CATALYST

University at Buffalo The State University of New York

FALL 2014

CHEMICAL & BIOLOGICAL ENGINEERING

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CHAIR'S WELCOME

It is a great pleasure to write this welcome note in the first edition of our re-engineered *Catalyst*, the UB CBE newsletter. As Chemical Engineering is undergoing a period of renaissance, our department is poised to play a key role in the development of the field in the years to come. My conviction stems from the outstanding quality of our faculty, students and alumni who work tirelessly to make the world a better place.

Our faculty research spans all areas of Chemical Engineering with particular emphasis in nanomaterials and nanotechnology, computational science, and bioengineering. These critical research areas align with the strategic plan of our university as well as the energy and health related priorities of our nation. For their research accomplishments, our faculty have won numerous prestigious awards and research grants that enabled exciting new research projects, a small number of which are featured in the following pages.

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Dylan Buyskes // Onion Studio, Inc.

This year we experienced significant growth with the addition of outstanding new faculty. Collectively, their research addresses important problems in the broad areas of materials informatics, computational chemistry, nanomaterials, and membranes for environmental and energy applications. Our growth efforts will continue this year as we are looking to hire more faculty in the area of bioengineering.

Both the enrollment and qualifications of our graduate and undergraduate students increased dramatically over the past few years and we have many exciting news items to share about our students' successes. We are also very proud of all our alumni, who responded enthusiastically to our calls to reconnect through social media and other means. I am thankful to all of you who volunteered to help the department with your expertise, time, and gifts. This year I am happy to announce the establishment of the Amol Ajinkya Fellowship for graduate students and the Amol Ajinkya Lecture Series, both of which were made possible by the generosity of our distinguished alumnus Dr. Milind Ajinkya, who is featured on the last page of this newsletter.

On behalf of the UB CBE family, thank you to all who made these events possible through your financial contributions. I hope that you will find the following pages as exciting as I do and I hope to see you on campus at one of our future events.

Please stay in touch
Stelios T. Andreadis

19 FACULTY

315 UNDERGRADUATE STUDENTS

140 GRADUATE STUDENTS

168 FACULTY PUBLICATIONS

$6 MILLION RESEARCH EXPENDITURES

8TH PLACE 2010 NRC PUBLICATIONS PER FACULTY

9TH PLACE 2010 NRC AWARDS PER FACULTY

DESIGN
Jessica Imbriano & Robyn Buyskes // Onion Studio, Inc.

NEW FACULTY ADD RESEARCH STRENGTHS

HAIQING LIN //

Assistant Professor

Membranes and Technology

Dr. Lin received his Ph.D. in Chemical Engineering from the University of Texas, Austin in 2005. Dr. Lin's research group focuses on the study of advanced polymer based membrane materials and processes for gas and vapor separation and water purification. His research combines design and synthesis of new materials and characterization of material structure and transport properties, with an end goal of solving practical problems and advancing fundamental understanding of structure-property correlation.

JOHANNES HACHMANN //

Assistant Professor

Big Data for Catalyst and and Materials Design

Dr. Hachmann received his Ph.D. in Chemistry from Cornell University in 2010 and conducted postdoctoral research at Harvard until 2014. His work combines quantum chemical modeling with virtual high-throughput and Big Data techniques as well as data mining ideas from machine learning and informatics. His approach facilitates an understanding of structure-property relationships in order to develop rational design capabilities. Particular applications are the areas of catalysis and advanced materials.

GANG WU //

Assistant Professor

Functional Materials for Electrochemical Energy Storage and Conversion

Dr. Wu received his Ph.D. from Harbin Institute of Technology in 2004. Prior to joining UB, he was Scientist at Los Alamos National Laboratory for almost five years. His research focuses on development of functional materials and catalysts for electrochemical energy science and engineering. The new type of nonprecious metal catalysts developed by Dr. Wu have been internationally recognized as a breakthrough, opening an avenue to use earth-abundant materials for sustainable energy technologies.

FACULTY HONORS AND AWARDS

PASCHALIS ALEXANDRIDIS

- Executive Committee of the American Chemical Society Division of Colloid and Surface Chemistry
- Associate Editor for the Journal of Surfactants and Detergents

MARK SWIHART

- 2014 UB Distinguished Professor
- 2013 Recipient of the Jacob F. Schoellkopf Medal

JEFFREY ERRINGTON

- 2013 CoMSEF Impact Award
- 2014 UB Sustained Achievement Award

CONGRATULATIONS

The following CBE faculty were promoted to the rank of *Associate Professor:*
Chong Cheng, Blaine Pfeifer, Sheldon Park, and Marina Tsianou.

DAVID KOFKE

- Elected 2014 Fellow of the AIChE
- 2014 SUNY Distinguished Professor

STELIOS ANDREADIS

- 2014 SUNY Chancellor's Award for Research and Creative Activities

CARL LUND

- Elected 2014 Fellow of the AIChE

MATERIAL RESEARCH:

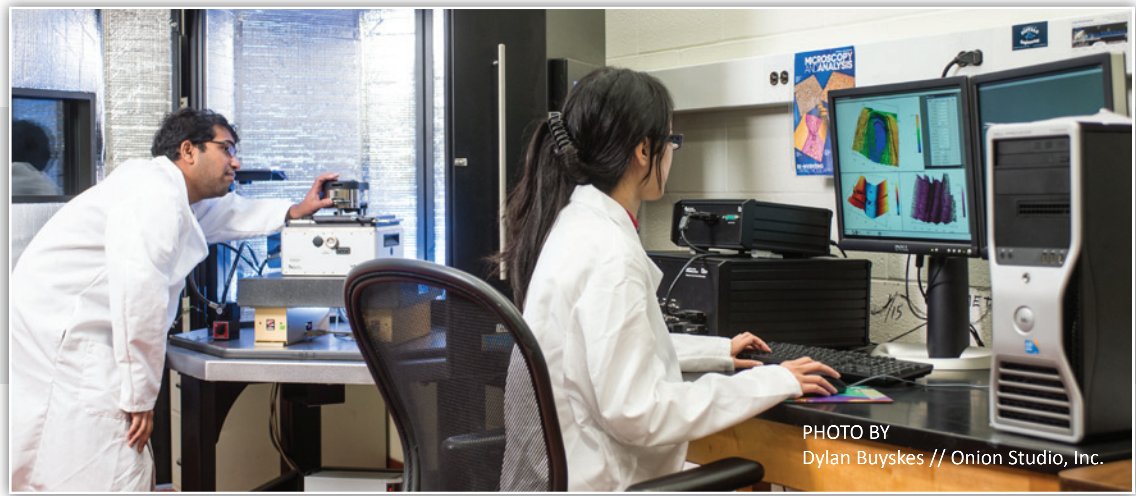
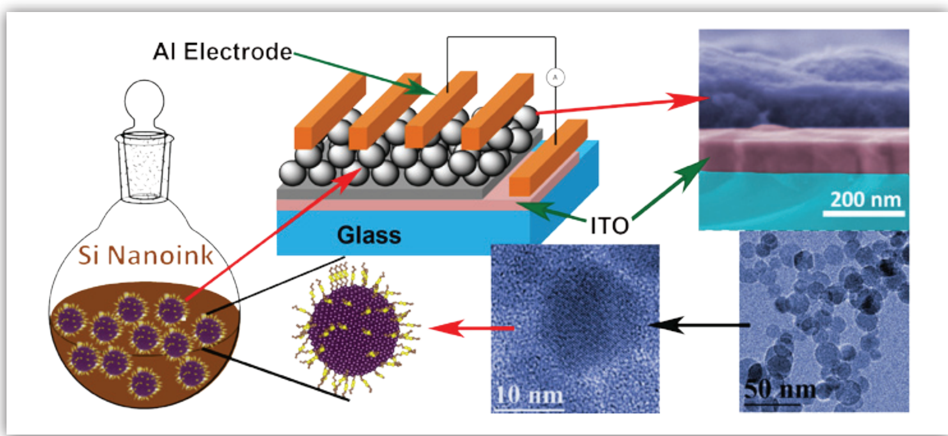


PHOTO BY
Dylan Buyskes // Onion Studio, Inc.

NEW SILICON NANOCRYSTAL INK FOR OPTOELECTRONICS

Professor Mark Swihart's research group has developed a new method to make functional optoelectronic devices using silicon nanocrystals (Si NCs) in a low-cost liquid phase coating process. Lead authors on the paper, published in *Advanced Functional Materials* (DOI: 10.1002/adfm.201400600) were Xin Liu, a recent Ph.D. graduate, and Tao Lin, a visiting student from Nanjing University. Solar cells, photodetectors, and light-emitting diodes (LEDs) are generally made using high-vacuum equipment and high temperatures. Use of printing or coating processes instead could dramatically decrease costs and enable production of flexible devices. The key to the success of the Swihart group's approach was attaching a molecule called allyl disulfide to the Si NCs. Allyl disulfide is a low-cost and environmentally friendly (though bad smelling) compound that naturally occurs in plants such as garlic. It has double bonds that can react with the Si NC surface, passivating it and protecting the Si NCs from oxidation. In addition, the SiNCs form stable dispersions in it, which is essential for use in printing. Finally, it does not block charge transport from one particle to the next in the final device. The research team fabricated a photodiode from this ink, using a simple spin-coating process to form the Si NC film. Their prototype device exhibited photoresponse to UV light comparable to commercially available UV photodetectors. This provides a new pathway to large-area, low-cost, solution-processed UV photodetectors on flexible substrates and demonstrates the potential of this new silicon nanocrystal ink for broader applications in solution-processed optoelectronics.



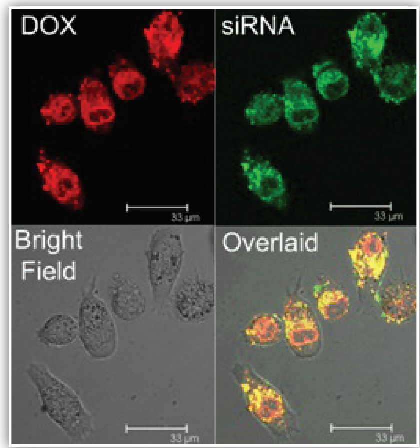
Schematic illustration of the fabrication of a UV-photodetector from silicon nanoparticle ink

NANOCAPSULES FOR CO-DELIVERY OF DRUGS AND GENES

Although combination therapies composed of both drugs and genes hold great promise for the treatment of various diseases, the absence of safe and efficient delivery technology remains a major barrier for their clinical applications. Recently, Professor Chong Cheng and collaborators established biodegradable cationic nanocapsules as novel biomaterials and demonstrated their applications in co-delivery of drugs and genes.

With remarkable hydrolytic degradability and very low cytotoxicity, these nanocapsules can encapsulate doxorubicin (DOX; an anticancer drug) with their inner cavities and adsorb negatively charged interleukin-8 siRNA (a tumor-suppressive genetic material) with their cationic shells. Via the nanocapsules, both DOX and interleukin-8 siRNA can be simultaneously delivered into cancer cells, resulting in synergistic therapeutic effects. Moreover, doxorubicin-loaded nanocapsules can bypass P-glycoprotein-mediated multidrug resistance of cancer cells, leading to increased intracellular drug concentration and reduced cell viability. As illustrated by *in vivo* studies using a mice model, these nanocapsules can avoid fast renal clearance but their degradation residues can be eventually eliminated through systemic clearance.

This work was sponsored by the *National Science Foundation*, and carried out in collaboration with Professors Paras N. Prasad and Stanley A. Schwartz's groups at UB. The peer-reviewed publication on this work appeared in *Nanoscale* in early 2014. Dr. Chih-Kuang Chen (Ph.D. in CE, 2014), the first author on that paper, completed his doctoral dissertation on novel materials for therapeutic delivery and is now employed as an Assistant Professor at Feng Chia University in Taiwan.



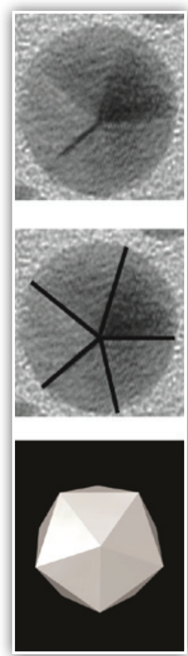
Confocal images illustrating co-delivery of DOX and siRNA into prostate cancer cells via biodegradable cationic nanocapsules

FUNCTIONAL BIOCOMPATIBLE POLYMERS FOR THE SYNTHESIS OF METAL NANOPARTICLES WITH MEDICAL APPLICATIONS

Nanometer-sized monodispersed metal particles are attracting significant attention due to their diverse applications. For example, gold nanoparticles (Au-NPs) have been used to preferentially target cancer cells, whereby taking advantage of their optical properties, hyperthermia can be induced, leading to selective apoptosis.

Professor Paschalis Alexandridis is the inventor of a novel methodology for the synthesis of metal nanoparticles where amphiphilic polymers act in tandem as reducing, stabilizing, and morphogenic agents (United States Patent 7,718,094, http://en.wikipedia.org/wiki/Colloidal_gold). This methodology is environmentally-friendly, taking place in aqueous solutions, and economical, as it involves commercially available polymers at ambient conditions. It also facilitates the direct utilization of the formed metal NPs in medicine via the use of pharmaceutically-approved polymers such as Poloxamers.

In recently published work (*Journal of Polymer Science A, 2013, 51, 1448-1456*), Alexandridis and coworkers from the University of Athens report the synthesis of Au-NPs using the polypeptide poly(L-proline) (PLP) which is biocompatible, biodegradable, and easy to conjugate. The extended secondary structure of PLP II resulted in the facile formation of highly crystalline Au-NPs in water at a very low Au(III)/PLP molar ratio. These Au-NPs have the smallest size and size distribution among NPs synthesized so far by polymeric materials in aqueous media and excellent colloidal stability.

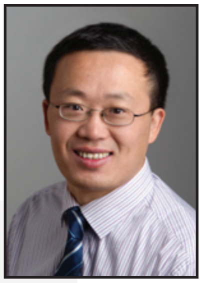


Most of the formed Au-NPs had icosahedral shape

MATERIAL RESEARCH:

ENERGY-EFFICIENT MEMBRANES FOR CO2 CAPTURE

Growing evidence indicates that man-made emissions of greenhouse gases, principally CO_2, are contributing to global climate change. The bulk of these CO_2 emissions are caused by the combustion of fossil fuels for power production. One approach to controlling CO_2 emissions to the atmosphere is to capture the CO_2 from the mixtures with N_2 and H_2 in a low-cost and energy-efficient manner.



As an energy-efficient separation technology, membranes are an attractive alternative to conventional thermally driven and energy intensive separations in addressing the critical challenges. Dr. Lin's research group focuses on molecular design and engineering of polymer based nano-structured materials with high CO_2 permeability and high CO_2/N_2 and CO_2/H_2 selectivity. The approach combines design and synthesis of new polymeric materials, and characterization of structure and transport properties, with an end goal of solving practical problems and advancing fundamental understanding of structure-property correlation. This work is supported by the Korean Carbon Capture & Sequestration R&D Center, and the School of Engineering and Applied Science at University at Buffalo.

NEW NSF EQUIPMENT GRANT PROVIDES UNIQUE CAPABILITIES FOR STUDYING MAGNETIC NANOMATERIALS FOR BIO-APPLICATIONS

CBE Professors Mark Swihart, Edward Furlani, and colleagues have been awarded a *National Science Foundation MRI* grant for the development of a unique multimodal instrument that will be capable of imaging and characterizing fundamental properties and behavior of biofunctional magnetic particles (MPs) *in situ* with unprecedented spatial and temporal resolution.

Applications of MPs are proliferating in the fields of microbiology, biotechnology, nanomedicine and lab-on-a-chip technology. They can be chemically treated to selectively bind to biomaterials ranging from proteins to whole cells and can be used to separate and sort such materials from complex samples using an external magnetic field.

Custom microfluidic devices will be developed to provide well-defined flows for transport and receptor binding studies. Computational software will be integrated with the instrument to advance predictive capabilities for rational design and to facilitate interpretation of experimental results. Once developed, the instrument will serve as a shared resource for use by researchers at UB's schools of engineering, science and medicine, the Roswell Park Cancer Institute and industrial and academic groups throughout Western New York. It will provide unique infrastructure that will advance fundamental and translational research across a broad range of bioapplications and enable commercialization of related technology.

Mark T. Swihart

Edward P. Furlani

Undergraduate, graduate, and post-doctoral trainees will obtain unique interdisciplinary hands-on training in state-of-the-art experimental and theoretical methods in the areas of biomagnetics, magnetic transport phenomena, cellular and tissue engineering, microfluidics, and biophotonics.

PHOTO BY
Dylan Buyskes // Onion Studio, Inc.

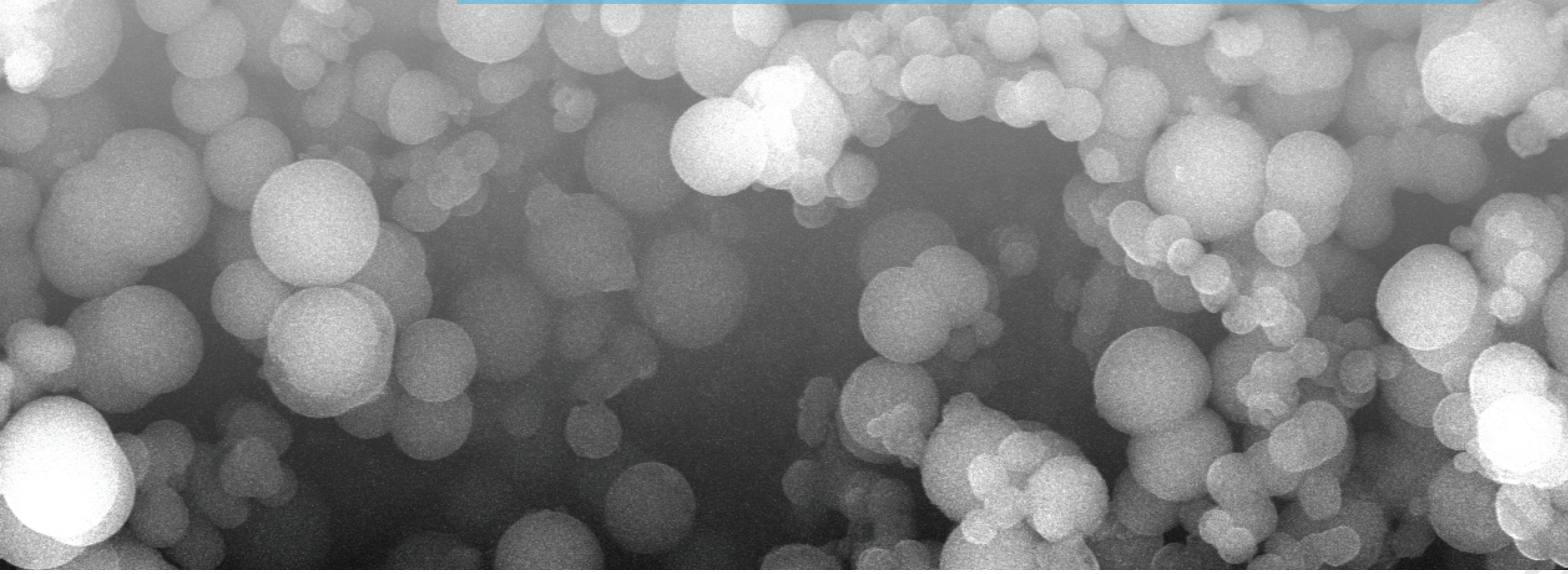
FUELS AND CHEMICALS FROM BIOMASS

PHOTO BY
Dylan Buyskes // Onion Studio, Inc.

The Carl Lund Group is studying the conversion of cellulose-derived carbohydrates to platform chemicals such as using mineral acid catalysts. When the process is carried out in aqueous solution, dark-colored, tarry solids known as humins are formed. The formation of humins is not desired as it reduces the yield of the more valuable platform chemicals.

The main focus of the Lund group is to reduce or eliminate humin formation, but methods for converting humins into more valuable products are also being pursued. Mechanistic kinetics studies combined with spectroscopic and microscopic characterization of the humins has revealed that aldol addition/condensation is a primary pathway for their formation. At the end of processing, there are multiple carbonyl groups remaining in the humins, and our studies have demonstrated that these carbonyl groups can be used to add new chemical functionality to the humins via post-processing aldol condensation.

Additional work continues, seeking to modify the shape and size distribution of the humin particles to make them more uniform. The group is studying the non-aqueous processing of the carbohydrates in an effort to reduce or eliminate humin formation. Mechanistic studies suggest that the primary pathway to humin formation involves the addition of water to the intermediate product, HMF. Hence, non-aqueous processing may reduce the amount of humins formed. At present, gamma-valerolactone is being studied as a potential solvent in combination with various co-solvents for the solubilization of glucose, the primary product of cellulose hydrolysis.



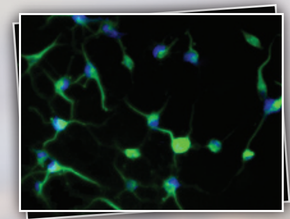
BIORESEARCH:

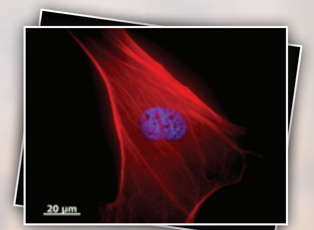
BUILDING ARTERIES WITH REJUVENATING STEM CELLS

The demand for small diameter vascular grafts is increasing as cardiovascular disease claims one in every four deaths in the United States and the world. The Andreadis group is addressing this problem using mesenchymal stem cells (MSC) and induced pluripotent stem cells (iPSC) to engineer arteries in the lab. However, they found that stem cells from older donors exhibited limited function, a significant challenge, as patients in need of vascular transplants are usually elderly.

An exciting new discovery promises to solve this problem. The Andreadis lab discovered that MSC senescence (aging) can be reversed by introduction of a single gene, Nanog. Expression of Nanog restored the impaired proliferation and differentiation potential of aged MSC, enabling generation of functional arteries. In collaboration with Dr. Daniel Swartz (Department of Pediatrics), these "rejuvenated" arteries were transplanted successfully into the arterial system of a pre-clinical animal (ovine) model, raising hopes for future clinical applications.

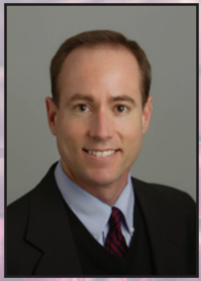
These discoveries were facilitated by a novel technology developed in this lab – the LentiViral Array (LVA) – which enabled quantitative and real-time monitoring of regulatory networks controlling stem cell fate decisions. Recent publications from this work appeared in Cell Stem Cell, Stem Cells, and Journal of Cell Science and Molecular Therapy. This work was made possible by grants from the *National Institutes of Health (NHLBI, NIDCR)* and the *National Science Foundation (NSF-CBET)*.



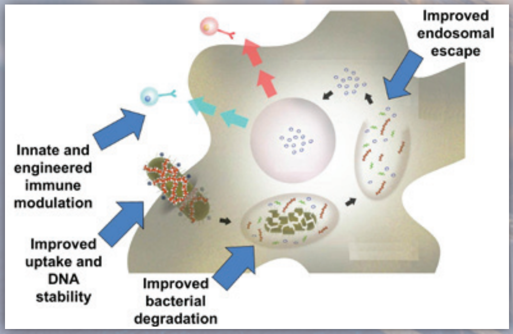


Differentiation of stem cells into neurons (Left panel, Tuj1 protein is shown in green) or muscle (Right panel, smooth muscle alpha actin filaments are shown in red).

SYNTHESIS OF HYBRID BIOMATERIAL-BACTERIAL GENE DELIVERY VECTORS



Vaccination is a powerful means of pre-empting or treating disease. The process depends on successful recognition of a foreign entity (an antigen) to illicit a strong immune response. The delivery of an antigen encoded as a DNA molecule (a genetic antigen) requires the assistance of a vector to facilitate the process of gene expression within immune system sentinels termed antigen presenting cells (APCs).

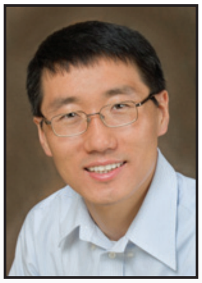


Hybrid vector genetic vaccine delivery schematic

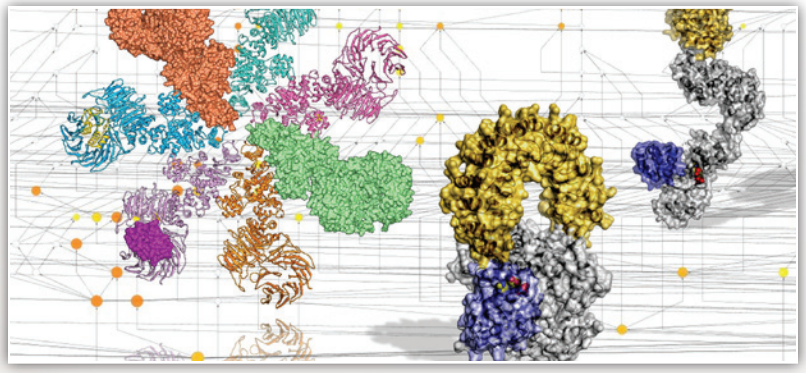
In work recently published in the *Proceedings of the National Academy of Sciences* by Charles Jones, a fourth-year graduate student in Professor Blaine Pfeifer's group, two normally distinct vectors (a bacterial cell and a synthetic polymer) were combined to generate a hybrid vector. The new vector coupled synergistic mechanisms to assist and improve gene delivery to APCs. Furthermore, the hybrid vector provides unique and complimentary engineering capabilities, which were demonstrated to further tailor and improve APC gene delivery.

PHOTO BY Dylan Buyskes // Onion Studio, Inc.

ENGINEERED PROTEINS IN THE MOLECULAR TOOLBOX



Engineered proteins have found various applications in science and medicine. Although all proteins are constructed from simple chemical units, i.e. amino acids, the large degree of freedom inherent in large protein molecules makes it difficult to predictably design their molecular properties.



Getting up close and personal with a diseased protein: N0D2 is often mutated in Crohn's disease. Homology modeling suggests a structure-based approach to regain lost activity

To overcome these limitations, the Professor Sheldon Park lab relies on a synergistic use of experimental and computational techniques to engineer novel proteins. For example, homology modeling and directed evolution were used together to create the world's first de novo monomeric streptavidin that is now used by biologists, chemists, and physicists.

The group is currently developing a novel synthetic biology tool to enable posttranslational assembly of large proteins that cannot be easily synthesized in microorganisms. The technology will allow multi-domain proteins to be efficiently constructed in a combinatorial fashion, which can be useful to develop a novel drug discovery platform.

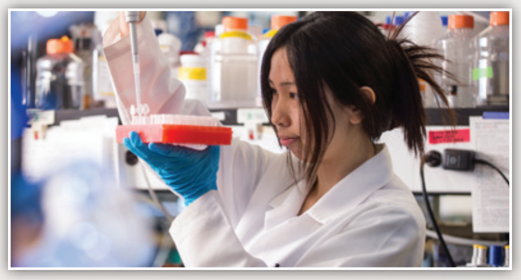
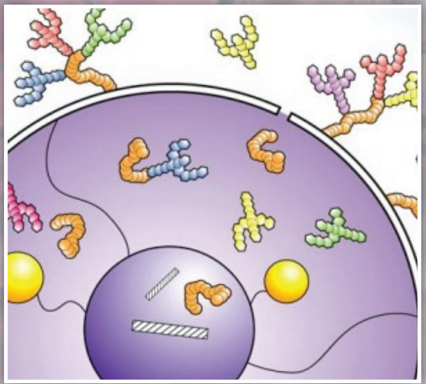


PHOTO BY
Dylan Buyskes // Onion Studio, Inc.

Separately, Park and co-workers have used a structure-based approach to investigate the pathogenesis of Crohn's disease, and engineered a peptide that suppresses the pathological inflammation commonly observed in the disease. The peptide may someday be used to develop a new therapy for the disease. The discoveries made in the Park lab, which are made possible through grants from the *National Science Foundation*, are expected to have far reaching implications in many areas of biotechnology.

SWEET MEDICINES DERIVED FROM STUDIES OF CHEMICAL REACTIONS IN CELLS

Almost every protein on the human cell surface is decorated by sugars or 'glycans'. These carbohydrates are synthesized inside cells and then transported to their surface by a network of biochemical reactions that are called 'glycosylation reactions'. Due to the abundant expression of such sugars on cells, almost all living processes involving cell-cell interaction also involve the glycans. This is particularly relevant to humans since aberrant sugar structures are some of the earliest biomarkers of cancer and a variety of functions mediated by these sugars control the progress of a variety of cardiovascular ailments. With support from *National Heart Lung Blood Institute* grants that support *Systems Biology Collaborations* and the *Program for Excellence in Glycosciences*, researchers in Professor Sriram Neelamegham's laboratory are applying chemical reaction engineering principles, both math modeling and experiments, to discover the rules of nature that regulate the appearance of specific sugars at defined times and locations on the cell surface. Such knowledge is used to design analogs of natural sugars ('Sweet Medicine') that can alter the progression of human cardiovascular and inflammatory ailments.



When two cells come together, almost without exception, sugars on cell surfaces are involved

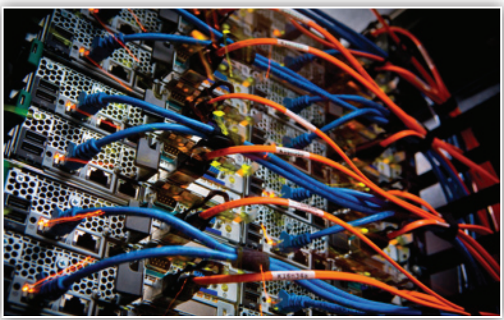
COMPUTATIONAL RESEARCH:

BIG DATA FOR CATALYST AND MATERIALS DESIGN

Many of the grand challenges in chemistry, chemical engineering, and materials science are inherently associated with complicated quantum phenomena. Johannes Hachmann and his team in CBE address these questions – in particular in the areas of catalysis and molecular materials – using the tools of computational quantum chemistry.

One specific example is the search for new high-performance catalysts for solar water splitting, a technology that could transform the way we harvest and store solar energy. The Hachmann Group always strives to team up with experimentalist partners and form integrated discovery pipelines, as theory often makes its most relevant contributions to real-world problems when it is closely tied to experimental efforts. The group combines traditional molecular modeling with virtual high-throughput techniques, which allows for the systematic study of millions of compound, material, or reaction candidates.

This approach naturally leads to a Big Data scenario, which can be used to facilitate an understanding of structure-property relationships. Such an understanding is an important foundation for the development of rational design capabilities. In order to extract insights from the volumes of data, the Hachmann Group adopts data mining and modeling ideas from the machine learning and informatics community. The group also leverages these ideas to develop smarter, more automated numerical algorithms, and thus advance computer-aided chemistry. This data-driven research program aligns directly with the objectives of the *NYS Center of Excellence for Materials Informatics* and the *White House Materials Genome Initiative*.



UB CCR high-performance and volume computing supports the research in the Hachmann Group

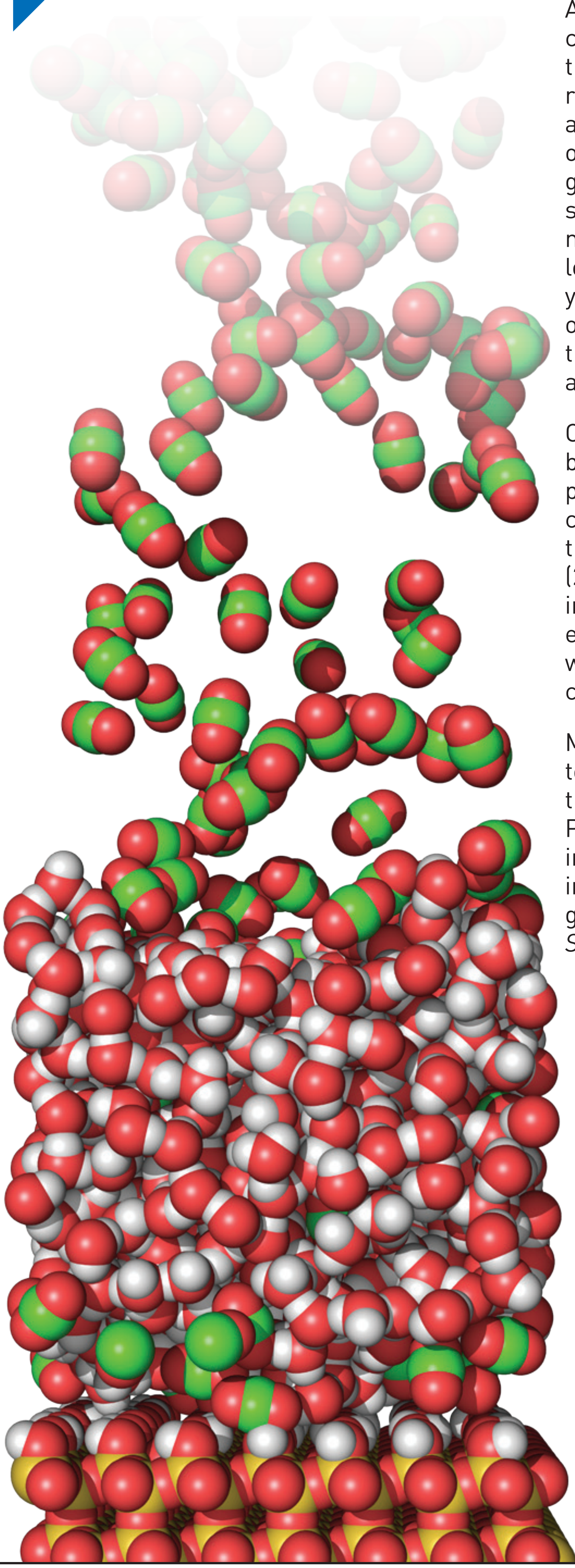
UNDERSTANDING CLATHRATES WITH MOLECULAR SIMULATION

Clathrate hydrates are crystalline compounds in which water molecules at high pressure and low temperature form a lattice of cage-like structures that encapsulate small hydrophobic solute molecules, such as methane or hydrogen. These materials have great technological and environmental significance, particularly in the petroleum field, where their unwanted formation in pipelines is a recurring problem to the industry. Huge natural reserves of methane hydrates are viewed as both a potential energy source, as well as a potential greenhouse-gas catastrophe if they ever spontaneously release into the atmosphere.

Clathrate hydrates have been studied by experiment for decades, and more recently they have been examined by molecular simulation. Despite this attention, there have been no comprehensive studies performed to determine thermodynamic stability of the phases from molecular models, examining all important factors. There are many to consider, including the hydrate crystal structure, the chemical species, concentration, and distribution of the solute, conditions of temperature and pressure, nuclear quantum effects, and the impact of co-solutes.

The CBE research group of David Kofke is examining all of these factors via molecular simulation. The results are needed to provide a solid foundation for studies of other important phenomena for these systems, such as nucleation and growth processes. Results from these studies might also provide understanding needed to formulate better mitigation strategies for preventing clathrate formation, and conversely, better ways to use clathrates in technological applications, such as energy storage. This research is being conducted with Research Assistant Professor Andrew Schultz, and graduate students Sabry Moustafa and Weisong Lin, with support from the *Petroleum Research Fund of the ACS*.

USING MOLECULAR SIMULATION TO STUDY CARBON DIOXIDE SEQUESTRATION



As the potential impacts of increased concentration levels of carbon dioxide in the atmosphere and ocean become more realized, scientists and engineers are placing an increased emphasis on the development of solutions to capture and store greenhouse gases such as carbon dioxide. Geological sequestration represents a promising means to store carbon dioxide for relatively long periods of time (several hundred to several thousands of years). Possible storage locations include deep saline aquifers, oil reservoirs, and unmineable coal seams. Implementation of this strategy is currently slowed by uncertainty regarding the amount of gas that can be injected safely into a reservoir.

One of the key mechanisms for gas leakage is capillary breakthrough. The relevant threshold pressure (the minimum pressure required to initiate gas flow through the porous caprock) is directly related to two interfacial properties: (1) the interfacial tension between brine and carbon dioxide and (2) the contact angle of a brine droplet at a mineral surface in a mother high-pressure carbon dioxide-rich fluid. Recent experiments point to several outstanding issues, particularly with respect to understanding the impact of high pressure carbon dioxide on the wettability of mineral surfaces.

Molecular simulation represents a potentially powerful tool for probing the microscopic aspects and for predicting the macroscopic interfacial properties of these systems. Professor Jeffrey Errington's group is now developing and implementing molecular simulation strategies for studying interfacial phenomena related to geological sequestration of greenhouse gases. This project is supported by the *National Science Foundation*.

Computational engineering graduate student Ramachandran Subramanian presents his research at the 2014 Symposium

ALUMNI & FRIENDS

Meet the Faces of CBE

Panagiotis Smirniotis, PhD, 1994

Professor, Chemical Engineering, University of Cincinnati and 2014 AIChE Lawrence K. Cecil Award recipient

"Being a Ph.D. graduate student in the Chemical Engineering Department at UB was one of the most important periods of my life. I had the opportunity to study numerous interesting problems and it was the foundation for my future career. I am very nostalgic for the years I spent in Buffalo and at UB."

Manoj Choudhary, MS, 1976

Senior Technical Staff, Owens Corning's Science and Technology Center

"I most cherish the support I received from my teachers, fellow students, and the UB community as a young graduate student freshly arrived from India. I am still in touch with friends I made at UB"

Dan Salem, BS, 2013

Ph.D. Student, Massachusetts Institute of Technology and recipient of the Barry M. Goldwater Scholarship

"I had an amazing experience as an undergraduate within the CBE department. One of my favorite memories was learning about McCabe-Thiele diagrams in Professor Lockett's Separations class. He introduced the subject by suggesting we all get tattoos of a McCabe-Thiele diagram on our forearms"

To see more Faces of CBE and become one yourself, check out our website at www.cbe.buffalo.edu/faces.

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Dylan Buyskes // Onion Studio, Inc.

SUPPORT EXCELLENCE

The UB CBE Annual Fund for Students, Lectures, and Programs

When you make a financial contribution to UB CBE, you allow bright, hard-working students to fulfill their dreams and complete their degrees through scholarships, special lectures, and learning environment improvements. Your gift also enables groundbreaking research at all levels of the department. To make a gift, simply send your donation in the return envelope enclosed, or go online to www.cbe.buffalo.edu/donate . Thank you!

RECONNECT
WITH UB CBE

HOST AN INTERN

Each year, the majority of UB CBE undergraduate students engage in internship experiences in Western New York and across the United States. There's a bright and eager student ready to work on real-world engineering problems at your firm too.

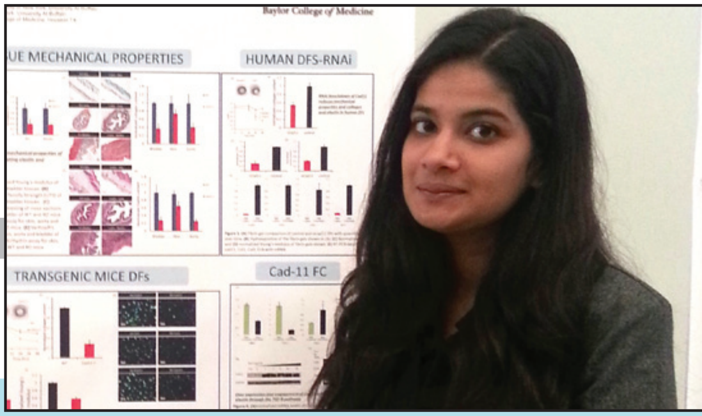
ATTEND EVENTS

Join us for the Fall UB CBE Graduate Research Symposium or the Spring annual Ruckenstein lecture. We would love to see you there!

GIVE A LECTURE

UB CBE is very lucky to have an active and engaged AIChE student chapter, and they are always looking for lecturers to discuss careers in chemical engineering and to host field trips to see the possibilities.

For more information on the UB CBE alumni program and to reconnect, like us on Facebook and LinkedIn, and sign up for the CBE e-bulletin at www.cbe.buffalo.edu/connect. You can also write us at cbe-chair@buffalo,edu, or call 716.645.1174.



ROW RECOGNIZED BY AIChE AND BMES

Congratulations to Sindhu Row, Ph.D. student in Professor Stelios Andreadis' lab, who received recognition by both AIChE and BMES last year:

AIChE 2013 Best Presentation, Session: Stem Cells in Tissue Engineering II, Awarded paper: "*Maturation of Implantable Vascular Grafts in An Ovine Model Using Small Intestinal Sub-Mucosa: Do We Need Pre-Seeding of Smooth Muscle Cells?*" Authors: S. Row, H.F. Peng, E.M. Schlaich, C. Koenigsknecht, D.D. Swartz and S.T. Andreadis.

BMES 2013 Outstanding Contribution, Awarded paper: "*Time Course of Healing and Maturation of Implantable Vascular Grafts in the Arterial System of an Ovine Model: Do We Need Cells in the Vascular Wall?*" Authors S. Row, H.F. Peng, E.M. Schlaich, C. Koenigsknecht, D.D. Swartz and S.T. Andreadis.

TUCCIARONE AWARDED MARSHALL SCHOLARSHIP

Congratulations to UB CBE undergraduate Phillip Tucciarone, who will use his Marshall scholarship to obtain his doctorate in materials science at either the University of Oxford or Imperial College of London. He will join the transcending research currently underway on graphene, one of the crystalline forms of carbon. Fueled by his desire to become a professor of materials science, Phil has devoted much of his undergraduate research to nanomaterials and the development of methods of non-toxic bio-imaging, which play a role in cancer treatment. In addition to the Marshall scholarship, Phil has also won the *2014 SUNY Chancellor's Award for Excellence* in academic performance and extraordinary commitment to campus and community. He also has received the *Barry M. Goldwater Scholarship* and the *2014 National Science Foundation Graduate Fellowship*. Phil has been working in the lab under the direction of Professor Mark Swihart.

STUDY ON "NANOJUICE"

Located deep in the human gut, the small intestine is not easy to examine. X-rays, MRIs and ultrasound images provide snapshots but each suffers limitations. University at Buffalo researchers are developing a new imaging technique involving nanoparticles suspended in liquid to form "nanojuice" that patients would drink. Upon reaching the small intestine, doctors would strike the nanoparticles with a harmless laser light, providing an unparalleled, noninvasive, real-time view of the organ. UB CBE Ph.D. student Yumiao Zhang of the Professor Jon Lovell lab and others, including CBE Professor Paschalis Alexandridis, have written a paper on the project that appeared in the July 6 issue of *Nature Nanotechnology* . Advancement could help doctors better identify, understand and treat gastrointestinal ailments.

STUDENT AIChE CHAPTER CONNECTS WITH THE COMMUNITY

The UB student AIChE (American Institute of Chemical Engineers) chapter brought in speakers from DuPont, Olin Corporation, Isle Chem and Flying Bison Brewery to share their knowledge and experiences in industry, and toured the brewery and Life Technologies. The Cheme-E Car team competed at the 2014 Mid-Atlantic Student Regional Conference at the University of Virginia in March. CBE students have also been volunteering, making liquid nitrogen ice cream during Open House, and playing with cornstarch and water at the Buffalo Museum of Science Engineers Week event. During UB's E-week 2014, AIChE hosted a separation challenge, forcing students to purchase filtration supplies with a limited amount of mock currency and then economically filter dirty water.

17TH ANNUAL GRADUATE STUDENT SYMPOSIUM SHOWCASES RESEARCH

Over the years the UB CBE Graduate Student Research Symposium has evolved into an exciting, comprehensive event that showcases the high quality, multidisciplinary research that is conducted in our department, and spans diverse areas such as molecular engineering of novel materials, nanotechnology, bioengineering, and molecular modeling. Every year our faculty and graduate students welcome the opportunity to present their work to their peers from CBE, other UB departments, our alumni, and representatives from local business. The Symposium has grown in ambition and scale, featuring over 70 posters, two lectures from senior graduate students, and a keynote lecture from an accomplished colleague in industry. This fall, CBE welcomed Dr. Daniel K. Schwartz, University of Colorado Boulder. An alumni/student reception featuring a poster judging contest immediately followed the lectures.

CALTECH'S MARK DAVIS DELIVERS RUCKENSTEIN LECTURE

The 2014 Ruckenstein Lecture featured Professor Mark E. Davis. The Ruckenstein Lecture series is presented in honor of Dr. Eli Ruckenstein, a prolific researcher who has made (and continues to make) contributions in almost every subfield of chemical engineering. Each spring the Series brings to our campus a distinguished scholar in chemical engineering to speak about research activities in his or her laboratory, trends in the field, and larger problems in society that chemical engineers can address. This year's lecture featured Dr. Mark E. Davis from the California Institute of Technology, who discussed "Fighting Cancer with Nanoparticle Medicines: The Nanoscale Matters!" Over 200 UB CBE graduate students and visitors enjoyed the standing room only lecture and reception at the Center for the Arts.

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MEMORIAL FUND SUPPORTS LECTURES AND FELLOWSHIPS

Milind Ajinkya believes that all students make an impact on their institution, through their studies, their research, and the people they connect with. A 1975 Ph.D. graduate of the UB Department of Chemical and Biological Engineering, Milind studied under the guidance of W. Harmon Ray, and learned from chemical engineering legends like Eli Ruckenstein, Sol Weller and Bill Gill."I found my first job at Shell Research in Amsterdam, Holland and later moved on to Exxon Research and Engineering Company in Florham Park, NJ, ultimately spending some 35 years in the reaction engineering field. UB ChE Department (as it was known at the time), did a fine job in preparing me for my industrial career."

As a token of his appreciation and gratitude, Milind has recently established the Amol Ajinkya Memorial Fund in his son's memory for Fellowships and Lectures. We're proud to announce that a lecture series has been established as a result of this generosity, with four speakers presenting this fall from universities across the United States. In addition, the Ajinkya Fund will provide fellowships for outstanding graduate students.

Now retired from Exxon, when he and his wife Raj are not travelling or babysitting their grandson, he enjoys working in his garden. He also teaches a graduate course in chemical reaction engineering at the University of Maryland – a passion he has followed as an adjunct even while employed at Exxon. He made his recent gifts to UB CBE in honor of the solid foundation he received during his time here as a student.

MILIND AJINKYA | PHD 1975, MS 1972