Spring 2023 - Departmental Seminars

- Jingxu Zheng (MIT)(1/11/23)
    - Title: Engineering Mesoscale Order in Crystalline Materials for Sustainability
    - Abstract
        - How crystals grow at dynamic interfaces is a broad-based science question that underpins a variety of opportunities for enabling key technologies. Fundamental answers are crucial for meaningfully advancing the state-of-the-art in, for example, energy storage materials and lightweight mechanical parts. However, the dynamic—*i.e.*, far from equilibrium & in the presence of anisotropic fields—nature of such growth poses critical challenges on its effective control, especially, at practical rates under ambient conditions. In this talk, as a point of departure from conventional approaches, I will discuss how mesoscale order of crystalline materials plays a critical—but underexplored—role in building high-performance batteries featuring low cost, intrinsic safety, and long cycle life. The focus on order at mesoscopic length scales is of interest because phenomena at these scales report explicit effects from intrinsic atomic bonding—*i.e.*, the crystal structure—and markedly impact macroscopic properties—*e.g.*, the electrochemical activity—of materials. Design and realization of mesoscale order via scalable methods offers a fresh path towards full utilization of the intrinsic anisotropy of crystalline materials for a diversity of applications.
    - Bio
        - Kent (Jingxu) Zheng is currently a postdoctoral associate at the Department of Physics, MIT. Beyond advancing his prior research on next-generation energy storage, Kent works on scalable synthesis of mesoscale ordered materials that host exotic electrochemical, mechanical, and electronic properties (advisor: Prof. Joseph Checkelsky). He obtained his PhD in 2020 under the supervision of Prof. Lynden Archer at the School of Chemical and Biomolecular Engineering, Cornell University. His PhD thesis study focused on the design of reversible metallic anodes in batteries, including Li, Zn, Al, *etc*., by controlling crystal growth at dynamic interfaces. Kent earned his bachelor's degrees in materials science and in history, respectively, from Shanghai Jiao Tong University in 2017. In 2014~2017, he worked in Frontier Research Center for Materials Structures (FRCMS). His research in FRCMS centered on atomic-scale characterization of phase transformations in light-weight alloys, *e.g.*, Mg and Al, using advanced transmission electron microscopy.
- Jason Adams (Caltech)(1/18/23)
    - Title: Organic Species, Alloys, and Support Identity Control the Transformation of H2, O2, and H2O over Metal Nanoparticles
    - Abstract
        - Direct reactions of H2 and O2 show promise for producing H2O2, an environmentally benign oxidant used for bleaching, disinfection, and selective oxidations. Understanding how catalytic surfaces convert H2 and O2 can improve yields of H2O2 formation while guiding the design of materials for

other redox reactions involving H-atom transfer. Herein, we examine the role of solvent molecules, alloy structures, metal-support interfaces, and surface redox mediators during transformations of H–H, O–O, and O–H bonds at the solid-liquid interface of noble metal nanoparticles. A combination of DFT calculations, *in situ* spectroscopy (XAS, FTIR), isotopic analysis, and kinetic measurements as a function of reactant activities and electrochemical potential suggest H_2O_2 forms by solvent-mediated proton-electron transfer paths resembling electrochemical oxygen reduction and hydrogen oxidation. Catalytic surfaces that present low barriers of hydrogen oxidation (Pd, Pt) increase reaction rates, while high barriers of O–O dissociation improve H_2O_2 selectivity. Consequently, alloying Pd or Pt with elements like Au, S, or H can create isolated sites of Pd or Pt that stabilize O–O bonds and favor H_2O_2 formation. Conversely, metal-support interfaces consisting of reducible metal-oxides (Au-La_2O_3) favor the cleavage of O–O bonds, while more acidic metal-support interfaces (Au-SiO_2) improve selectivity to H_2O_2. Surface-bound redox mediators with carbonylic functions (CH_2O*, quinones) introduce paths that improve rates and selectivities of H_2O_2 formation relative to clean Pd surfaces. Furthermore, this work informs the design of catalytic structures that heterolytically activate H_2 and O_2 with broad applications in hydrogenation and oxidation reactions at solid-liquid interfaces.

- Bio
  - Jason Adams is an electrochemical engineer interested in designing catalytic materials and reactors that will decarbonize and electrify the most carbon-intense reactions of chemical manufacturing. Jason received his bachelor's degree in Chemical and Biomolecular Engineering from Georgia Tech in 2015. He then pursued his Ph.D. as an NSF Fellow at the University of Illinois Urbana-Champaign. As a student of David Flaherty, Jason designed automated reactor systems to investigate reactions of H_2 and O_2 at solid-liquid interfaces by combining isotopic analysis, *operando* spectroscopy, and kinetic measurements with collaborative studies of density functional theory. His work combined concepts of thermal and electrocatalysis to elucidate the transformation of O–O, H–H, and O–H bonds over noble metal nanoparticles, leading to catalyst design principles for controlling rates and selectivities of H_2O_2 formation. After receiving his Ph.D. in 2022, Jason began his postdoctoral position at Caltech. Working under Karthish Manthiram, Jason studies reactor engineering, transport-coupled kinetic modeling, and organic electrocatalysis to develop catalytic materials and systems for electrochemically activating H_2O or O_2 during the epoxidation of olefins. Jason aims to build upon these concepts to create catalytic processes that utilize temperature, pressure, and electrochemical potential to sustainably convert petrochemicals and emerging feedstocks (derived from CO_2, biomass, and plastic upcycling) to value-added chemicals. Jason intends to build a group that combines material chemistry, electrochemical reactor engineering, *in situ* spectroscopy, and kinetic analysis to design catalytic

materials and cells that perform selective partial oxidations that generate carbon-neutral electricity while mitigating CO2 emissions.

- Vibha Kalra (Drexel)(1/23/23)
    - Title: Integrating Material Design, *In-operando* Spectroscopy and Electrochemical Study for Next Generation Lithium-Sulfur Batteries
    - Abstract
        - Rechargeable batteries with conversion type electrodes are attractive due to their ability to achieve higher capacity through multi-electron transfer reactions. Elemental sulfur (S) is one of the most interesting materials amongst all conversion-based cathodes because of its high theoretical capacity (~1675 mAh/g – 5-10-fold higher than Li-ion batteries), natural abundance, non-toxicity, and cost-effectiveness. In this talk, I will present our group's research on integrating material design and fabrication, *in-operando* and *postmortem* spectroscopy, and device assembly and testing (coin/pouch) to study and develop next generation lithium-sulfur batteries. In particular, I will discuss our projects on studying cathode and electrolyte chemistries to mitigate the notorious polysulfide shuttle by first triggering favorable interactions of intermediate redox products, namely, polysulfides with the S-host or the electrolyte species followed by tailoring of S redox to trigger the elimination of polysulfides for long-term cycle stability.
    - Bio
        - Dr. Vibha Kalra is George B. Francis Chair Professor in the Department of Chemical and Biological Engineering at Drexel University. She also serves as the associate editor of *Chemical Engineering Science* journal, since 2013. Additionally, she is on the advisory council for the Smith School of Chemical and Biomolecular Engineering at Cornell University. Kalra received her BS from the Indian Institute of Technology (IIT), Delhi, India in 2004 and PhD from Cornell University in 2009, both in Chemical Engineering. Her research group combines material assembly & characterization, study of fundamental electrochemical behavior, in-situ spectro-electrochemistry, and device assembly and testing to develop energy storage devices, including next-generation batteries and supercapacitors. She has published over 60 peer-reviewed journal articles and has 11 pending/issued patents in the field of energy storage.
- Jason Bates (Wisconsin)(1/30/23)
    - Title: Teaching Old Electrocatalysts New Tricks: Merging Concepts from Thermal Catalysis and Molecular Synthesis
    - Abstract
        - Decarbonizing the energy and chemical industries motivates the development of new catalytic technologies that use renewable energy inputs, alternative feedstocks, and spatially distributed production modalities. In this context, electrocatalysts are tasked with producing fuels, chemicals, and energy by mechanisms that fundamentally differ from those of electrolyzer and fuel cell technologies, and the thermocatalytic technologies of incumbent petrochemical processes. In this presentation I will show how concepts from thermal and molecular catalysis can stimulate new approaches for the synthesis and

application of a class of heterogeneous electrocatalysts known as M-N-Cs, or metals incorporated into nitrogen-doped carbon. M-N-Cs (e.g., M = Fe, Co) catalyze electrochemical reduction of O2, such as in fuel cells, and catalyze thermochemical reduction of O2 using hydroquinone (HQ) as the source of reducing equivalents. Kinetic studies reveal an unexpected mechanism for HQ-mediated O2 reduction through a direct chemical pathway facilitated by a catalyst microenvironment modified by adsorbed HQ species. This alternative mechanism circumvents the rate–potential relationship observed for electrocatalytic O2 reduction, opening new opportunities to design fuel cell systems that reduce O2 with higher energy efficiency (i.e., lower overpotential). In a complementary effort, Fe-N-C heterogeneous catalysts were prepared to contain atomically dispersed metal active sites by adapting synthetic strategies used to metalate molecular macrocycle catalysts under solution-phase conditions and milder temperatures (150 °C) than those of conventional pyrolysis-based preparation routes (600–1100 °C). These well-defined Fe-N-C catalysts directly implicate atomically dispersed FeNx moieties as the active sites for aerobic oxidation reactions. These studies show how thermochemical and molecular concepts can be leveraged to understand and improve the structure and function of electrocatalysts that are critical for next-generation energy and chemical conversion processes.

    - Bio
        - Jason S. Bates received his B.S. in Chemical Engineering at the University of Kansas in 2014 and a Ph.D. in Chemical Engineering at Purdue University in 2019, under the supervision of Rajamani Gounder. He is currently an NIH postdoctoral fellow at the University of Wisconsin–Madison in the Department of Chemistry, under the supervision of Shannon S. Stahl. His research explores the fundamentals of heterogeneous (electro)catalysis in areas relevant to decarbonization of the energy and chemical industries.
- Monica Neugebauer (Broad Institute of MIT and Harvard)(2/6/23)
    - Title: Engineering enzymes for biocatalysis and gene editing
    - Abstract
        - Enzymes catalyze chemical transformations with exquisite selectivity. Through directed evolution, we can reprogram enzymes for applications in biocatalysis and medicine. In the first part, I will discuss my work to discover, characterize, and engineer FeII/α-ketoglutarate-dependent enzymes that halogenate unactivated Csp3—H bonds. I solved the anaerobic crystal structure of a novel lysine halogenase (BesD), discovered homologs that enable the formation of nine new chlorinated amino acids, and developed enzymatic cascades to produce chlorinated heterocycles, diamines, keto-acids, and peptides. Through structural studies and high-throughput screening, I investigated the mechanistic basis for regioselectivity and catalytic selectivity within this enzyme family and used the resulting insights to engineer hydroxylases to perform halogenation with activity and selectivity comparable to that of native halogenases. In a second story, I developed novel cytosine base editors (CBEs) through directed evolution. Base

editors consist of a programmable DNA binding protein, such as catalytically impaired Cas9, fused to a deaminase enzyme, and enable precise nucleotide changes within a target site in the genome. CBEs, which convert C•G base pairs into T•A, are typically larger and have more undesired off-target editing than their adenine base editor (ABE) counterparts. To develop a new class of CBEs that retain the favorable properties of ABEs, I used continuous protein evolution to evolve ABEs to instead perform highly efficient cytosine base editing within therapeutically relevant sites and cell types. These newly evolved base editors overcome several limitations of existing CBEs and demonstrate the power of protein evolution for addressing challenges in biotechnology.

    - Bio
        - Monica obtained her B.Sc. in Chemical and Biological Engineering from MIT, where she conducted research in the laboratory of Prof. Alice Ting. She then earned her Ph.D. in Chemical and Biomolecular Engineering from UC Berkeley in the group of Prof. Michelle Chang. During her Ph.D., she discovered novel biosynthetic pathways and engineered enzymes for biocatalysis. As a post-doctoral fellow in the laboratory of Prof. David Liu at the Broad Institute of MIT and Harvard, she used directed evolution to develop novel gene editing tools with enhanced therapeutic properties. She uses protein evolution to develop useful tools and to gain basic mechanistic insights into enzymatic catalysis.
- Regina García Méndez (Cornell)(2/13/23)
    - Title: Rational Microstructure and Property Design of Electrolytes Toward Better Batteries
    - Abstract
        - Long-term decarbonization of the electricity supply and electrification of the energy economy are the most pressing energy challenges of our time. Without decisive action, energy-related emissions of CO2 will more than double by 2050. Thus, low-carbon energy technologies, such as batteries, will be crucial in changing the current path. The need for advanced batteries that can deliver the energy required to power high-energy mobile and stationary applications with improved safety has accelerated the development of solid-state batteries and alternative chemistries from readily available raw materials. At the core of the research is the structural design of electrolytes and interfaces at the atomic and macro-scale. Therefore, in this talk, I will present different approaches to modifying the structure of solid electrolytes via synthesis and processing to achieve stable electrochemical cycling. Furthermore, I will show that a coupled multi-scale, in-situ, and operando characterization approach provides a mechanistic understanding of chemical, electrical and mechanical phenomena at relevant length scales and temporal resolution for future battery development.
    - Bio
        - Regina García-Méndez is currently a post-doctoral fellow at Cornell University. She completed her B.S. in Chemical Engineering from UVG in Guatemala, a M.S. in Materials Science and Engineering at Michigan State University, and a Ph.D. in Materials Science and Engineering at the University of Michigan under

Prof. Jeff Sakamoto in 2020. Her doctoral work focused on correlating structural and interfacial effects of ceramic solid electrolytes with the cycling stability of Li metal in solid-state batteries. Her current work is focused on the materials and interphase design for highly reversible, long-duration, cost-effective Al batteries. She is the recipient of a Cornell Energy Systems Institute post-doctoral fellowship, the SHPE community engagement award, and a Fulbright fellowship. Her research interests revolve around understanding materials behavior through multi-scale characterization to address energy and environmental-related challenges.

- Valencia Witherspoon (NIH)(2/20/23)
    - Title: Increasing Diagnostic Power Through the Development of Quantitative Imaging Phantoms
    - Abstract
        - Magnetic Resonance Imaging is a proven robust diagnostic method that has the potential to perform non-invasive pathological assessments. One goal of radiological sciences is to develop MRI biomarkers. These quantitative objective parameters indicate the tissue's pathophysiological state(s) in the hope that they can be used to detect diseases, disorders, trauma, etc. Another vital application of quantitative imaging is enabling single-subject, longitudinal, and multisite clinical studies so that imaging data can be pooled from them. A key to advancing quantitative imaging is to develop quantitative MRI phantoms. These are made of known, highly controlled material(s) designed to mimic specific features of human tissues. Examples include compartment size, shape, orientation, and tissue composition. Most current phantoms fail to incorporate the necessary complexity or morphological features to benchmark MRI scanners. To improve the utility and robustness of diffusion MRI-based biomarkers, I have been designing and fabricating 3D-printed phantoms mimicking unique tissue environments. Some designs are suitable for high-field MRI scanners, while others are suited to low-field MRI scanners for point-of-care diagnostic applications. I will describe our efforts to develop phantoms that mimic the magnetic field-dependent relaxometry behavior of neural tissue. I will also discuss our efforts to map the relationships between specific extracellular matrix (ECM) mimics and their respective MRI biomarkers/fingerprints at low magnetic fields.
    - Bio
        - Dr. Velencia Witherspoon is currently a postdoctoral fellow in the lab of Peter Basser, The Section for Quantitative Imaging and Tissue Science, at Eunice Kennedy Shriver National Institute of Child Health located at the National Institutes for Health Bethesda, MD. She earned her B.S. in Chemical and Biomolecular Engineering (CBE) from Florida A&M University and her Ph.D. in CBE from the University of California, Berkeley. Her dissertation discussed a magnetic resonance (MR) perspective on adsorption dynamics in metal-organic frameworks. She connected framework chemistry and structure to MR measures and molecular dynamics simulations of molecular motion. To extend her training

to biological complex media, she joined SQITS, where she is developing novel quantitative MR(Imaging) phantoms to reflect salient features of neurological tissue microstructure. She became interested in quantitating compositional and organizational changes in the extracellular matrix (ECM) and their relation to tissue inflammation. She was awarded a K99/R00 grant to develop low-field MRI methods and biomarkers to assist in fingerprinting pathological states of ECM in shallow connective tissues.

- Blake Rasor (Northwestern)(2/27/23)
    - Title: Engineering cell-free platforms to accelerate sustainable biomanufacturing
    - Abstract
        - Climate change presents significant challenges to human and environmental health driven by greenhouse gas emissions from products and processes we use every day. Society needs sustainable alternatives to make chemical products with less waste and lower emissions to mitigate these challenges, and biology offers routes to achieve this goal. Biological reactions convert simple substrates into thousands of unique chemical products without harsh conditions or toxic byproducts, but engineering cells to specifically make one target molecule requires significant time and optimization. To address this challenge, my research implements cell-free systems from bacteria and yeast to reconstitute biosynthetic pathways *in vitro* for rapid biochemical production. Cell-free synthesis of proteins and other biochemicals uses the contents of cells that have been broken open, exploiting biological machinery in the absence of growth or cellular regulation. The resulting cell extracts are extremely flexible systems with open reaction environments that enable greater control over variables than cell cultures for combinatorial screening. I implement cell-free systems both to inform the design of cellular production strains and to serve as standalone synthesis platforms with reduced waste generation. Here, I will discuss pathway prototyping to accelerate the design of non-model bacteria for carbon-negative chemical synthesis, highlight the ability for cell-free systems to achieve greater volumetric productivities than whole cells, and describe the ease with which diverse chemicals can be synthesized using crude cell extracts. Overall, this work accelerates our ability to engineer biological systems for greener chemical manufacturing strategies.
    - Bio
        - Blake Rasor earned a B.S. in biology & microbiology from Miami University before pursuing graduate studies in chemical engineering for more quantitative, applications-driven projects. He conducted Ph.D. research with Michael Jewett at Northwestern University, where he characterized and engineered cell-free platforms for sustainable synthesis of proteins and biochemicals with applications in biomanufacturing, defense, and education. Blake is currently transitioning to postdoctoral research with Tobias Erb at the Max Planck Institute for Terrestrial Microbiology to study and engineer photosynthesis for biological carbon capture. Blake has received NDSEG and NSF Graduate Fellowships, and he is a finalist for the Schmidt Science Fellows.

- Arup Chakraborty (MIT)(3/27/23)
    - Gubbins Lecture: Viruses, Immunity, and Vaccines
    - Abstract
        - Infectious disease-causing pathogens have plagued humanity since antiquity, and the COVID-19 pandemic has been a vivid reminder of this perpetual existential threat. Vaccination has saved more lives than any other medical procedure, and effective vaccines have helped control the COVID-19 pandemic. However, we do not have effective vaccines against rapidly mutating viruses, such as HIV; nor do we have a universal vaccine against seasonal variants of influenza or SARS-CoV-2 variants that may evolve in the future. The ability to develop effective vaccines that protect us from highly mutable viruses will help create a more pandemic-resilient world. I will describe how by bringing together approaches from statistical physics, virology and immunology, progress is being made to address this challenge. I will focus on broadly protective antibody responses. First, I will describe some general principles and then I will discuss how by combining physics-based modeling and data from humans who received COVID vaccines we are learning new mechanisms underlying the antibody response upon infection or vaccination.
    - Bio
        - Arup K. Chakraborty is one of the 12 Institute Professors at MIT, the highest rank awarded to a MIT faculty member. He is also a Professor of Chemical Engineering, Physics, and Chemistry at MIT. He served as the founding Director of MIT's Institute for Medical Engineering and Science, and he is a founding member of the Ragon Institute of MIT, MGH, and Harvard. For over two decades now, Chakraborty's work has largely focused on bringing together approaches from statistical physics, immunology, and virology. His interests span T cell signaling, development of the T cell repertoire, and a mechanistic understanding of virus evolution, antibody responses, and vaccine design. Since 2016, Chakraborty has also been deeply interested in the role of phase separation in gene regulation. Chakraborty is one of only 25 individuals who are members of all three branches of the US National Academies – National Academy of Sciences, National Academy of Medicine, and National Academy of Engineering.
- Shelly R. Peyton (UMass)(4/3/23)
    - Abstract
        - I'll discuss how we use our engineering principles to create these environments and show how we've begun to use them to study grand challenges in cancer biology. In the US, metastatic breast cancer has no effective therapeutic options. One of the overwhelming challenges in treating metastatic cancer is that tumors in the brain, lung, skeleton, and liver are typically drug resistant, and we do not have a good understanding of why these tumors evade therapy. The biomaterials we have built over the years are perfectly suited for drug screening applications to make better predictions of efficacy, which offers better translation to preclinical models and clinical trials. I'll talk about how our biomaterials allow

us opportunities to study cancer in new ways, how we are collaborating internationally to understand why breast cancer is particularly deadly in other parts of the world, and strategies to work in R1 lab environments and classrooms in increasingly inclusive and equitable ways.

    - Bio
        - Shelly Peyton is the Armstrong Professional Development Professor in Chemical Engineering at the University of Massachusetts Amherst. She received her B.S. in Chemical Engineering from Northwestern University in 2002 and went on to obtain her MS and PhD in Chemical Engineering from the University of California, Irvine in 2007. She was then an NIH Kirschstein post-doctoral fellow in the Biological Engineering department at MIT before starting her academic appointment at UMass in 2011. Shelly leads an interdisciplinary group of engineers and molecular cell biologists seeking to create and apply novel biomaterials platforms toward new solutions to grand challenges in human health. Her lab's unique approach is using our engineering expertise to build simplified models of human tissue with synthetic biomaterials. They use these systems to understand 1) the physical relationship between metastatic breast cancer cells and the tissues to which they spread, 2) the role of matrix remodeling in drug resistance, and 3) how to create bioinspired mechanically dynamic and activatable biomaterials.
- Rodney D. Priestly (Princeton)(4/10/23)
    - McCabe Lecture
    - Abstract
        - Providing access to safe water is a major global challenge due to expansion of industrialization, growth of the global population, and contamination of freshwater resources. According to the United Nations, in the last century, global water requirements grew at a rate more than twice that of the population growth rate. In the United States alone, the Environmental Protection Agency has identified over 70,000 water bodies in the United States alone that are impaired by pollution. The health issues associated with consuming contaminated water are well-known: waterborne disease outbreaks, leading to gastrointestinal illness, reproductive complications, and neurological disorders, amongst others. More than 1.5 million people die each year from diarrhea caused by the intake of unsafe drinking water. Therefore, developing advanced water purification technologies that provide access to safe water to more of the global population remains an enduring challenge.
        - Hydrogels have emerged as promising soft materials for sustainable and off-grid water purification and harvesting. However, the low water production rate well below daily human demand is a current impediment to technology translation. To make progress towards addressing this challenge, we present work on the development of a rapid-response solar absorber gel membrane capable of producing potable water from various contaminated sources at a rate of ~ 26 kg m-2 h-1, which is sufficient to meet daily water demand. The membrane—produced at room temperature *via* aqueous-based processing using

an ethylene glycol (EG)-water mixture—uniquely integrates the attributes of poly(N-isopropyl acrylamide) (PNIPAm), polydopamine, and poly (sulfobetaine methacrylate) to enable off-grid water purification with enhanced photothermal response and the capacity to prevent oil- and bio-fouling. The use of the EG-water mixture was critical to forming the loofah-like structure with enhanced water transport. Remarkably, under various sunlight irradiations of 1 and 0.5 sun, LSAG required only 10 to 20 min to release ~ 70 % of its stored liquid water, respectively. Equally important, we demonstrate the ability of the membrane to purify water from various harmful sources, including those containing small molecules, oils, metals, and microplastics.

    - Bio
        - Rodney D. Priestley is the Dean of the Graduate School at Princeton University. He is the Pomeroy Betty Perry Smith Professor in the Department of Chemical and Biological Engineering and the Co-Director of the NSF I-Corps Hub. He is the former inaugural Vice Dean for Innovation at Princeton. He obtained his Ph.D. in Chemical Engineering from Northwestern University in 2008. His research involves describing and developing complex materials, especially nanoparticles, thin polymer films, and nanocomposites, focusing on material properties at small length scales. From designing next-generation biocompatible surfactants to creating ultra-stable polymer films resistant to properties changes upon heating, his work impacts industries ranging from personal care to aerospace. His recent interests include the use of polymers in sustainability and their implications on the environment. He has been recognized with several awards for his research and commitment to teaching and mentorship.
- Anne Robinson (Carnegie Mellon)(4/17/23)
    - Abstract
        - The adenosine receptor subfamily of G-protein coupled receptors is an important family of membrane receptors that modulate blood pressure, and more recently have been implicated in cancer, neurodegenerative diseases, and diabetes, making them a significant fraction of drug discovery efforts. As multipass membrane proteins, G protein coupled receptors remain challenging but important targets of drug discovery, and our efforts have enabled the high-level expression of the adenosine family of receptors. Adenosine A2A receptor (A2AR), one of four subfamily members, has a longer C-terminus than the other adenosine receptor subtypes, which may contribute to its exceptional trafficking to the plasma membrane, but its flexibility has been attributed to protein-protein interactions. In this talk I will discuss some of our expression and protein trafficking engineering, particularly related to creating protein chimeras, as well as in-depth biophysical characterization of their binding to G-proteins and lipids.
    - Bio
        - Anne Skaja Robinson is the Trustee Professor and Department Head of Chemical Engineering at Carnegie Mellon University. Dr. Robinson completed her B.S. and M.S. degrees in Chemical Engineering at the Johns Hopkins University, and then moved to the University of Illinois at Urbana-Champaign for her Ph.D. She is the

author of over 100 peer-reviewed publications, a co-author on the textbook, *Mass and Heat Transfer*, and has trained 34 PhD students, five postdoctoral researchers, and hundreds of undergraduates. Her scientific achievements have been recognized by several awards, including an NSF Presidential Early Career Award (PECASE) and the Society for Biological Engineering (SBE)'s Biotechnology Progress Award. The ACS BIOT Division recognized Dr. Robinson's scientific achievements by awarding her the David Perlman Memorial Lectureship in 2015 and the Marvin Johnson Award in Microbial and Biochemical Technology in 2022. In 2016, she was named a Fellow of the American Institute of Chemical Engineers.

- Harvinder Gill (Texas Tech)(5/1/23)