Dr. Katja Lamia
Scripps

“Cryptochromes Integrate Circadian Rhythms with Metabolism and Cancer”

Monday, October 7, 2019
12:00 Noon
CBIS, Bruggeman Room

Refreshments Served 11:45
Biogeochemistry in Aquatic Environments: Deciphering the Molecular Messages of Dissolved Organic Matter

Prof. Sasha Wagner
Department of Earth and Environmental Sciences
Rensselaer Polytechnic Institute

Dissolved organic matter (DOM) gives water its color and is comprised of millions of soluble organic molecules, derived from living organisms and detritus. DOM is mobilized by water and plays an integral role in connecting terrestrial and aquatic systems. The extreme molecular heterogeneity of DOM presents many analytical challenges, but its complexity also provides numerous, yet-unexplored, opportunities to read and interpret the chemical clues it contains. Thus, we employ a variety of analytical and chemical techniques to probe the sources, processing, and fate of DOM in aquatic environments. In this talk, we will discuss two approaches in particular: 1) using ultrahigh resolution mass spectrometry (FT-ICR/MS) to obtain DOM “molecular fingerprints” and investigate the influence of hydrology and land use on riverine DOM composition and 2) employing a new online HPLC-IRMS method to measure compound-specific stable carbon isotopes and constrain sources of fire-derived carbon in the open ocean. Determining the origins of DOM and refining our understanding of the location and timing of its reactivity in aquatic systems is critical for balancing carbon budgets on both local and global scales.

4:00 PM – Bruggeman Conf. Room - Biotech Building
(Refreshments at 3:45 PM)
CBE Seminar Series – Fall 2019

Dr. Sanat Kumar
Bykhovsky Professor | Department of Chemical Engineering
Columbia University

Seminar: Wednesday, October 9, 2019
9:30 a.m. (RI 203)

“Polymer-Grafted Nanoparticle Membranes with Unusual Gas Separation Properties”

Abstract:

Polymer membranes are employed in several critical sustainability applications involving the separation of gas mixtures based on size differences. In spite of their widespread use, important performance challenges remain outstanding - the need to dramatically affect the transport of a desired mixture component and improving mechanical resilience relative to the current state-of-the-art. Here, we develop novel membranes based on polymer-grafted nanoparticles (GNPs) which possess controllable, spatially inhomogeneous gas transport behavior. We show that smaller gases are transported more uniformly than larger solutes in the polymer layer of pure GNPs; these larger gases preferentially move through the interstices between the NPs. Free chains added to these GNPs preferentially segregate into these interstices where they selectively hinder large solute motion and thus yield dramatic performance improvements for several industrially relevant gas pairs. The magnitude of these effects are controlled by grafting parameters and the length of the free chains. Our ability to create and tune spatial inhomogeneities in GNPs, apparently through judicious manipulation of chain entropy, is thus a new, apparently general, physics-based paradigm to design membranes with unprecedented performance even using common polymers.

Biography:

Professor Kumar received a BTech in chemical engineering from the Indian Institute of Technology, Madras in 1981 and a ScD in chemical engineering from the Massachusetts Institute of Technology in 1987. He joined the faculty of Columbia Engineering in 2006. His group has been the pioneer over the last decade in the practically relevant topic of Polymer Nanocomposites where inorganic nanoparticles are added to polymers to obtain materials with synergistic properties. A central problem in this area is that the inorganic, hydrophilic nanoparticles are frequently immiscible (organic) polymers – thus the promised property improvements from these materials have remained hard to realize. His work in this area spans all topics of polymer nanocomposites including self-assembly, microstructure, glassy segmental dynamics and vitrification, elasticity and reinforcement, linear and nonlinear mechanical-dynamical phenomena (such as strain softening and yielding), chain relaxation, and nanoparticle diffusion and dynamics.

Refreshments will be available in the Ricketts Coonley Lounge (120) at 9:00 a.m.
"Task-oriented Modelling of Mechanical Systems"

Jozsef Kovacs
McGill University, Montreal, Quebec

Wednesday, October 9, 2019
10:30 AM – 11:30 AM
DCC 330

Abstract A main element in Mechanics is the development of representative models for physical systems and their behaviour. This is generally guided by some traditional approaches and interpretations in kinematics and dynamics. However, these can include significant limitations and hinder the understanding of a broad range of behaviours in mechanical systems. We will discuss these possible shortcomings and introduce some novel elements for the modelling of mechanical systems. We present a so-called task-specific modelling and analysis approach to provide insight into the behaviour of various types of mechanical systems. This starts from the broader interpretation of some main concepts of mechanical modelling, and leads to the possibility to establish task-oriented models and performance measures for both static and dynamic behaviours. We illustrate the material with examples taken from vehicle dynamics and robotics.

Bio: Jozsef Kovacs is Professor of Mechanical Engineering at McGill University and member of the Centre for Intelligent Machines. His main area of research is dynamics and control; within that he has worked on a variety of fields such as multibody systems, contact mechanics, robotics, simulation, and space systems. He has served on editorial boards and scientific committees of prestigious international journals and conferences. He also received three best paper awards, and the Synergy Award for Innovation of the Natural Sciences and Engineering Research Council of Canada.
Coupling Nonlinear Optical Dynamics to Polymer Systems for Light-Directed Organization of Functional Materials

Ian Dean Hosein
Department of Biomedical and Chemical Engineering
Syracuse University

Abstract Coupling polymeric systems to nonlinear dynamics offers opportunities to create materials with tailored morphology and functionality via pattern forming processes. Examples include periodic striations from traveling fronts in thermal polymerization, coalescence of polymer films during dewetting, oscillatory gels, and phase separation. Here, we present a fundamentally new mechanism to organize polymeric materials that couples photopolymerization to the nonlinear dynamics of optical fields. In a new process of optical auto-acceleration, a positive feedback mechanism emerges between photopolymerization and transmitted light intensity, whereby a mutual, dynamic interaction emerges between optical field distribution and the underlying morphology of the polymer medium. The input light undergoes Modulation Instability – dividing into a multitude of microscale “self-trapped” beams, which are nonlinear waveforms characterized by divergence-free propagation. As a result, these nonlinear waveforms inscribe permanent microstructure consisting of microscopic “channels” in the polymer. This coupling between optical nonlinearity and morphology evolution will be demonstrated in multifunctional acrylate systems, polymer blends, as well as polymer-solvent mixtures. As a demonstration of the potential of this new process and the material properties, their application towards creating light-collecting encapsulants for solar cells will be discussed. Harnessing nonlinear optical pattern formation to direct the organization of polymeric materials opens opportunities for studying the fascinating complexity of nonlinear systems, while creating advanced microstructures that can serve functional roles in a broad range of applications.

Biosketch: Dr. Ian Hosein is an Assistant Professor in the Department of Biomedical and Chemical Engineering at Syracuse University. He completed his graduate studies at Cornell University in the Department of Materials Science and Engineering. Dr. Hosein then completed post-doctoral positions at the University of Waterloo and McMaster University, Canada. At Syracuse University, Dr. Hosein leads an group of graduate, undergraduate, and high school students to create materials-based solutions to address global issues on energy, the environment, and sustainability. The group combines materials processing techniques with smart polymer chemistry to create highly organized polymeric materials tailored with enhanced optical, electronic, and chemical functionality. Dr. Hosein is a winner of the ACS Petroleum Research Fund Doctoral New Investigator Grant, National Science Foundation Early CAREER award, and the 3M Non-Tenured Faculty Award.
Recently, machine learning tools have been used to aid in the search for novel materials with desirable properties. Materials informatics – the combination of machine learning with materials science – is a promising area of research which opens up new avenues for materials discovery and the unearthing of physical insights. In this talk, we will use materials informatics to search for new two-dimensional (2D) magnetic materials. The recent discovery of intrinsic ferromagnetism in monolayer CrI3 and bilayer Cr2Ge2Te6 created great interest in 2D materials with intrinsic magnetic order. How many of these materials exist? What are their properties? We use materials informatics to study the magnetic and thermodynamic properties of 2D materials. Crystal structures based on monolayer Cr2Ge2Te6, of the form A2B2X6, are studied using density functional theory (DFT) calculations and machine learning tools. Magnetic properties, such as the magnetic moment are determined. The formation energies are also calculated and used to estimate the chemical stability. We show that machine learning, combined with DFT, provides a computationally efficient means to predict properties of two-dimensional (2D) magnets. In addition, data analytics provides insights into the microscopic origins of magnetic ordering in 2D. This non-traditional approach to materials research paves the way for the rapid discovery of chemically stable 2D magnetic materials.
Research at RAND Corporation

Terry Kelly
RAND Corporation

Thursday, October 10, 2019
10:00am – 11:00am
CII 5003

(The public is invited to attend. Refreshments will be served)

Abstract:
The RAND Corporation is among the nation’s foremost public policy research outfits. It grew out of the nation’s efforts in WWII to harness operations research to solve complex military problems, and now runs seven research divisions that focus on problems and customers as diverse as health and education policy to nuclear deterrence, defense S&T and acquisition challenges. Terrence Kelly is a RAND Vice President and the Director of one of those research divisions. He will provide an overview of RAND’s structure, staff and research, using examples from recently completed RAND research projects that should be of interest to the ISE faculty and students. Paul stays active professionally by regularly engaging local businesses and business leaders to stay abreast of current trends so he can incorporate these into the classroom. Further, he has attained the APICS CPIM designation (Certified in Production and Inventory Management) and ISM Lifetime CPM designation (Certified Purchasing Manager)."
Bio:

Terrence Kelly is vice president and director of the Homeland Security Operational Analysis Center, and director of the RAND Homeland Security Research Division. He has been a senior operations researcher at the RAND Corporation since 2002.

Over the past decade he has worked on homeland security strategy and policies; counterinsurgency in Iraq and Afghanistan; U.S. Department of Defense and Army strategy; and science, technology, and acquisition problems. From 2011-2014 Kelly served as the Strategy, Doctrine and Resources program director in the RAND Arroyo Center, and from 2014-2015 as the Arroyo Center’s acting associate director. In 2006 and 2007 Kelly served as director of the Joint Strategic Planning and Assessment Office in the U.S. Embassy in Baghdad, and in 2004 as the director of Militia Transition and Reintegration for the Coalition Provisional Authority in Iraq. Prior to joining RAND, Kelly served for 20 years as a commissioned officer in the U.S. Army.

Prior to retiring from the Army, Kelly's positions included senior national security officer in the White House Office of Science and Technology Policy; chief of staff of the National Critical Infrastructure Assurance Office; legislative liaison officer in the Army's office of legislative affairs; White House Fellow; assistant professor in West Point's Systems Engineering Department and Rensselaer Polytechnic Institute's Mathematical Sciences Department (visiting); command and staff positions in the 82nd Airborne Division and the 8th Infantry Division; and as a staff officer on the Army Staff.

Kelly holds a Ph.D. in mathematics from Rensselaer Polytechnic Institute.
Biomedical Engineering Presents:
“Tissue Protection and Repair Extracellular Matrix Hyaluronan”
Mary K. Cowman, Ph.D.
New York University
Thursday, October 10, 2019
2:30 pm
Bruggeman Room, CBIS

The polysaccharide hyaluronan (HA) is produced by cell membrane-embedded synthase enzymes and can be bound to cell surface receptors to anchor the pericellular matrix. HA is also an important keystone molecule of the extracellular matrix. HA interactions with proteoglycans and other HA-binding proteins in the pericellular and extracellular matrices lead to a highly hydrated protective network. Originally thought to be important only for its mechanical properties, HA is now known to participate directly in cell signaling pathways important for defensive response to inflammation and microbial attack. We will document and explain the correlation between increased HA synthesis and defense against reactive oxygen and nitrogen species (ROS/RNS) or other inflammation mediators. Increased HA content also alters the osmotic and viscoelastic properties of the matrix, driving the formation and controlling the transport of extracellular vesicles mediating cell-cell communication. We also show how excessive degradation of HA by ROS/RNS leads to fragmentation and altered cell signaling by de-clustering of cell surface receptors. We tested the concept of using specific HA-binding peptides to modulate the interaction of HA or its fragments with its CD44 receptors and co-receptors such as Toll-like receptors and RHAMM, in a model for cartilage repair. A 15mer HA-binding peptide, coupled with microfracture as a source of bone marrow derived mesenchymal stem cells, was found to show promise for non-fibrotic repair of a full thickness defect in articular cartilage.

Mary K. Cowman, Ph.D., received her Ph.D. in Chemistry from Case Western Reserve University, and completed postdoctoral training in Biochemistry at Brandeis University, and in Ophthalmology Research at Columbia University College of Physicians and Surgeons. She is Professor and Associate Dean of Biomedical Engineering in the NYU Tandon School of Engineering, and Professor of Orthopaedic Surgery in the NYU School of Medicine. Dr. Cowman’s research concerns discovery and development of new biotherapeutics, biomarkers, and bioactive materials based on cellular response to components of the extracellular matrix, with special expertise in hyaluronan polysaccharide. Dr. Cowman is President of the International Society for Hyaluronan Sciences.
Learning Motion in Feature Space: Locally-Consistent Deformable Convolution Networks for Fine-Grained Action Detection

Thursday, October 10, 2019
3:00 PM EDT / 1900 GMT
https://ibm.webex.com/join/aihn

Speaker: Khoi-Nguyen Mac
UIUC

Abstract: Fine-grained action detection is an important task with numerous applications in robotics and human-computer interaction. Existing methods typically utilize a two-stage approach including extraction of local spatio-temporal features followed by temporal modeling to capture long-term dependencies. We propose a novel locally-consistent deformable convolution, which utilizes the change in receptive fields and enforces a local coherency constraint to capture motion information effectively. Our model jointly learns spatio-temporal features (instead of using independent spatial and temporal streams). The temporal component is learned from the feature space instead of pixel space, e.g. optical flow.

from ICCV 2019

Bio: Khoi-Nguyen is a Ph.D. Candidate at the University of Illinois at Urbana-Champaign, Department of Electrical and Computer Engineering. He is working with Prof. Minh N. Do, in Coordinated Science Laboratory's Computational Imaging Group and IBM's Center for Cognitive Computing Systems Research (C3SR). His research interests include Action Detection and Recognition, Machine Learning, Computer Vision, and Signal Processing. https://knnmac.github.io

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