CBE Centennial Seminar Series: April Kloxin (Univ. of Delaware)

January 12 @ 9:30 am - 10:30 am

Abstract

Engineered microenvironments: From 3D culture models to biomanufacturing
The microenvironments that cells experience in the human body, which vary in structure, stiffness, and biochemical content, are instrumental in cell function and fate in disease processes, from scar tissue formation in the lungs that leads to fibrosis to the re-activation of dormant disseminated tumor cells that leads to the late cancer recurrence. Engineered, bioinspired culture systems provide great opportunities for both *i)* studying these complex processes for improved mechanistic understanding and drug evaluation and *ii)* exploiting known mechanisms for improved production of cell-based therapies. In this talk, I will highlight some of our recent efforts in this arena. Specifically, we have established reductionist synthetic extracellular matrices (ECMs) based on well-defined hydrogels and inspired by common sites of late recurrence (e.g., bone marrow, lungs). We have applied these ECMs in 3D cultures, along with a range of molecular tools, to dissect different cell-matrix and cell-cell interactions in breast cancer dormancy and re-activation. Additionally, for enhancing the production of cell therapies, we collaboratively have established a modular manufacturing platform that combines soft synthetic ECMs with commercial flow-based membrane devices for improved activation, expansion, and transduction of primary human T-cells. Together, our results demonstrate the great utility of soft biomaterials for addressing outstanding questions and needs for improving human health.

Biography

April M. Kloxin, Ph.D., is the Thomas and Kipp Gutshall Development Professor of Chemical and Biomolecular Engineering in the Departments of Chemical and Biomolecular Engineering, Materials Science and Engineering, and Biomedical Engineering at the University of Delaware (UD), as well as a member of the Breast Cancer Research Program at the Helen F. Graham Cancer Center and Research Institute. She obtained her B.S. and M.S. in Chemical Engineering from North Carolina State University and Ph.D. in Chemical Engineering from the University of Colorado, Boulder, as a NASA Graduate Student Research Program Fellow, and trained as a Howard Hughes Medical Institute Postdoctoral Research Associate at the University of Colorado, Boulder. Her multi-disciplinary group creates unique materials with multiscale property control and applies them in conjunction with other innovative molecular tools for addressing outstanding problems in human health, with a focus on understanding and targeting dynamic cell-microenvironment interactions in wound healing, fibrosis, and cancer and translational systems for manufacturing of cell-based therapies. She is a recipient of the 2022 Mid-Career Faculty Excellence in Scholarship Award at the University of Delaware, the 2019 *Biomaterials Science* Lectureship, a 2018 ACS PMSE Arthur K. Doolittle Award, a NIH Director's New Innovator Award, a Susan G. Komen Foundation Career Catalyst Research award, a NSF CAREER award, and a Pew Scholars in Biomedical Sciences award.

CBE Seminar: Alexa Easley (Cornell University)

January 22 @ 1:30 pm - 2:30 pm

Abstract

Real Time Monitoring of Redox-active Polymers and CO 2 Release

Within a few decades, lithium-ion batteries (LIBs) have revolutionized technologies facilitating the rapid development of new portable devices and electric vehicles. However, this rapid technology growth has exceeded the ability to address issues associated with mining lithium, cobalt and other mineral ore resources, their safe usage, and their non-hazardous disposal. Indeed, only a small fraction of LIBs are recycled, further exacerbating global material supply for these strategic elements. In fact, if current demand continues, there will be a global deficit of cobalt by 2030. To curb this reliance on strategic elements, organic-based electroactive materials have received considerable attention as alternative electrode materials for LIBs. Next-generation organic-based electroactive materials chemistries seek to apply innovative approaches to address the need for on-demand deconstruction and reconstruction of batteries. Here, the influence of electrolyte valency on coupled water-ion transport is determined for viologen-based redox-active polymers. The second part of the talk will focus on new initiation strategies for the synthesis of polymers. Specifically, there is a need to identify safe and easy-of-use latent initiators for applications in industrially relevant polymerizations. Here, the real time decarboxylation for a family of thermally latent initiators is discussed. The interplay between initiator structure and the molecular weight distribution of the resulting polymers is considered.

Biography

Alexandra Easley is a Klarman Post-Doctoral Fellow at Cornell University working with Brett Fors on carbon capture and utilization in polymer chemistry. She received her Ph.D. in Materials Science and Engineering from Texas A&M University, where her research focused on the fundamental properties and application of non-conjugated polymeric materials for energy storage. She received her bachelor's degree in Biomedical Engineering from Texas A&M University in 2017. She was previously a NSF-GRFP and Texas A&M Diversity fellow.

Add to calendar

DETAILS

Date:

January 22

Time:

1:30 pm - 2:30 pm

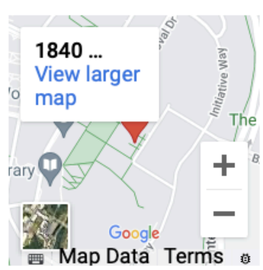
ORGANIZER

Department of Chemical and Biomolecular Engineering

VENUE

Engineering Building III – Room 2201

1840 Entrepreneur Dr.
Raleigh, NC 27606
United States + Google Map



CBE Centennial Seminar Series: Billy Bardin (DOW)

January 19 @ 9:30 am - 10:30 am

Abstract

Sustainability and Energy Transition in the Chemical Industry

Today's market and stakeholder demands require institutions to produce materials more sustainably, with demonstrated progress towards reductions in greenhouse gas emissions, lower water use, and improved ability to recycle products at the end-of-life. Dow has embarked on a "decarbonize and grow" strategy that will drive towards reducing scope 1 and 2 emissions by 15% between 2020-2030, while advancing on its path to carbon neutrality across scopes 1, 2, and, 3 with product benefits by 2050. The intersection of digital capabilities with sustainability strategy is a necessity. The reporting, tracking, and transacting of carbon emissions require improved data connectivity and transparency enabled by a digital thread through the value chain starting with suppliers and flowing through to the customer. Improved monitoring of assets and optimization of processes help to validate emissions data while enhancing operational performance. Examples of current and planned programs supporting sustainability ambitions will be highlighted.

Biography

Billy B. Bardin is the Global Climate Transition Director for Dow. He is accountable for the development of Dow's strategy to transition to a carbon neutral future. His responsibilities include engaging Dow's businesses, customers, and external stakeholders on efforts to reduce carbon emissions with a focus on value generation. He leads the coordination, prioritization, and organizational commitment to establish and execute Dow's climate change strategy. Bardin leads the Dow Climate Program Management Office and Climate Steering Teams. Bardin holds a Bachelor of Science in Chemical Engineering from North Carolina State University, and a Master of Science and a Doctor of Philosophy in Chemical Engineering from the University of Virginia. He is a Registered, Professional Engineer (PE) with the West Virginia State Board of Registration for Professional Engineers. Bardin is currently the President of the American Institute of Chemical Engineers (AIChE).

Add to calendar

DETAILS

Date:
January 19

Time:
9:30 am - 10:30 am

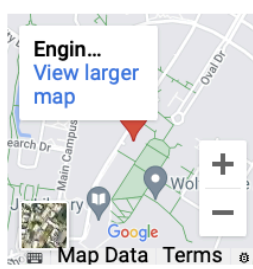
Event Category:
Seminars

ORGANIZER

Department of Chemical and Biomolecular Engineering

VENUE

Engineering Building I – Room 1011
911 Partners Way
Raleigh, NC 27606
United States + Google Map



CBE Centennial Seminar Series: John Wolf (Spectrum Plastics Group)

January 26 @ 9:30 am - 10:30 am

Abstract

John's seminar will share key insights from his career in manufacturing including the impact of his NC State engineering experience, learnings from a career of acquiring key skills, and how he views the future of manufacturing in which our Engineering department can better prepare and position NC State graduates for success.

Biography

John Wolf is the Global Leader for DuPont's Healthcare business and CEO for Spectrum Plastics Group, a leading medical components and contract manufacturing company. SPG is a leader in the design, development, and manufacture of specialty medical polymer products to the medical device, aerospace / defense, and food service markets. With revenue ~$700MM, the Healthcare business employs over 2,200 people at 20 locations in the US, Mexico, Canada, Ireland, Malaysia, and Costa Rica. In August 2023, AEA and the SPG management group completed the sale of Spectrum to DuPont for $1.75B.

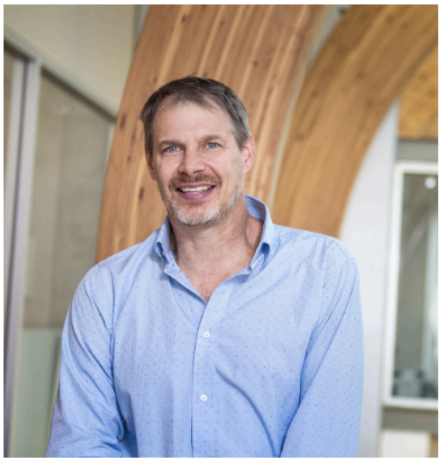
John has spent over 27 years of professional experience delivering strong and sustainable growth, significant innovation, customer service improvement and operational efficiencies across multiple business disciplines. Prior to joining Spectrum in 2019, he enjoyed a 23 year career with Sealed Air Corporation, holding executive leadership roles including Global Vice President and General Manager for the Automated Fulfillment Solutions Business Unit, Global Vice President of Marketing for the $1.6 billion Product Care Packaging Division, Vice President of Global General Packaging and Vice President of Strategy and Execution.

John earned a Bachelor of Science in Chemical Engineering with a minor in Economics from North Carolina State University and is credited with 9 US Patents. He has a true Wolfpack family, with wife Deanna a 1995 graduate in Psychology, and three daughters: Isabelle a 2021 graduate in Graphic Design, Annalise a 2023 graduate in Physics, and Evelynne who is currently studying Biomedical Engineering at NC State.

Add to calendar

CBE Ollis Lecture: Peter Zandstra (Univ. of British Columbia)

January 31 @ 10:30 am - 11:30 am



Abstract

Engineering Immune System Development

Engineered T cells are at the leading edge of clinical cell therapy. T cell therapies have had a remarkable impact on patient care for a subset of hematological malignancies. This foundation has motivated the development of off-the-shelf engineered cell therapies for a broad range of devastating indications. Achieving this vision will require cost-effective manufacturing of precision cell products capable of addressing multiple process and clinical-design challenges. Pluripotent stem cell (PSC)-derived engineered T cells are emerging as a solution of choice. To unleash the full potential of PSC-derived T cell therapies, the field will require technologies capable of robustly orchestrating the complex series of time- and dose-dependent signaling events needed to recreate functional T cell development in the laboratory. In this seminar I will present our recent progress in this field and outline timely opportunities for advancement with an emphasis on niche engineering, computational modeling and synthetic biology.

Papers:

1. https://pubmed.ncbi.nlm.nih.gov/37928777/
2. https://pubmed.ncbi.nlm.nih.gov/36849828/
3. https://pubmed.ncbi.nlm.nih.gov/37090676/
4. https://pubmed.ncbi.nlm.nih.gov/35213533/

Biography

Dr. Peter Zandstra is the Director of the School of Biomedical Engineering and the Director of the Michael Smith Laboratories at the University of British Columbia. The Zandstra lab is interested in how individual cells form complex tissues and organs. His research focuses on understanding multiscale interactions between cells, and the influence of these interactions on internal regulatory control networks, and the external microenvironment that shapes cell fate and functional tissue development. His team is developing mathematical models of interactions between cellular regulatory networks and their local microenvironment, and using model predictions to guide the design of engineered niches and synthetic cells that detect, select and control functional tissue development from adult and pluripotent stem cells. These discoveries will elucidate the process of multicellular organization into complex functional tissues and enable production of therapeutically relevant cell types, with a particular focus on the blood cell forming system.

CBE Centennial Seminar Series: Kenny Mineart (Bucknell University)

February 2 @ 9:30 am - 10:30 am

Abstract

Solute Diffusion in Block Copolymer Organogels Through the Lens of Transdermal Drug Delivery

Effective transdermal drug delivery patches must exhibit multiple characteristics including the ability to store and release desired pharmaceutical compounds, enhance permeation of those compounds through skin, and moderately adhere to skin while avoiding irritation. Gels composed of styrenic block copolymers and various aliphatic hydrocarbon 'solvents' (*e.g.*, white mineral oil and tackifying resin) inherently exhibit the latter pair of these properties. Furthermore, recent in-vitro and in-vivo experiments have shown that these gels can be empirically formulation-matched to the performance of existing transdermal delivery products. In hopes of empowering bottom-up design, my research group has spent the past several years developing formulation-property relationships for solute diffusion through styrenic block copolymer organogels. This work is built upon our measurement of solute diffusion in gels varying in block copolymer concentration, block copolymer molecular weight, solvent viscosity, penetrant (*i.e.*, solute) identity, and temperature using Fourier-transform infrared spectroscopy (FTIR). As anticipated, gels with low copolymer concentration, low solvent viscosity, and small penetrants exhibit the fastest diffusion ($D \approx$ 5x10-8 cm2/s at 21 °C) whereas materials composed at the opposite end of these ranges translates to the slowest diffusion (D ≈ 3x10-9 cm2/s at 21 °C). Diffusivity is also noted to exhibit an Arrhenius dependence (with temperature). Beyond these observations, we are able to draw generalizable meaning from our measured diffusivity values by fitting them with a model that considers gels as a heterogenous polymer network. This particular model's strengths come from its physically-relevant basis and its ability to describe our data across all of the system parameters considered. Ultimately, this fitting allows us to approximate several fundamental and molecular-scale gel transport properties – such as, the solute hopping rate and diffusion activation energy – for these materials.

Biography

Kenny Mineart is an Associate Professor of Chemical Engineering at Bucknell University. His teaching specialities include chemical engineering principles, materials science and polymer science while his research interests are polymer self-assembly in gels and solutions, reverse-phase assembly, and structure-property relationships of polymer gels. Kenny received his B.S.E. in chemical engineering from the University of Iowa and his M.S. and Ph.D. from North Carolina State University. He conducted postdoctoral research as a NRC Postdoctoral Fellow at the National Institute of Standards and Technology.

CBE Centennial Seminar Series: John Weidner (Univ. of Cincinnati)

February 9 @ 9:30 am - 10:30 am

Abstract

Modeling Battery Performance Due to Volume Change in Porous Electrodes
In order to accurately predict the behavior of electrochemical devices, it is necessary to develop sophisticated models that take into consideration transport processes, electrochemical phenomena, mechanical stresses, and structural deformations on the operation of an electrochemical system. Several different models exist that can predict the electrochemical performance of these devices under a variety of operating and design conditions. However, in many of these models, the porosity of a porous electrode is often assumed to be constant since the volume changes seen during the intercalation reaction can be small. However, electrode materials developed in recent years show significant volume changes during intercalation, which are unable to be accurately predicted using these constant porosity models.Porosity and dimensional changes in an electrode can significantly affect the resistance of the battery during cycling and can cause premature failure of the battery due to generated stresses. Over the past decade and a half, we have shown the ability to incorporate dimensional and porosity changes in a porous electrode during intercalation through the coupling of various mechanics treatments with porous electrode theory. Many assumptions were used to obtain an analytical solution, including the assumption of bulk strain, uniform porosity, and uniform concentration across the electrode. This model was extended to look at design considerations as well as non-uniformity within a single porous electrode coupled to a lithium metal reference. This model was further improved by removing some of the earlier assumptions and incorporating stress, strain, and porosity gradients across a porous electrode during cycling in a battery containing a blended anode undergoing volume change coupled to an NMC cathode. The reversible volume change predictions were then validated using data from pouch cells seen in the Chevrolet Volt. Following our validation studies, we illustrated the impact that coupled electrochemical-mechanical volume change can have on electric vehicle battery pack design.

Biography

Dr. John W. Weidner is Dean of the College of Engineering and Applied Science at the University of Cincinnati. Prior to his appointment as dean in August of 2019, he was the Chair of the Department of Chemical Engineering at the University of South Carolina (USC), Director of their Hydrogen and Fuel Cell Center, and a Distinguished Scientist at the Savannah River National Laboratory. He received his BS degree in chemical engineering from the University of Wisconsin-Madison in 1986 and his PhD in chemical engineering from NC State University in 1991. He has advised 24 PhD students, generated over $10 million in research funding, and published over 125 refereed journal articles in the field of electrochemical engineering, particularly in the synthesis and characterization of electrocatalysts and electrochemically active materials, and the mathematical modeling of advanced batteries, fuel cells, and hydrogen production processes. Dr. Weidner was a visiting scientist at NASA's Jet Propulsion Laboratory, the University of California-Berkeley, Los Alamos National Laboratory, and the Fraunhofer Institute for Solar Energy Systems. He was awarded the Golden Key Faculty Award by USC in 2006 for "Excellence in Integrating Undergraduate Teaching and Research". In 2008 and 2010, he received the Energy Research Award from the E.ON International Research Initiative and the Research Award from the Energy Technology Division of the Electrochemical Society (ECS), respectively, for his work on large-scale hydrogen production technology. For his overall contributions to electrochemical research, he received the USC Educational Foundation Award for Research in Science, Mathematics and Engineering (2013), the Education Leadership Award at the Energy Inc. Summit in Charlotte, NC (2016), the Breakthrough Leadership in Research Award from USC (2016), and the Carl Wagner Memorial Award from ECS (2019). He is a Fellow of ECS and the American Institute of Chemical Engineers (AIChE), and a Program Evaluator (PEV) for ABET.

CBE Centennial Seminar Series: Stacey Orlandi (Chevron Renewable Energy Group)

February 8 @ 9:30 am - 10:30 am

Abstract

A Look at Bio-Based Diesel

In June 2022, Chevron acquired Renewable Energy Group (REG), a major producer of bio-based diesel, for $3 billion. This seminar will provide an overview of Chevron, the why behind the acquisition of REG, and a deeper look at the dynamics of bio-based diesel.

Biography

Stacey Orlandi has over 30 years of experience in the energy industry, holding senior positions with BP, Marathon Petroleum and Shell. She has worked in technology, operations and commercial roles across refining, chemicals, renewables and gas. As Director, Manufacturing, Ms. Orlandi oversees HSE, Operations, Engineering, Capital Projects, Technical Services and Technology Development for 11 biorefineries and 650 staff across the U.S. and Germany. She is responsible for the people, processes and performance of all 11 refineries in the U.S. and Europe as well as the engineering and support functions in Ames, Iowa and Tulsa, Oklahoma. Prior to Chevron Renewable Energy Group, Ms. Orlandi served as Vice President of Prelude Crux where she oversaw the safe operations, commercial delivery and strategic direction for the Prelude Floating LNG facility and the East Browse gas basin, Shell's operated joint venture off Australia's west coast. Prior to her most recent role at Shell, Ms. Orlandi served as CEO of Virent, Inc., (a wholly owned subsidiary of Marathon Petroleum) where she led a consortium of partners/investors aiming to scale-up and commercialize Virent's BioForming® technology. She successfully navigated the transition of Virent from Andeavor to Marathon in 2018. Ms. Orlandi grew up in the U.S. Southeast. She studied Chemical Engineering at North Carolina State University, Business at the University of Chicago and leadership education from MIT, Rice University and INSEAD.

CBE Centennial Seminar Series: Jonathan Conway (Princeton)

February 16 @ 9:30 am - 10:30 am

Abstract

Engineering Plant-Microbe Interactions Towards Advanced Agriculture Biotechnologies
Few plant-microbe interactions involving commensal microbiota are mechanistically understood, and filling this knowledge gap is necessary to manipulate and engineer these interactions for the development of new technologies. Through genetic engineering of non-model bacteria from the plant root microbiome, we can probe these interactions, define them mechanistically, and manipulate these bacteria, plants, and their interactions for application. Here, I will present past and ongoing work to probe and mechanistically define plant-microbe interactions involving 1) microbial evasion and suppression of the plant immune system and 2) chemical communication in the root microbiome involving auxin plant hormones. Through loss-of-function genetic engineering and screening of plant-associated bacteria, we have identified bacterial genes that play essential roles in suppression of the flg22-mediated plant immune response and auxin hormone homeostasis. Detailed biochemical characterization of these proteins and pathways is providing new insight into the functions of commensal microbiota in the rhizosphere. This fundamental understanding will enable us to engineer microbes as agriculture biotechnologies to improve plant growth, health, and resilience.

Biography

Jonathan Conway is an Assistant Professor of Chemical and Biological Engineering at Princeton University. His research areas include biomolecular engineering, energy and environment. He received his B.S. in chemical engineering from the University of Notre Dame, and received his M.S. and Ph.D. in chemical engineering from North Carolina State University. At Princeton, the Conway Lab is focused on defining and engineering plant-microbe and microbe-microbe interactions at plant-microbe interfaces. Interactions at plant-microbe interfaces shape much of the life on our planet. The microbes at interfaces with living plants can positively and negatively affect the growth, health, and productivity of the plants that fix atmospheric carbon to feed our world. And, the microbes at interfaces with dead plants decompose the complex polymers that make up plant biomass to return carbon to the atmosphere. The Conway Lab uses genetic engineering of non-model bacteria found at plant-microbe interfaces and biomolecular engineering of their products to probe and mechanistically define consequential plant-microbe and microbe-microbe interactions in these complex ecosystems. Then, using this mechanistic understanding, we engineer these bacteria, plants, and their interactions for the development of new technologies for the bio-agriculture, bio-energy, and bio-chemical industries.

CBE Centennial Seminar Series: Julie Willoughby (CIRC/Blue Hummingbird)

February 23 @ 9:30 am - 10:30 am

Intertwining Science & Creativity to Improve Humanity and Our Planet

Biography

Dr. Willoughby is the Chief Innovation Officer of Blue Hummingbird, LLC where she combines scientific and creative design to help clients commercialize climate-positive technology. She served as the Chief Scientific and Commercialization Officer at Circ®, Inc. from 2019-2023; leading the team from recycling one t-shirt a day in a lab reactor to a semi-commercial continuous operation. This work led Circ® to be a 2023 The Earthshot Prize finalist. Previous to her entrepreneurial roles with start-up companies, Willoughby drove corporate entrepreneurship in Nike's material and manufacturing innovation departments and served as a faculty member in the Wilson College of Textiles at North Carolina State University. She is an expert in the fields of textiles & nonwovens, surface chemistry & surface dynamics, coatings, and utilization of renewable resources as feedstock for advanced materials. Her work as the principal investigator for a Bill and Melinda Gates Foundation Grand Challenge Exploration grant resulted in a commercial "Wrap & Plant" cellulosic fiber technology that provided smallholder farmers in Africa with over a 50% increase in their crop yields. Willoughby is an avid scientific author and inventor in the areas of polymers, silicone chemistry, interfacial and surface science, and barrier packaging. Her 25+ year career as a chemical engineer has spanned multiple industries – chemical, pulp & paper, packaging, life sciences, textiles and fashion.

Dr. Willoughby has a Bachelor of Science in Chemical Engineering from the University of Kentucky and a PhD in Chemical Engineering from North Carolina State University.

Add to calendar

DETAILS

Date:
February 23

Time:
9:30 am - 10:30 am

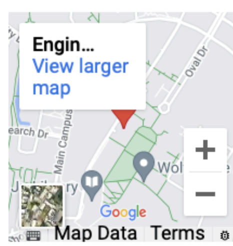
Event Category:
Seminars

ORGANIZER

Department of Chemical and Biomolecular Engineering

VENUE

Engineering Building I – Room 1011
911 Partners Way
Raleigh, NC 27606
United States + Google Map



CBE Centennial Seminar Series: Admiral Daryl L. Caudle

February 29 @ 3:00 pm - 4:00 pm

Building a Culture of Excellence

Biography

Adm. Daryl Caudle is a native of Winston–Salem, North Carolina and a 1985 graduate of North Carolina State University (magna cum laude) with a degree in chemical engineering. He was then commissioned after attending Officer Candidate School in Newport, Rhode Island. Caudle holds advanced degrees from the Naval Postgraduate School, Master of Science (distinction) in Physics; from Old Dominion University, and Master of Science in Engineering Management. He also attended the School of Advanced Studies, University of Phoenix, where he obtained a Doctor of Management in Organizational Leadership with a specialization in Information Systems and Technology. His doctoral dissertation research was conducted on military decision making uncertainty regarding the use of force in cyberspace. He is also a licensed professional engineer.

Add to calendar

DETAILS

Date:
February 29

Time:
3:00 pm - 4:00 pm

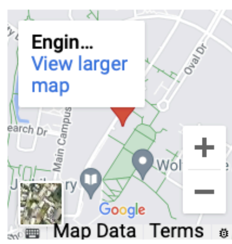
Event Category:
Seminars

ORGANIZER

Department of Chemical and Biomolecular Engineering

VENUE

Engineering Building I- Room 1005
911 Partners Way
Raleigh, NC 27606
United States + Google Map



CBE Special Seminar: Bernard Lotz (CNRS and Université de Strasbourg)

March 14 @ 3:00 pm - 4:00 pm

Abstract

Crystalline polymers morphology: an overview

The organization and structure of polymers is analyzed by various techniques. Global means, such as DSC, are ideal when dealing with e.g. phase transitions (crystallization, melting, glass transition, etc.). Some of these techniques (e.g. IR or NMR) do probe local features and sub-molecular dynamics. Analysis of the crystalline polymers morphology and structure is often more demanding, but it provides unexpected opportunities to explain "visible" features by sub-molecular details that cannot be reached by available techniques. The presentation will illustrate several issues that could be solved by resorting to structural analyses. They are taken from the literature and from my own work. Following a short survey of chain folding and its consequences, of nucleation and growth processes, and of lamellar shape (twist and scroll), the recent analyses of two several decades-long puzzles will be developed: the Brill transition in nylons and the real nature of a minor (but controversial!) component of crystalline polymers, the RAF (Rigid Amorphous Fraction).

Biography

Dr. Bernard Lotz received his MS in physical chemistry from the Université Louis Pasteur in Strasbourg, FR and his PhD from Université Louis Pasteur under the tutelage of Prof. André Kovacs. He did a two-year postdoc at Bell Labs in Murray Hill, NJ, and then joined the Centre de Recherche sur les Macromolécules in Strasbourg, France, where he built a career addressing the fundamentals of crystallization of macromolecular materials. He is currently Director of Research (éméritus) at the Institute Charles Sadron in Strasbourg. His current interests include the elusive Brill transition in nylons and the controversial rigid amorphous phase (RAF) in semicrystalline polymers. He is the recipient of multiple awards, including the "Grand Prix" from the Groupe Français des Polymères for the elucidation of the crystal structure of silk and Fellow of the American Physical Society. He has over 300 archival publications and over 21,500 citations with an h-index of 81.

CBE Centennial Seminar Series: Srinivasa Raghavan (Univ. of Maryland)

March 29 @ 9:30 am - 10:30 am

Abstract

Colloidal Engineering at the Nano, Micro, and Macro Scales: Materials that Can Move, Morph, Protect and Heal
Our laboratory seeks to engineer colloidal building blocks (polymers, surfactants, and particles) into a variety of functional fluids and soft materials. Our work extends across the length scales. Many of our systems are 'smart', i.e., their properties can be tuned by an external stimulus.

- At the **nanoscale**, we study molecular self-assembly into structures like micelles and vesicles. In addition, we have created self-assembling biopolymers that convert liquid blood into a gel; thereby, these 'hemostatic' materials stop bleeding from injuries. This research has resulted in a commercial product (*Rapid-Seal Wound Gel*) that is available across the USA.
- At the **microscale**, we create polymer capsules inspired by the architecture of biological cells or tissues. Examples include: capsules with many inner compartments; onion-like capsules with multiple layers; capsules that move in water in the presence of a chemical fuel; and capsules that act as 'miniature factories', synthesizing products on-demand.
- At the **macroscale**, we make hydrogels with unusual properties. Examples include: gels that can protect a delicate object from impact, and 'gel-sheets' that absorb more water than cloth or paper towels. We have also found a way to adhere gels to tissues by applying a low electric field, which may enable surgeries to be performed without sutures.

Biography

Srinivasa (Srini) Raghavan received his B.Tech. and Ph.D. in Chemical Engineering from the Indian Institute of Technology, Madras, and North Carolina State University, respectively. His research has resulted in more than 190 publications and 20 patents, which have been cited more than 17,000 times (hindex of 73). At UMD, he has been recognized both for his teaching and his research, including being designated a *Distinguished Scholar-Teacher* in 2017. He has been a four-time nominee for a UMD *Invention of the Year* and won this award in 2009 and 2022. He is also the scientific co-founder of four startup companies based on technologies invented in his laboratory.

CBE Centennial Seminar Series: Arthi Jayaraman (Univ. of Delaware)

April 5 @ 9:30 am - 10:30 am

Abstract

Linking computational techniques to experiments for establishing design-structure-property relationships in soft materials.
My research group's expertise lies in the development of physics-based molecular models and simulation methods as well as data-driven machine learning models for designing and characterizing soft macromolecular materials. In this talk, I will highlight examples from my group's recent work to showcase how we develop and use computational tools (e.g., CREASE and PairVAE) to interpret experimental characterization data from small angle scattering and electron microscopy. I will also show how we link our experimental collaborators' results to our molecular modeling and simulation work to establish design-structure and structure-property relationships for soft materials (synthetic- & bio- polymers, colloids) and formulations.

Biography

Arthi Jayaraman is currently a full professor in the Departments of Chemical and Biomolecular Engineering and Materials Science and Engineering at the University of Delaware (UD), Newark. She is also the director for an NSF-funded NRT graduate traineeship program on 'Computing and Data Science Training for Materials Innovation, Discovery, and Analytics'. She serves as editor for both American Chemical Society (ACS) journals Macromolecules and ACS Polymers Au (gold). Jayaraman received her Ph.D. in Chemical Engineering from North Carolina State University and conducted her postdoctoral research in Materials Science and Engineering at University of Illinois-Urbana Champaign. After holding the position of Patten Assistant Professor in the Department of Chemical and Biological Engineering at University of Colorado (CU) at Boulder, in 2014 she joined the faculty at UD. Jayaraman's research expertise is in development of molecular modeling, theory and simulation techniques and application of these techniques to study polymer nanocomposites, blends, and solutions, and biomaterials. She has received the following honors: UD College of Engineering Faculty Award for Excellence in Teaching (2023), AIChE COMSEF Impact Award (2021), American Physical Society (APS) Fellowship (2020), Dudley Saville Lectureship at Princeton University (2016), ACS PMSE Young Investigator (2014), AIChE COMSEF division Young Investigator Award (2013), CU Provost Faculty Achievement Award (2013), Department of Energy (DOE) Early Career Research Award (2010), and CU Department of Chemical and Biological Engineering's outstanding undergraduate teaching award (2011) and graduate teaching award (2014).

CBE Centennial Seminar Series: James Semler (Merck)

April 12 @ 9:30 am - 10:30 am

Inspirations for a Career Path for Growth

Biography

Jim Semler recently joined Merck as a principal scientist in the Materials and Biophysical Characterization group focused on drug substance and drug product development. Prior to Merck, he was the Director of Materials Science & Sustainability within the Medication Delivery Solutions business unit at Becton Dickinson. At BD he was responsible for leading a team to explore and evaluate next generation medical device material innovation and provide new product development teams with material selection guidance. Additionally, his team reduces launched product material risks through proactive alternate supply scoping. Prior to joining BD, Jim worked at Lexmark International developing elastomeric mechatronic components, specialty coatings, and materials computational models. Jim holds a Bachelor of Science in Chemical Engineering from Michigan Technological University, and a Master of Science and a Doctor of Philosophy in Chemical Engineering from North Carolina State University. He was recently vice-chair of the MedTech Europe Research and Innovation Committee. Jim has over 20 years of industrial experience in materials development. He is published in multiple peer-reviewed journals, holds multiple patents, and is a Senior Member of the American Institute of Chemical Engineering.

Add to calendar

DETAILS

Date:

April 12

Time:

9:30 am - 10:30 am

Event Category:

Seminars

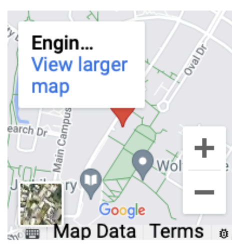
ORGANIZER

Department of Chemical and Biomolecular Engineering

VENUE

Engineering Building I – Room 1011

911 Partners Way
Raleigh, NC 27606
United States + Google Map



CBE Special Seminar: Dr. Jim Bray

April 18 @ 4:00 pm - 5:00 pm

Jim Bray, Sc. D.

Principal, Convergent Consulting LLC

Adjunct Professor, NC State University, Forest Biomaterials

Abstract

Skiing Ahead of an Avalanche – Life in a Material Science Startup

The mystique of working in a startup company post-graduation with the chance to bring transformative technology to the market to satisfy customer demands tempts many students. While the environment can be truly exhilarating allowing you to have a direct daily impact on company progress, the reality of startup life involves uncertainty, rapid pace, significant personal responsibility with minimal direction and the risk of unemployment. This can be particularly challenging when the startup is in the material science space requiring production of qualification samples and construction of pilot plant and manufacturing infrastructure, i.e., lots of money. The key to an enriching startup experience is ensuring your personality and competencies are matched to the cultural environment of this type of company. Dr. Bray will provide some insights to a successful match based on his 10 years with Tethis, a technology spinoff based on technology licensed from NC State's Department of Forest Biomaterials.

Biography

A Chemical Engineer by education, Dr. Bray received his BS from NC State and ScD from MIT with research work in biomedical materials. This was followed by 50 years in development, manufacture and commercialization of polymeric materials serving multiple industries. His company experience includes product development, operations, general management, and CEO roles. While his initial jobs were in Fortune 100 to 500 size companies, the last 18 years have been in various roles in the frenetic environment of startup and early-stage companies. The most enjoyable part of this time has been in mentoring and developing young technical and managerial talent, with a side benefit of being able to participate in the NCSU CBE mentoring program.

Add to calendar

DETAILS

Date:

April 18

Time:

4:00 pm - 5:00 pm

Event Category:

Alumni

ORGANIZER

Department of Chemical and Biomolecular Engineering

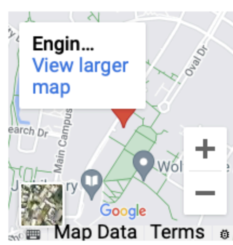
VENUE

Engineering Building I – Room 2015

911 Partners Way

Raleigh, NC 27606

United States + Google Map



CBE Centennial Seminar Series: Matthew Gebbie (Univ. of Wisconsin-Madison)

April 19 @ 9:30 am - 10:30 am

Abstract

Exploring how ionic correlations influence ion transport and electron transfer in electrochemical systems
Electrochemical technologies promise to play a major role in mitigation of carbon emissions associated with energy and chemical production. In most electrochemical devices, high ion concentrations and large operating voltages induce strong ion-ion correlations, which drives electrolyte ions to collectively assemble into nanostructured networks. While ionic correlations are known to govern electrochemical properties in concentrated electrolytes, major questions persist surrounding how ion assembly influences mechanisms of ion transport and electron transfer. As fluids composed solely of ions, ionic liquids are excellent model systems for investigating how ion clustering can be tuned at the molecular level to promote selective redox ion transport and alter electrocatalytic activity. I will discuss three examples of how we are studying ionic liquids to explore the link between ionic clustering, ion transport, and electron transfer in electrochemical systems. I will first present our work aimed at linking nanoscale structures and dynamics of ionic liquid-solid interfaces to rates and selectivity of CO_2 electrochemical reduction as a model system for illuminating how ionic assembly influences electrocatalysis. I will then highlight a microscopy-based approach to quantifying lithium-ion mobility in ionic liquids that opens the door to high throughput determination of redox ion mobility in nanostructured electrolytes. I will conclude by explaining how we are using entropic driving forces to design new ionic liquid-derived electrolytes that promise to bridge the gap between existing solid and liquid electrolytes for next-generation batteries. I will use all three examples to highlight how increased fundamental understanding of nanoscale ion assembly can provide transformative new avenues for designing advanced electrolytes and electrochemical devices.

Biography

> Professor Matthew Gebbie joined the Department of Chemical and Biological Engineering at the University of Wisconsin-Madison in fall 2019, where he is a Michael F. and Virginia H. Conway Assistant Professor. He received his B.S. in Chemical Engineering from NC State University in 2010 and Ph.D. in Materials from the UC Santa Barbara in 2016, where he was a 2011–2015 Science and Engineering Fellow in the NSF Center for Nanotechnology in Society. He was then a 2016–2018 GLAM Postdoctoral Fellow at Stanford University before joining UW-Madison. Dr. Gebbie's research addresses fundamental roadblocks at the intersection of soft matter, interface science, and electrochemistry to achieve sustainable interconversion of chemical and electrical energy. His current projects are centered around exploring new electrolyte design paradigms to enable safe, high-performance batteries and facilitate electrochemical recycling of waste CO_2. Matt's independent research has been recognized by a CAREER Award from the National Science Foundation, an Early Career Award from the Army Research Office, and a Doctoral New Investigator Grant from the American Chemical Society Petroleum Research Fund.

CBE Centennial Seminar Series: Srinivas Siripurapu (Prysmian Group)

April 26 @ 3:00 pm - 4:00 pm

Abstract

Innovation and Sustainability as Intertwined Forces to Accelerate Net Zero Goals
The trifecta of clean energy, power grids modernization and digital transformation is driving innovation on steroids for the wire and cable (W&C) industry. For example, the US government has set a goal to deploy 30GW of new offshore wind energy by 2030 and the EU has increased the region's target to 110GW in the same timeframe. These ambitious targets can only be achieved with reliable hi-tech cabling infrastructure such as novel 525kV HVDC systems that can transmit over 2GW of power. At the same time, most governments have committed to significant incentives to reduce the digital divide in our society that will require both new optical fiber connectivity solutions and skilled workforce. These innovations enabling future critical infrastructure have to be developed moving away from a first cost framework to design for sustainability.

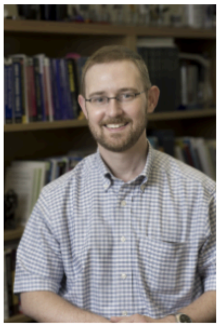
Biography

> Srinivas 'Srini' Siripurapu is Chief Innovation Officer and Chief Research & Development Officer of Prysmian Group. He is responsible for the company's Global R&D strategy, R&D talent development and Innovation pipeline. Srini manages Prysmian's global network of 26 R&D centers with over 1000 R&D personnel and an annual R&D expend of over 110M€. He chairs Prysmian's Innovation Steering Committee and is a member of the company Sustainability Steering Committee and Diversity, Equity & Inclusion Steering Committee. He is a certified Design for Six Sigma Black Belt and is an inventor on over 50 patents. He is passionate about sustainability and mentoring young engineers and scientists. He has a PhD in Chemical Engineering from North Carolina State University.

Add to calendar

CBE Seminar: John Kitchin (Carnegie Mellon University)

April 29 @ 11:30 am - 12:30 pm



Abstract

Data Science & Machine Learning Approaches to Catalysis and Chemical Engineering

Data science and machine learning (DS/ML) are changing the way many people approach catalysis research, ranging from new design of experiment approaches, new methods in simulation, even new ways of interacting with the scientific literature. It is challenging today to even keep up with new work as it changes so quickly. In this talk, I will provide an overview of several ways we have incorporated DS/ML into our catalysis research, beginning with a state of the art large catalysis machine-learned model from the Open Catalyst project. I will then show how we have used concepts from DS/ML to develop new solutions to problems in chemical engineering using automatic differentiation. The takeaway messages from this talk will be that DS/ML is here to stay, and worth learning about. It is not a panacea solution though, with remaining challenges to address including educational, technical and communication challenges.

Biography

John Kitchin completed his B.S. in Chemistry at North Carolina State University. He completed a M.S. in Materials Science and a PhD in Chemical Engineering at the University of Delaware in 2004 under the advisement of Dr. Jingguang Chen and Dr. Mark Barteau. He received an Alexander von Humboldt postdoctoral fellowship and lived in Berlin, Germany for 1 ½ years studying alloy segregation with Karsten Reuter and Matthias Scheffler in the Theory Department at the Fritz Haber Institut. Professor Kitchin began a tenure-track faculty position in the Chemical Engineering Department at Carnegie Mellon University in January of 2006. He is currently a Full Professor. At CMU, Professor Kitchin works in the areas of alloy catalysis and molecular simulation. He was awarded a DOE Early Career award in 2010 to investigate multifunctional oxide electrocatalysts for the oxygen evolution reaction in water splitting using experimental and computational methods. He received a Presidential Early Career Award for Scientists and Engineers in 2011. He completed a sabbatical in the Accelerated Science group at Google learning to apply machine learning to scientific and engineering problems in 2018.

https://kitchingroup.cheme.cmu.edu/