-River Falls

Zinc tungstate (ZnWO4) has recently stirred up excitement in materials science research for its prospects as an efficient photocatalyst for use in dye sensitized solar cells, photo induced water cleaving, or organic contaminant abatement [1]. Research has been done into increasing the photocatalytic effect of stoichiometric ZnWO4, but the effects of varying the

Zn to W ratio present in the material has not yet been examined.

Non-stoichiometric thin-films of $ZnWO_4$ were deposited on Si (001) using spray pyrolysis with an aqueous precursor [2]. X-ray diffraction shows that all films exhibit a crystalline structure consistent with $ZnWO_4$ for all ratios studied, and that the structure is improved by post deposition annealing. Using a solar simulator lamp with AM1.5G filter as an illumination source, the photocatalytic activity of these films was studied by looking at the degradation of methylene blue dye with UV – Vis spectrometry. Results suggest that they photocatalytic efficiency of $ZnWO_4$ depends both on the Zn to W ratio, as well as post deposition processing.

28) Effects of Post-Workout Nutritional Interventions during Resistance Training

Matthew Breit, Cody Hanick, Jacob Richmond, Thomas Wetter, Annie Wetter, UW-Stevens Point

Numerous research studies have investigated whether ingesting whey protein provides training and performance benefits when consumed post-workout, during a strength training program. Few studies, however, have compared it to ingesting whole foods, and fewer still, in a placebo controlled, randomized, double-blind study.

Twenty females and seven males (18-24 years old) who had not weight trained for the past year were randomly assigned to one of three beverage groups: whole food blend, whey protein, and a placebo, consumed immediately post-workout. All subjects participated in a 5-week, 3-day per week, progressive, resistance-training program that was split-focused on multi-joint movements such as leg press and bench press. Hypertrophy was measured with bioelectrical impedance for FFM and bf %. Muscular power was assessed with vertical jump measurements and muscular strength and endurance were measured from 1RM and 60% 1RM bench press and leg press, respectively. Data were entered into an SPSS database. A three day food record was given to each subject to determine nutritional composition and entered into SuperTracker. Macronutrient and energy intake from diet records and post-workout beverages were calculated. Variation between muscular strength and supplement approached, but did not reach significance ($p = 0.2729$), muscular endurance and supplement approached independent prognostic significance ($p = 0.0817$), and muscle power and supplement displayed a slight trend towards significance ($p = 0.2912$). No significant association between bench press vs. protein intake ($r = 0.0078$) were identified. The results indicated no significant correlation between post-workout supplementation and all variables. Based on data analysis, untrained individuals strength training short-term will experience improvements in variables tested, regardless of macronutrient intake or post-workout supplement consumed. Further research with control for diet and other variables should be conducted to determine the most effective post-workout supplement.

29) Characterization of Three Chlorophyll Deficient Mutants in Soybean

Alicia Meis, Andrea Noll, Taylor Atkinson, Balpreet Dhatt, Brittany Erickson, Callie Jean Johnson, Jessica Boelter, Stephanie Abel, Eric Singsaas, Sol Sepsenwol, Devinder Sandhu, UW-Stevens Point; Katherine Espinosa, Susana Goggi, Reid Palmer, Iowa State University

We have identified a viable-yellow and two lethal-yellow mutants in soybean. The three phenotypes green, lethal- and viable-yellow were easily distinguished based on their light reflectance indices, chlorophyll abundance and photochemical conversion efficiency. Photochemical conversion efficiency was reduced in the viable-yellow plants, whereas, lethal-yellow plants showed no ability to convert light energy. The lethal-yellow and viable-yellow plants showed significant reduction of Chlorophyll A and B. In lethal-yellow plants proplastids did not differentiate into chloroplasts and few membranes were present. The reduction in thylakoid stacking was apparent in the viable-yellow plants. Genetic analysis revealed recessive epistatic interaction between one of the lethal- and viable-yellow genes. One lethal-yellow gene was mapped to a 320 kb region on chromosome 3 that contained 42 predicted genes. We have identified four potential candidate genes in this region. The other

lethal-yellow gene was mapped to a 85 kb region on chromosome 15 that contained 8 predicted genes. Glyma.15g275900 is an excellent candidate gene for this lethal-yellow gene as it displayed homology to an Arabidopsis gene which codes for a chloroplast-localized protein that is involved in biogenesis of Photosystem I and II. The viable-yellow gene was mapped to a 227 kb region on chromosome 2. We located 24 predicted genes in the region. Of these, one candidate gene is of particular interest, Glyma.02g233700, as it showed homology to a translocon in the inner membrane of chloroplast (Tic110) in Arabidopsis. Tic110 is known to play critical role in plastid biogenesis and heterozygous mutants for Tic110 in Arabidopsis exhibited a pale phenotype. Sequencing of the possible candidate genes are in progress, leading to further insight into the mutations. Characterization of lethal- and viable-yellow genes may help to better understand the biosynthetic pathways involved in the development of chloroplasts.

30) Characterization of Mechanical Properties of Bi2Sr2CaCu2O8+x Superconductor through Scanning Electron Microscopy

Gavriel DePrenger-Gottfried, Sarah Sortedahl, James McFarlane, Alexandra Putney, Christopher Hopp, Diego Vieira, Amir Kajbafvala, Matthew Jewell, UW-Eau Claire

In this work, we analyze the mechanical properties of a superconducting material, Bi2Sr2CaCu2O8-x (Bi-2212), through Scanning Electron Microscopy (SEM). Bi-2212 is a high -temperature superconducting material with an engineering critical current density of 640 A/mm2 at 4.2 K and 20 T. However, Bi-2212 is mechanically very weak and brittle, in particular as compared to the pure silver that encompasses the remainder of the Bi-2212 wires.

Through SEM imaging, our research has identified and characterized Bi-2212 superconducting filament cracks. These cracks, created through electromechanical testing in both applied tensile and compressive strain, correspond to specific thresholds of the wire's critical current degradation. Different heat treatment profiles also produce secondary phases and variances in Bi-2212 filament density, which have significant influence on both the peak and degraded current carrying capacity of the wires. By analyzing these properties, a stronger, more elastic filament can potentially be engineered that

will still retain the high-temperature superconducting properties that make the application of this material so advantageous, while making the entire wire more mechanically robust.

31) Development of Riccardin C Analogs: Design and Synthesis of Building Blocks with Labile Protecting Groups

Tabitha Payne Dmitry Kadnikov, UW-Stout

With the prevalence of conditions such as cardiovascular disease and type II diabetes in society, regulation of cholesterol homeostasis has become a popular therapeutic approach. Liver X receptor (LXR), a member of nuclear receptor family of transcription factors, regulates cholesterol homeostasis by activating transcription of lipoproteins and cholesterol transporters, thus stimulating efflux of cholesterol from the cells and eventually leading to increased levels of HDL-cholesterol and decreased levels of LDL-cholesterol. The Kadnikov research group is synthesizing small molecule analogs of a natural product Riccardin C, which is reported to have an interesting LXR- activation profile. While the synthesis of the model system is nearly completed, removal of the protecting groups during the final stages requires harsh conditions which appear to compromise the molecule. Thus, the goal of my research project is to modify the early stages of synthesis to create building blocks with labile protecting groups that can be easily removed to finalize the synthesis. Several approaches to exchange the protecting groups have been explored and a modified synthetic sequence to accommodate functional group compatibility has been developed.

32) ZnO-Based Electro-Absorption Modulators

Tanner Wolf, Miranda Elkins, Bryan Nestingen, Seth King, Eric Gansen, UW-La Crosse

The ability to modulate the amount of light from a source (LED or laser) is a fundamental aspect of free-space communication, displays, and data storage technologies fueling the need for electro-absorption modulators (EAMs). One common variation of EAM is constructed from a semiconductor multiple-quantum-well (MQW) structure, where the amount of light that is transmitted through the device is controlled electrically using the quantum-confined Stark effect (QCSE). In this effect, the absorption properties are modified by the application of a voltage across the layers of the MQW. While most of the current research on EAMs centers on devices that operate in the infrared spectral region, there is a growing demand for short-wave devices that operate in the blue and ultraviolet (UV) spectral regions. ZnO has a band-gap energy in the UV region and can be paired with alloys to make MQW structures therefore making it an attractive material for EAMs. The project aims to construct and test EAMs based on ZnO/ZnMgO quantum well structures that are grown by sputter deposition. We will discuss our recent progress in developing these devices. Our experimental results will include absorption spectra collected using a broad-band, temperature-tunable, spectroscopic system.

33) Investigating Metallographic Sample Preparation Techniques for Bi2Sr2CaCu2O8+x Superconducting Wire

James McFarlane, Alexandra Putney, Christopher Hopp, Diego Vieira, Gavriel DePrenger-Gottfried, Amir Kajbafvala, Matthew Jewell, UW-Eau Claire

Ongoing advances in high energy physics depend on developing high field superconducting magnets capable of producing magnetic fields in excess of 20 Tesla. Bi2Sr2CaCu2O8+x (Bi-2212) is the only High Temperature Superconducting (HTS) material available as a round wire, which is preferred for magnets that require cables. The development of HTS magnets requires not only a conductor capable of carrying sufficient critical current density at high magnetic field, but also one that is sufficiently strong to withstand various stresses resulting during application. Therefore, it is important to study the microstructure of Bi-2212 wire to understand how the material fails under mechanical loading. Bi-2212 wires contain brittle Bi-2212 filaments embedded in a soft, silver matrix. The difference in the hardness of these two materials makes the sample preparation for the microstructural examination very difficult.

In this study, a series of novel sample preparation

techniques were developed to study the microstructure of Bi-2212 wire including internal and external deep etch, attack polish, and vibratory polish. Grinding can introduce damage into the filaments, therefore etching the silver that surrounds the filaments is a gentle method to observe Bi-2212 filaments. The internal deep etch allows for analysis of filaments that are near the center of the wire while the external deep etch allows us to examine filaments located towards in the outer ring of sub-elements. The attack polish is a quick and effective method that etches silver while simultaneously polishing the Bi-2212 surface in order to look within the filaments. Vibratory polishing is a traditional polishing method that slowly and gently removes material from the wire. Scanning electron microscope (SEM) in addition to laser confocal and optical microscopes are used to assess the quality of the prepared samples. This systematic study of the Bi-2212 sample preparation provides confidence for the subsequent analysis of these brittle, composite wires.

34) Kinetics of Naphthalimide Aminolysis

Sam Anderson, Stanford Mitchell, David Lewis, UW-Eau Claire

The aminolysis of N--subs3tuted 4--chloro--1,8--naphthalimides ocurs only whenthe substituent is an aryl group. The reaction exhibits a second order rate law – Rate = k[imide][BuNH2] • N--alkyl--4--chloro--1,8--naphthalimides react by displacement of the halogen • An electron--releasing group at posi3on 4 suppresses the aminolysis of the imide

35) Regulated Promoters To Control Toxic Genes In The Methylerythritol Phosphate (MEP) Pathway Of Cyanobacteria For Isoprene Production

Meghan Raebel, Matthew Nelson, Toivo Kallas, UW-Oshkosh

Our group has engineered the cyanobacterium Synechococcus sp. PCC 7002 to produce the gas isoprene, which is a precursor for high-value terpene bioproducts and biofuels. To further increase isoprene yields, genetic modifications can be made to enhance the methylerythritol phosphate (MEP) pathway that leads to isoprene. However, when genes for this pathway are expressed at high levels, some of the gene products, such as 1 deoxy-D-xylulose 5 phosphate synthase (DXS) appear to be toxic to the cell. One strategy to alleviate this is to use regulated promoters, i.e. gene regulatory elements that turn on gene expression only when desired. This can be an effective means to control the buildup of toxic aggregates. Toward this goal, we are testing a temperature-sensitive repressor and promoter DNA sequence from a bacterial virus. At low temperatures the repressor protein will bind to the promoter and prevent gene expression, but at high temperatures (greater than 40°C), the repressor will denature, and the targeted gene will be expressed. We have linked this regulator to the gene for the yellow fluorescent protein (YFP) to create a 'reporter' DNA construct. This has been successfully assembled and introduced it into E. coli bacteria, with successful temperature regulated control of gene expression. The DNA for this genetic switch has also been introduced into Synechococcus cyanobacteria, and testing is underway to evaluate its integration and function. Future research will focus on inserting the regulated repressor-promoter upstream of the potentially toxic MEP pathway DXS gene to test temperature-controlled gene regulation as a strategy for increased isoprene production in Synechococcus cyanobacteria.

36) Investigating Lithium Niobate as Strain Gauge Sensor

Bishop Freeman, Michael Dorn, Ozgur Yavuzcetin, UW-Whitewater

Strain gauge is a device that is used to measure stress or strain on an instrument/structure. They can be used on bridges, digital scales and electronic sensors. LiNbO3 can be used as a strain gauge sensor due to its intrinsic piezoelectric property. This enables it to be used as a sensor for vibration, shock, pressure, acceleration and strain. It can perform a lot faster than a commercial strain gauge!

37) The Effect of Foot Inclination Angle on Lower Extremity Kinematics and Ground Reaction Forces During Running

Matt Pechacek, UW-River Falls; Brian Heiderscheit, Mikel Stiffler, UW-Madison

PURPOSE: Foot inclination angle (FIA), the angle at which the foot strikes the ground during running, has been an area of interest as it relates to injury risk and performance. Specifically, a reduction in foot inclination angle (less heel-strike) has been suggested as a way

to minimize bone stress injury risk. The objective of this study was to characterize how gait kinematics and ground reaction forces are influenced by foot inclination angle among elite runners. As FIA decreases, we hypothesized runners would encounter greater peak vertical ground reaction forces (pVGRFs). A secondary aim was to explore the relationship between FIA measured on a continuum and vertical center of mass (COM) excursion, horizontal distance from heel to COM and stance phase percentage. METHODS: Three-dimensional kinematics and VGRFs were recorded on healthy male (n=9) and female (n=16) NCAA Division 1 cross country runners at two speeds: preferred and 3.58 m/s. Pearson correlations were calculated between FIA, kinematic variables, and pVGRF. Linear regression models were created to predict FIA with other kinematic measures, with final models created using stepwise variable selection. T-tests compared gender differences between variables. RESULTS: Smaller FIAs were associated with increased pVGRF across both speeds ($p < 0.001$). Decreased FIA was also associated with decreased stance phase percentage ($p < 0.001$) across both speeds and an increased vertical COM excursion ($p < 0.05$). Horizontal distance from COM to heel significantly predicted FIA at preferred speed ($R2 = 0.633$, $p < 0.001$) and at 3.58 m/s ($R2 = 0.497$, $p < 0.001$). Gender differences between FIA were significant across preferred speed ($p = 0.003$) and fixed speed ($p = 0.013$). CONCLUSIONS: Our results suggest FIA is significantly associated with pVGRF and other lower extremity kinematics. As excessive pVGRF has been considered a cause of running-related injuries such as patellofemoral and iliotibial band pain, FIA may be a surrogate measure of pVGRF, thereby providing a clinically feasible option for its assessment.

38) Continuous And Stable Carbon Capture And Isoprene Production In Fast-Growing Cyanobacteria

Matthew E. Nelson, Olalekan Aremu, Rhiannon Carr, Meghan Raebel, Lydia Chebii, Brandon Bukovitz, Jesus Martinez, Toivo Kallas, UW-Oshkosh; Kyle Dunn, Valparaiso University; Eric Singsaas, UW-Stevens Point

Cyanobacteria efficiently convert solar energy to carbon dioxide into carbon polymers and thus hold great potential for production of renewable chemicals. One such product is isoprene (C_5H_8), a volatile precursor for thousands of terpenes including synthetic rubber, pharmaceuticals, fragrances, and biofuels. Isoprene can be made via the 2-C-methyl-D-erythritol 4-phosphate (MEP) pathway whose products are isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP). Cyanobacteria possess the MEP pathway but lack an isoprene synthase (IspS) enzyme for converting DMAPP to isoprene. We have introduced synthetic, optimized IspS and IPP-DMAPP isomerase (IDI) genes from Populus sp. into Synechococcus sp. PCC 7002 cyanobacteria and obtained isoprene production at rates ~40 to 80 fold higher than previously published for cyanobacteria. To further enhance production we are pursuing several strategies that include: 1) addition of enhanced genes for carbon capture and the MEP pathway, 2) use of genetic switches to avoid toxic effects, 3) inactivation of genes for glycogen and soluble sugar synthesis to eliminate competing pathways, and 4) development of algal photobioreactor (PBR) and isoprene capture systems to demonstrate commercial viability. Cyanobacterial strains are being tested in PBRs linked to a real-time, Fast Isoprene Sensor to assess isoprene production under natural day-night cycles. Continuous isoprene production has been achieved for 30+ days in a PBR culture. These findings demonstrate stable production and emission of isoprene gas from Synechococcus cyanobacteria, which will be attractive as platforms for bio-isoprene and terpene production in PBRs that use wastewaters and flue gases from industries or biodigestors as nutrient and CO_2 sources. Patent application US-2014-0030785 has been filed via WiSys and further technology and business development is supported by an NSF-STTR Phase I award and SBIR-Advance supplement from the UW Center for Technology Commercialization.

39) Effects of Emulsifying Salts on Smoked Gouda Processed Cheese

Allison Nohre, Molly Patterson, UW-River Falls

According to the USDA, per capita cheese consumption in the US has increased over the last 25 years. More

specifically, Gouda volume sales in grocery stores increased by double digits in 2011-2012. By re-purposing a current edible waste product to develop a new marketable product, a new processed cheese was able to be created. The processed cheese was made using varying combinations of emulsifying salts. Several characteristics were observed such as: pH, meltability, sliceability, and moisture content of three separate trials. In the production of processed cheese, emulsifying salts are responsible for physiochemical variations within the product. This development could be the gateway to a new line of processed cheese which would fulfill the demand in the marketplace and reduce edible waste products in the cheese industry.

40) Thin Film Chemical Analysis of Gold Janus Nanoparticle Systems

Connor Richards, Eric Miller, Jennifer Dahl, UW-Eau Claire

Preparation of a substrate is key to developing a self-assembled monolayer (SAM) that will be able to go through characterization techniques. Evaporating a thin layer of gold onto a piranha cleaned silicon wafer, then template stripping the gold off of the silicon using an optical adhesive was shown to create a uniformly smooth layer of gold. This newly formed layer of gold was then subject to solution in order to form a SAM. Another way to create thin films is the use of a deposition technique in the Langmuir trough in which a thin layer of nanoparticles are deposited uniformly onto a prepared substrate. The analysis of these thin films is commonly conducted using characterization techniques including polarization-modulated infrared reflection adsorption spectroscopy (PM-IRRAS), which is used to analyze surfaces of the films that have been deposited onto substrate, and x-ray photoelectron spectroscopy (XPS), which is used to determine the elemental composition of thin layers. These surface sensitive techniques are suitable for characterizing the external interface of thin layers.

41) Janus Nanoparticle Systems Cross-linked via Bisdithiol for Enhanced Stability

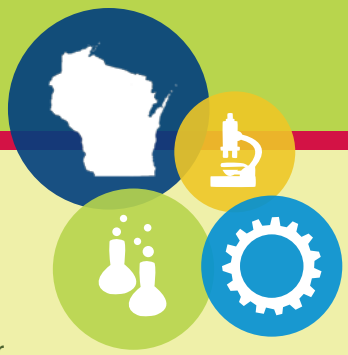
Kyle Lobermeier, Igor Araujo de Carvalho, Jennifer Dahl, UW-Eau Claire

Creation of Janus nanoparticle systems is based on regioselective ligand exchanges on thin films created in a Langmuir trough. These films are created by casting a solution of hydrophobic alkanethiol capped gold nanoparticles upon an air-water interface. Previously, dithiol crosslinking molecules were introduced to the compressed film to create covalent bonds between adjacent particles. To transform this network into a Janus system, incoming ligands can be introduced to either the aqueous subphase or organic superphase to induce regioselective ligand exchange. However, the dithiol crosslinkers could also be subject to exchange, disrupting the film structure and reducing the regioselective aspect of these reactions. To increase the stability of this film, a bisdithiol ligand has been synthesized and is expected to be stable during ligand exchange due to its chelating effect. There are no commercially available cross-linkers available for this purpose. Here, we detail the synthesis and implementation of this new crosslinking technology.

42) A11, a Potential Drug for Melanoma Cancer

Noah Stueven, Cheng-Chen Huang, UW-River Falls

Our lab is working on identifying various skin lightening drugs to compare with current drugs already on the market. One phenolic compound that was identified and named A11 could reduce the black pigment in developing zebrafish embryos. A11 was more potent than other common current human skin-lightening products, including arbutin, niacinamide, kojic acid, gallic acid, and tretinoin, and was found to be non-toxic. Using a transgenic zebrafish line that produced a melanoma-like phenotype in fresh embryos, we found that A11 seemed to suppress the melanoma formation when the embryos were constantly treated to the compound. To continue testing of A11, my project was to use a B16-F10 mouse melanoma cell line. Because this is a mammalian cell line, it can easily be studied, and the effects of chemicals can be easily observed. The cell line was used by treating the melanoma cells with A11 and other skin lightening drugs, and then counting the cells and measuring the melanin in the cells. The results showed that A11 killed the cells and lowered the melanin at higher concentrations, while not being very effective at lower concentrations. A11 also seems to reduce the expression of a gene called dct which is known to be expressed in melanocyte precursor cells but not in mature melanocytes, suggesting A11 might suppress melanocyte formation and/or proliferation and survival.



With more testing, A11 could eventually become a viable drug for skin cancer, or be used in combination with other cancer drugs to help cure melanoma.

43) The Surprising Cardiac Toxicity of Arbutin, a Common Skin Lightening Chemical

Hannah Vaught , Cheng-Chen Huang, UW-River Falls

Arbutin is a natural and popular skin-lightening agent found within many cosmetic products designed to lighten and even skin tone. However, the toxicity of arbutin has not been closely studied. Earlier research done by our lab has shown unusual cardiac toxicity of arbutin in developing zebrafish embryos. My project was designed to better understand the arbutin toxicity. We first found that arbutin consistently caused specific cardiac defects in a dosage dependent manner. In the next experiment, young zebrafish embryos were treated with arbutin before cardiac development occurred in order to identify the effects of arbutin on the developing heart. Older embryos were also treated with arbutin to study the impact of arbutin on the developed heart. The results showed that while arbutin was toxic to all the embryos tested, the older embryos with already developed cardiac tissues exhibited poor circulation, reduced heart size, and death earlier than younger embryos. Paraffin-sectioning of the hearts showed that arbutin treated embryos displayed collapsed cardiac chambers, and no lumen was visible within the two chambers. Furthermore, labeling and analysis of cell death within arbutin treated embryos revealed an overall increase of apoptosis in cardiac tissue. Throughout this project, arbutin has displayed unreported cardiac toxicity, showing a need for alternate skin lightening compounds.

44) Comparative Analysis of Breast Cancer Mammospheres Derived from Induced 3D Artificial Tissues and Hanging Drop Cultures

Lindomar Pessoa, Ariane Silva, Alyssa Timmers, Jesse Robinson, Rebecca Haugen, Charlotte Stanford, Eric Valder, Kevin Rixmann, Timothy Lyden, UW-River Falls; Ray Haselby, Marshfield Clinic

According to American Cancer Society statistics, breast cancer was the leading type of new cancer cases reported for women during 2013. In that year, it represented 29% of new cases reported, while it was the second leading cause of cancer deaths among women. As with most cancers, breast cancer generally causes death by a process called metastatic spread. In this pathologic process cells or clusters of cells detach from the original primary tumor and exit into body fluids, eventually entering the blood stream and traveling to distant locations where it then establishes new secondary tumors. This process is the common cause of mortality in almost all types of cancer. Despite many decades of study and experimentation, a great deal is still not understood concerning the mechanisms responsible for this cellular behavior. In order to address this lack of understanding, our laboratory has been applying 3D culture techniques in order to develop modeling systems which replicate natural physiologic conditions in the body. In this study we have been studying the breast adenocarcinoma cell line MCF7, which, under certain conditions, will generate cellular spheroids displaying many characteristics in common with invasive metastases. Particularly, in this presentation we report on continuing studies comparing and contrasting the characteristics, population dynamics, structural details and invasive potential of spheres generated by media induction of 3D artificial tumor tissues produced with the MCF7 cell line and those spheroids produced with a recently developed "hanging drop" technique. These two approaches generate distinct populations of spheres which seem to share many attributes. Preliminary and ongoing studies have already demonstrated that these spheres reflect the metastatic process in many ways and therefore represent an excellent modeling system. The current work reported here focuses on internal spheroid structural details, stromal tissue attachment and subsequent cellular invasion. Future projects will build on these observations to examine potential pathways for blockage or inhibition of those invasive processes in vitro as a potential model for developing new therapeutic approaches.

45) MCF-7 Hanging Drop Spheroid Cultures as an In-Vitro 3D Model of Cancer Metastasis

Ariane Silva, Alyssa Timmers, Lindomar Pessoa, Jesse Robinson, Rebecca Haugen, Charlotte Stanford, Eric Valder, Kevin Rixmann, Timothy Lyden, UW-River Falls; Ray Haselby, Marshfield Clinic

Since 2004, our laboratory has been focused on using 3D modeling techniques to examine and explore the behavior of cells engaged in normal and pathological histogenesis. Until recently, the majority of this work has been focused on the application of natural 3D matrix materials to develop artificial tissues. In 2008, our work shifted onto a strongly defined pathway of modeling several types of cancer in 3D and generating long-term artificial tissues from both primary patient samples and standard tumor cell lines. These studies identified an interesting aspect of 3D tumor modeling, in that as the tissue became established and developed it also began to produce significant numbers of potentially metastatic cells and nodules or spheroids. This effect was particularly seen in breast cancer models and is the focus of this report. One limitation for the intricate study of these tumor products (spheroids) has been the relatively pleomorphic distributions observed in these cultures. In order to address this short coming, and to study the actual metastatic potential of such shed nodules, we have begun to employ a new hanging-drop technology to produce large numbers of very consistently sized spheroids using the breast adenocarcinoma cell line, MCF-7. In this report, we present the initial results of both labeling studies and morphometric analysis of the spheroids generated from an initial 5000 cells and cultured for up to 5 days. The results of this work have already provided significant evidence that these spheres are reasonable models for metastatic nodules and/or micro-tumors in-vivo. Continuing studies are working to evaluate the invasive capacities of these and the “natural” spheres from each respective time point and relative morphology.

46) Development and Application of a New Miniature Bioreactor and Nature Scaffold System to Generate and Test Artificial Breast Cancer Tumor Tissues Using MCF-7 Cells.

Kris Cole, Dylan Miller, Timothy Lyden, UW-River Falls; Steven Goodman, Microscopy Innovations, LLC

During the past decade, the UWRF Tissue and Cellular Innovation Center has been focused on the application of natural extra-cellular matrix materials as biomimetic scaffolds for small-scale 3D artificial tissue (AT) and artificial tumor tissue (ATT) modeling. These constructs represent much more physiologically relevant in-vitro models than most standard 2D cultures and are now the focus of a series of studies aimed at developing new models of cancer progression and metastasis. Of particular interest is the modeling of breast adenocarcinoma and monitoring/testing of the progression of these constructs into metastasis-related processes. Although we have been successful in generating ATT's from several cells lines and primary patient tumors, our approach has always been limited by relatively non-standardized culture conditions. These conditions were consistent enough for basic construct characterization and general "proof-of-concept" validation but next-step direct experimentation has been limited by these culture conditions. In late 2013, we partnered with Microscopy Innovations, LLC to begin testing their mPrep capsules as miniature bioreactors in combination with our standard natural matrix/scaffold materials. In these studies, we are working to standardize culture conditions and develop a prototype reactor system approach to study MCF-7 breast adenocarcinoma cell-derived ATT's and their progression toward metastasis. Early loading studies of mPrep capsules with MCF-7, MCF10A non-cancerous ductal cells as well as stromal fibroblast and pre-adipocyte (3T3-Swiss and L1) cell lines have generated substantial tumor and control constructs. Ongoing characterization studies are examining the relative population dimensions of cancer stem cells as well as EMT/MET markers and cell cycle status of both ATT cells and the abundant shed cells appearing in the flow-through effluent of the capsule chambers.

47) Simulation of the UWRF Neutron Monitors using GEANT4

Nick Jensen, UW-River Falls

Neutron monitors are surface detectors that measure highenergy cosmic rays that constantly bombard the Earth's atmosphere. Cosmic rays interact in the upper atmosphere dumping all of their energy into showers of particles that reach the ground. At the surface neutrons are the dominant type of particles up to 100 MeV. A neutron monitor is a multilayered detector designed to detect these neutrons. The outer layer of polyethylene reflects medium energy neutrons, but allows high energy neutrons to pass through. The middle layer, made of lead, captures high energy neutrons and produces many medium energy neutrons. The inner layer of polyethylene further slows down the neutrons to thermal energies. Low energy (0.0110 eV) neutrons are captured by boron10 atoms in an inner detector, which is a long tube proportional counter. The University of Wisconsin-River Falls acquired two incomplete neutron monitor tubes. To understand the response of these tubes to neutrons, a Monte Carlo simulation using GEANT4 was used to model the monitors and to simulate neutron interaction. Results are compared with real neutron monitor data from the two detectors in River Falls.

48) High Energy Muons from Hadronic Showers in Ice

Nick Kulacz, UW-River Falls

Cosmic rays are energetic particles from space that constantly collide with the upper atmosphere where they dump all of their energy into a shower of many particles, some of which reach the Earth's surface. There are many types of particles that constitute cosmic rays, among them the neutrino, of which there are three types, called flavors. Unlike other secondary particles, which interact in the atmosphere, a neutrino interacts easier in a dense medium and produces a hadronic shower. Neutrinos can be detected using special types of telescopes like the IceCube and ANTARES telescopes deployed under ice and water respectively. The showers of particles from neutrino interactions appear as either tracks or spheres of light in the neutrino telescope. The shape of the pattern of light allows for the identification of flavor. There is a phenomena where very energetic particles, muons, can be produced in these hadronic showers. The muons appear as long tracks of light emerging from spheres of light in the detector. These types of events are rare but they have the potential to complicate the identification of neutrino flavors. To study these rare events Monte Carlo simulations are used. Pythia8 was used to force an interaction between a neutrino and nucleon and a modified version of CORSIKA to simulate the resulting hadronic shower in ice. The particles of interest from the Pythia8 simulations are pions, kaons, and D mesons which decay into energetic muons. Preliminary results indicate that energetic muons are produced in hadronic showers in ice and some of them are energetic enough to be observed in current neutrino telescopes.

49) An LED model of the IceCube Neutrino Telescope

Nick Jensen, Kimberly Doerr, UW-River Falls

We report on updates on the design, construction, and performance of a 3D interactive model of the IceCube detector. It displays neutrino events as seen by IceCube. The model is used for education and outreach activities of the IceCube collaboration. IceCube is a massive neutrino detector deployed in the glacial ice at the South Pole. Neutrinos are near massless, neutral particles that hardly interact, and are not influenced by magnetic fields that pervade the universe. Very highenergy neutrinos are thought to be produced in some of the most energetic astrophysical objects like supernova explosions, active galactic nuclei and gamma ray bursts. The model, measuring 2.4 m x 2.5 m x 2.1 m, consists of 5160 LEDs arranged in the same pattern of the DOMs in IceCube. It allows for the visualization of real IceCube neutrino data, namely the burst of light observed by the DOMs when neutrinos interact. An early version of the model was on display at the MIT Museum as part of the International Neutrino Conference in Boston in 2014. Recently we introduced sonification to complement the visual aspect of the display and incorporated a visualization of the relentless bombardment of the detector by particles from the atmosphere. A major effort has been undertaken to document the design of the LED model, produce a complete part list, and produce working drawings and assemble the parts in the program

Sketchup. This documentation will be made available to the public so that anyone can make their own LED IceCube model. Another update to the model involves introducing more LED strings to represent DeepCore, the low energy inner core of IceCube.

50) Characterizing the Emission from Light Emitting Diodes in IceCube cDOMs

Samantha Pedek, UW-River Falls; Robert Zill, College of DuPage

IceCube is a one cubic kilometer neutrino telescope located deep within the Antarctic ice. It is a new type of telescope designed to study the Universe using neutrinos, an electrically neutral, nearly massless particle that is emitted from energetic objects like supernovas and active galactic nuclei. Neutrinos are detected indirectly by the light emitted when they interact in the volume of ice observed by IceCube. The light emitted can be detected by the thousands of light sensors called DOMs (Digital Optical Modules) the make up IceCube. Most DOMs are equipped with twelve identical Light Emitting Diodes (LEDs) used for calibrating the detector and the properties of the ice within the detector's sensitive volume. A few DOMs, cDOMs (Color Digital Optical Modules), are fitted with LEDs of four different wavelengths. In this study, we determined different properties of the LEDs in a cDOM including the peak wavelength, spectral width, absolute intensity, and angular emission profile of each LED. These results will be used to better understand the data taken when the cDOM LEDs are flashed and will improve our understanding of the wavelength dependence of detector response and ice properties.

51) IceTop Snow Cover Study

Hanna Feleke, Minneapolis Community and Technical College

Results on the simulation of IceTop with different snow covers are presented. IceTop is the surface component of IceCube, a neutrino telescope located at the South Pole in Antarctica. IceCube consists of a gigaton of ice instrumented with 5160 light sensors arranged in a cubic kilometer array on 86 strings of power and data cables. The sensors respond to light produced when neutrinos, particles produced in energetic astrophysical objects, interact in the volume of ice observed by IceCube. IceTop, a detector on the surface, consists of 81 stations located on top of the same number of IceCube strings. Each station has two tanks, each equipped with two downward facing light sensors. IceTop, built as a veto and calibration detector for IceCube, also detects air showers from energetic primary cosmic rays. The surface array measures the cosmic-ray arrival directions in the Southern Hemisphere as well as the flux and composition of cosmic rays. The IceTop detector is continuously calibrated during regular data taking. An important aspect of calibration requires a good understanding how IceTop tank respose is affected by the annually changing snow cover. In this project, simulations of tank response to different snow covers were carried out using IceCube Monte Carlo simulation software. Results are presented for single tank response to low energy particles. These results can also be used when analyzing IceTop data with the independent neutron monitor experiment at the South Pole.

52) High Energy Cascade Reconstruction Studies in IceCube Gen2

Justin Diercks, UW-River Falls

The IceCube Neutrino Observatory, a 1 km3 neutrino telescope in the Antarctic ice, has opened the era of neutrino astronomy. The in-ice array consists of 5160 light sensors called Digital Optical Modules (DOMs) deployed on 86 vertical strings between the depths of 1450 and 2450 meters. The DOMs operate as independent data collection units, sending reports when they detect a pulse of light to a central computer system on the surface. IceCube has been successful in meeting a major goal of detecting astrophysical neutrinos. The IceCube collaboration has proposed a next generation upgrade (Gen2) to increase the number of observed events to better understand the sources and mechanisms that produce very high energy neutrinos. The instrumented volume of 10 km3 would substantially increase the sample size of all neutrino flavors, potentially detect higher energy neutrinos, and increase direction resolution for point source searches. Four layouts or geometries have been proposed for the Gen2 extension. Explorations of simulations of the various geometries to reconstruct and differentiate cascade events are reported in this presentation. A cascade event produces an essentially spherical expanding ball of light from a shower of secondary particles produced in a neutrino interaction. In this study three existing event reconstruction methods are used to identify neutrino events in IceCube: Improved-Line-Fit, Tensor-of-Inertia,

and Cascade Likelihood. A description of how the reconstructions are used to make cuts on the data to reduce atmospheric muon backgrounds and retaining cascade-like events will be provided. It is hoped that this continuing research would show a clear preference of one layout over the others for selecting cascade type events in Gen2.

53) Upgrade and Optimization of Muon Taggers for Calibrating IceTop

Joe Wagner, UW-River Falls

This project focused on upgrading and optimizing existing portable cosmic ray detectors used to calibrate IceTop, the surface component of IceCube. IceCube is a cubic kilometer neutrino telescope deployed deep in the glacial ice at the South Pole. It is used to observe the universe via neutrinos – neutral, almost massless particles created in supernovas, active galactic nuclei, and other energetic astrophysical objects. IceTop observes showers of charged particles that are produced by the cosmic rays continuously bombarding the upper atmosphere. IceTop consist of 162 tanks of ice, each equipped with two light sensitive modules. Charged particles, mostly muons, traversing the ice in IceTop tanks are detected by the light sensors. Methods for calibrating the response of the tanks to muons is the use of an independent portable muon detector, called a muon tagger, which can be placed above the tanks. A subset of coincident particles – seen both by the taggers and tanks – is then selected to be used for calibration. The taggers must count muons and record the detection times accurate to less than 1 microsecond. Cosmic rays are directly observed by up to four scintillator paddles with photomultiplier tubes that result in voltage outputs. These voltages are then analyzed by a microcontroller to determine whether or not they represent the desired muon event. A program that runs on a microcomputer then creates a text file containing event times. Current muon taggers were built and last updated in 2006. Replacement options for both the microcomputer and the data acquisition microcontroller, as well as power supply, were explored. Factors such as power usage, cost, practicality, and user interface were considered, and the Raspberry Pi B was chosen as the new microcomputer. The microcontroller was replaced with its updated version, both of which were built by QuarkNet. Software and wiring were upgraded or replaced to be compatible with hardware changes. Preliminary data from the new configuration were consistent with expectations for muon event rates, however further testing must be done to confirm the software is ready for field use. The result of all changes will be a better user interface, a simplified operating system, longer battery life, and the replacement of obsolete 9-pin serial ports with USB 2.0 cables and an HDMI port. This update has a predicted operational lifetime of 5-10 years.

54) Standard Candle Analysis in Icecube

Samuel Gardner, UW-River Falls

The Standard Candle (SC) is an in-ice laser module (337 nm pulsed nitrogen laser) with absolutely calibrated light output. It uses a reflective cone to simulate the Cherenkov light from an electronneutrino induce cascade propagating through the ice. Because the location and per-pulse energy of the Standard Candle are known well it is used to calibrate the energy and vertex reconstruction for cascades. In Icecube the Standard Candle has no way to communicate with the rest of the detector, therefore the real data was filtered by using cascade reconstruction information. Working with Icecube simulation software, Monte Carlo simulations of Standard Candle pulses were produced. Analysis of the simulation and real data show that properties of the simulation method used are improperly modeling some factor in the ice.

55) Investigating The Use Of Partridge Pea And Silky Lupine To Protect Native Grasses From Knapweed

Denner Guimaraes, Sonja Maki, UW-River Falls

The invasive knapweed plant (Centaurea maculosa) is causing serious harm to landscapes in North America, particularly in the Western and Midwestern United States. Leguminous plants such as lupine (Lupinus perennis) have been shown to provide some benefit to native grasses when planted in knapweed infested sites. Legumes, such as lupine, have been shown to exude an increased amount of organic acids, such as oxalic acid, when grown in knapweed infested sites. Knapweed also secretes less chatechin, an allelopathic chemical, into the

soil suggesting a two way interaction between legumes and knapweed. Legumes are thought to provide some protection to native grasses because of this interaction. We were interested in whether another legume, the partridge pea (Chamaecrista fasciculata) would have similar protective effects on native grasses. Partridge pea is native to the Upper Mississippi River Valley and has been developed as a model system for plant biology. In this study we use gene expression resources that were available for partridge pea and we grew knapweed, big bluestem, partridge pea, and silky lupine in both a greenhouse experiment and big bluestem, partridge pea and knapweed in a lab setting to investigate whether partridge pea has any protective effects on native grasses. We concluded that Partridge pea grew well with knapweed, initiating an average of 10.6 leaves. Also, Knapweed and big bluestem had decreased growth when grown in media containing activated charcoal (knapweed= 6.67 leaves; big bluestem=4.33 leaves).

56) Improving Computation Of Attributes Of A Flashing Digital Optical Module (DOM) In The Icecube Project Using The Python Language

Vanessa Roxanne Esaw, University of Minnesota

IceCube is the world's largest neutrino detector, which spans over one cubic kilometer. Neutrinos are unique because they always travel across space without deflection. They can be used as astronomy messengers since they point back to their source of origin such as active galactic nuclei, which are galaxies with massive black holes in their center. The IceCube detector is composed of many sensors called Digital Optical Modules (DOMs) that are designed to detect the light emitted when neutrinos interact with the ice around the detector. DOMs also have LEDs that can be flashed to simulate light emitted from a neutrino. Data from flashing LEDs are used in experiments to better understand properties of the ice in which neutrinos interact, and to test the algorithms used to find neutrinos in IceCube data. These are all possible because the LEDs represent a well-known, controlled light source. Parameters that can be controlled for a flashing DOM includes the brightness, flash time, duration of flash, and flashing rate. Except for the flash time, these parameters are stored in one of IceCube's databases and need to be retrieved when this data is used. Flash time is computed based leading edge of the pulse that turns on the LEDs. The code that gets this data about a flashing DOM, and calculates flash time was out of date and difficult to build with current IceCube software because of dependencies that are being slowly phased out, making it difficult to obtain these parameters for analyses. The focus of this project was to replace the old code that computes flashing DOM information. This project involves the creation of a program that does this in the Python programming language. The new code was written and tested against the old code for correctness. It was also tested on the IceCube cluster in Madison to verify it can be used within the framework of the IceCube project. This will make it easier to analyze data from simulations and experiments that use flashing DOM data to further understand and calibrate the IceCube neutrino detector.

57) Modeling Artificial Tumor and "Normal" Breast Ductal Cancer Tissues Using the New Cell-Mate ™ 3D Matrix Material.

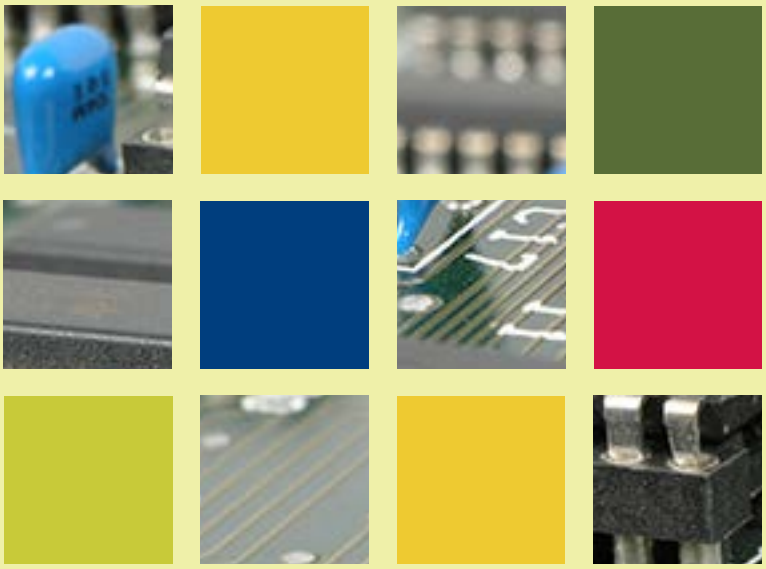
Bruna Stilpen Justen, Ronaldo Loureiro and Timothy Lyden, UW-River Falls

In collaboration with BRTI Lifesciences, LLC., the UWRF TCIC has been engaged in testing and evaluating a new synthetic 3D tissue engineering matrix material product called Cell-Mate. This new material is based on a combination of hyaluronic acid and chitosan which yields a final matrix gel that enmeshes cells at relatively high densities to generate artificial tissues. In this series of studies, breast ductal adenocarcinoma cells (MCF-7) and "normal" breast ductal cells (MCF10A) were employed to generate significant artificial tissues (ATs) based on the application of Cell-Mate. MCF-7 ATs were generated from 40, 20 and 10 million cells respectively and MCF10A ATs were generated from 20 and 10 million cells. In all cases, successful ATs resulted with significant areas of tissue or tumor-like architecture and distinct evidence of cellular differentiation as well as tumor cell progression. MCF-7 ATs generated evidence of tumor progression and eventual metastasis-related spheroid, cluster and single cell release. In the case of 40 million cell seeding loads, spheroid production occurred within the first week of culture while at 20 and 10 million cell loads the timing of spheroid generation/release was significantly longer at 2-3 weeks. However, within the first week, 20 million and 10 million cell loads did show definitive rounded features on the surfaces of the developing ATs. Interestingly, some cluster generation

was seen in the "normal" MCF10A cell line ATs as well, but at a much lower level. Also in the case of MCF10A, shed cells formed monolayers in the bottom of culture wells which displayed differentiation-associated cells and colonies after 2-3 weeks of ATs development. These cells contrasted distinctly from those seen in the original culture monolayers which strongly supports the interpretation that ATs microenvironments induce pathway specific changes in cellular behaviors. Continuing studies are evaluating the morphology and marker expression profiles of tissues within the generated ATs as well as examining and comparing Cell-Mate generated MCF-7 spheroids in contrast to media induced or hanging drop culture generated spheroids. Based on studies to date, we propose the application of Cell-Mate as an effective approach to modeling breast cancer tumors in-vitro and expect that this will open the door to better understanding of the role of microenvironments in tumor progression generally.

Thank you for your attendance at WSTS 2015! We hope it was a productive time for your research and commercial endeavours.

From the whole WiSys team, we appreciate your efforts in education, research and entrepreneurship. If there is any way that WiSys can be of assistance to you, contact us.



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