SIEMENS | Foundation

Siemens Competition
2017 Regional Finals

University of Texas at Austin Judge Bios

Jennifer Maynard (Lead Judge)
McMakin Associate Professor, Chemical Engineering, UT Austin
BA Human Biology, Stanford
PhD Chemical Engineering, UT Austin
Post-doc, Microbiology & Immunology, Stanford

We develop protein therapeutics and vaccines to address unmet medical needs in infectious diseases. These proteins aim to directly interfere in disease progression or augment essential immune system activities. To do this, we design a candidate protein, with an emphasis on engineering the kinetics with which it interacts with other proteins as well as targeting protein transport to specific tissues in the body. This is followed by protein expression and purification to make the protein; biophysical, biochemical and cellular analyses to elucidate the molecular basis of activity; and, ultimately, *in vitro* and *in vivo* experiments to evaluate the protein's ability to prevent disease.

Z. Jeffrey Chen
D. J. Sibley Centennial Professor in Plant Molecular Genetics,
Departments of Molec Biosci and Integrative Bio, UT Austin
M.S. in Genetics and Breeding at Nanjing Agricultural University
Ph.D. in Genetics at Texas A&M University

Jeff Chen has developed an innovative research program to study molecular mechanisms for gene expression changes and evolutionary consequences in hybrids (formed between strains of the same or different species) and allopolyploids (formed between two or more related species) relative to the parents. His research employs Arabidopsis (a weedy plant in the mustard family) and cotton as experimental systems and uses genomic, proteomic, and systems biology approaches, as well as molecular biology and genetic methodologies. Dosage changes and novel interactions between parental genomes and alleles in hybrids and polyploids may induce epigenetic and epigenomic changes, leading to hybrid incompatibility, heterosis in plants, and diseases and cancers in animals. He and his colleagues have found that epigenetic changes in gene expression in plant hybrids and allopolyploids are associated with altered circadian rhythms and hybrid vigor, seed size, enhanced resistance to biotic and abiotic stresses, and fiber cell and trichome development. Moreover, the results have significant implications, not only for the field of genetics and epigenetics, but also for the ultimate success of biotechnological efforts to safely and effectively manipulate gene expression associated with growth vigor in plants and crops that produce food, feed, and biofuels.

Karl Gebhardt
Herman and Joan Suit Professor of Astrophysics, UT Austin
B.S. Physics and Astronomy, University of Rochester
M.S. Physics and Astronomy, Michigan State University
Ph.D. in Physics and Astronomy, Rutgers University

I have been studying the central regions of galaxies in order to understanding their evolutionary history. The fist step involves measuring the mass of any central black hole. Together with the Nuker Team , we have found that nearly all galaxies contain a central supermassive black hole. Furthermore, the mass of the black hole strongly correlates with various galaxy properties. I have been working on a Black Hole Webpage that describes the data and results. In order to measure the mass of the black hole, we use a sophisticated orbit-based model to represent the galaxy. These models provide one of the most general solutions for how stars can orbit in a galaxy. This modeling code allows us to not only measure the central black hole accurately, but also to determine how the stars orbit throughout the galaxy. Both of these relate to how the galaxy formed and evolved.

Graeme Henckelman
Professor, Department of Chemistry, University of Texas at Austin
BS, Queen's University (1996);
PhD, University of Washington (2001);
Postdoctorate, Los Alamos National Laboratory (2002-2004)

COMPUTATIONAL ALGORITHMS FOR MODELING CHEMICAL REACTIONS AND KINETIC PROCESSES IN MATERIALS AT THE ATOMIC SCALE. Our interest is to understand the mechanism and rate of chemical reactions and the dynamics of molecular systems. We focus on the development of new computational algorithms for finding reaction pathways and extending the time scale of simulations beyond what can be simulated directly with molecular dynamics. These methods allow us to investigate reactions at surfaces, novel catalysts, and battery materials. More information can be found on our group website.

Simon Humphrey
Associate Professor, Department of Chemistry, UT Austin
MChem, University of East Anglia, Norwich (2002)
Ph.D., University of Cambridge (2005)
Post-Doctoral Scholar, University of California, Berkeley (2005-2007)
Research Fellow, St John's College, Cambridge (2006-2009)

TWO MAJOR AREAS OF RESEARCH IN THE HUMPHREY GOURP ARE (1) PHOSPHINE COORDINATION MATERIALS FOR GAS STORAGE, SEPARATION, AND CATALYSIS AND (2) NOBLE METAL NANOPARTICLES AND COMPOSITE CATALYST MATERIALS.

Phosphine ***C***oordination ***M***aterials are a new class of porous coordination polymers that is defined by the use of phosphine ligands to link between metal nodes. The phosphine site allows for a wide variety of both pre- and post-synthetic modifications, leading to the potential inclusion of catalytically active metals, guest-accessible polar groups, charged species, and halogenated species. Such functionalization could lead to applications in numerous fields, including selective heterogeneous catalysis at single sites, gas sensing and separation, and small molecule sequestration. The reproducible preparation of near-monodisperse samples of noble metal nanoparticles with defined surface structures, which can also be easily activated for applications in heterogeneous catalysis is an ongoing synthetic challenge. We are presently interested in using non-conventional routes such as microwave heating in combination with automated reaction apparatus to prepare single-metal, alloy, and core-shell nanocrystals of the group IX, X and XI metals.

Keith Keitz
Assistant Professor, Chemical Engineering, University of Texas at Austin
B.S., Chemical Engineering, University of Texas at Austin
Ph.D., Chemistry, California Institute of Technology
Postdoctoral Researcher, University of California, Berkeley

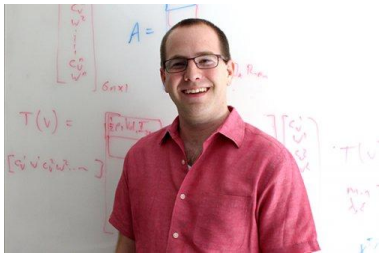
We use synthetic chemistry and synthetic biology in conjunction with chemical engineering fundamentals to design new functional materials for use in catalysis, energy generation, environmental remediation, biological separations, and medicine. By connecting concepts from each of the above fields, we aim to develop artificial ecosystems where biological processes can interface with inorganic and organic substrates to generate materials with previously unknown structure and function. The nature of our work requires an engineering approach that incorporates aspects of chemical kinetics, synthetic chemistry, surface chemistry, structural biology, and the study of genetic/metabolic networks. By implementing and developing tools in each of these areas we hope to prepare students and scholars for the engineering challenges of the future.

Lorenzo Sadun
Professor of Mathematics, UT Austin
Ph.D. University of California, Berkeley (Ph.D. advisor: Cliff Taubes)
M.A. University of California, Berkeley
B.S. Massachusetts Institute of Technology

Lorenzo Sadun is a Professor of Mathematics at the University of Texas. His work spans a variety of areas related to geometry, dynamical systems, mathematical physics, and probability. He is currently working on projects on (1) phase transitions in random graphs, (2) topological dynamics of tiling dynamical systems, and (3) mass transport in aperiodic tilings.

David Taylor
Assistant Professor, Molecular Biosciences, UT Austin
BS, Biochemistry, Syracuse University
MS and PhD, Molecular Biophysics, Yale
Post-doc, UC Berkeley

In bacteria, the clustered regularly interspaced short palindromic repeats (CRISPR)–associated (Cas) DNA-targeting complex Cascade (CRISPR-associated complex for antiviral defense) uses CRISPR RNA (crRNA) guides to bind complementary DNA targets at sites adjacent to a trinucleotide signature sequence called the protospacer adjacent motif (PAM). The Cascade complex then recruits Cas3, a nuclease-helicase that catalyzes unwinding and cleavage of foreign double-stranded DNA (dsDNA) bearing a sequence matching that of the crRNA. Cascade comprises the CasA–E proteins and one crRNA, forming a structure that binds and unwinds dsDNA to form an R loop in which the target strand of the DNA base pairs with the 32-nt RNA guide sequence. Single-particle electron microscopy reconstructions of dsDNA-bound Cascade with and without Cas3 reveal that Cascade positions the PAM-proximal end of the DNA duplex at the CasA subunit and near the site of Cas3 association. The finding that the DNA target and Cas3 colocalize with CasA implicates this subunit in a key target-validation step during DNA interference. We show biochemically that base pairing of the PAM region is unnecessary for target binding but critical for Cas3-mediated degradation. In addition, the L1 loop of CasA, previously implicated in PAM recognition, is essential for Cas3 activation following target binding by Cascade. Together, these data show that the CasA subunit of Cascade functions as an essential partner of Cas3 by recognizing DNA target sites and positioning Cas3 adjacent to the PAM to ensure cleavage.



Etienne Vouga, Ph.D.
Department of Computer Science
Assistant Professor
University of Texas at Austin

Dr. Etienne Vouga received his Ph.D. at Columbia University in 2013 under Eitan Grinpsun and spent a year as an NSF Mathematical Sciences Postdoctoral Fellow at Harvard, working with L. Mahadevan. His research is at the intersection of computer graphics, computational mechanics, and mathematics, and his specific interests include physical simulation of everyday materials like cloth, hair, and paper; algorithms for detecting and resolving collisions that arise during animations; and using geometry processing algorithms and discrete differential geometry to solve design problems such as creating masonry buildings that stand up under their own weight, or origami patterns that compact into a small volume and deploy into large curved shapes. Special effects studios Disney and Weta Digital have used his work on cloth and hair simulation in movies such as Tangled and The Hobbit.

Janet Zoldan
Assistant Professor, Biomedical Engineering, UT Austin
BS Chemistry, Hebrew University
MS, PhD Materials Engineering, Technion–Israel Institute of Technology
Post-doc, Langer lab, MIT

Dr. Zeidan received her BSc degree in chemistry from the Hebrew University, and then pursued her master's degree and doctorate in the Technion-Israel Institute of Technology, Department of Materials Engineering, specializing in polymer science. In Her postdoctoral training, she expanded her research base and entered the growing field of tissue engineering. She first joined Dr. Shulamit Levenberg's Lab at the Technion and delved into stem cell biology. Receiving both the Aly Kauffman Fellowship and the Technion's Outstanding Woman Scientist in Engineering Award allowed her to join Dr. Robert Langer's lab at the Massachusetts Institute of Technology. In the Langer lab, she focused on nucleic acid delivery to human embryonic stem cells and protein microfluidic delivery. During her last year at MIT, and in parallel to her post-doctoral research, she established, and served as director to, a new research facility for nano-scaled material characterization that combines research disciplines from biology with engineering. In 2013 Dr. Zeidan joined The University of Texas at Austin as an assistant professor. Research in the Zeidan lab focuses on human induced pluripotent stem cells (iPSCs) as a model system to explore key principles underlying vascular tissue formation processes and regenerating ischemic tissue. Understanding these processes and controlling them with material design and microfluidic protein delivery are critical for treating a broad spectrum of pathological conditions (e.g. heart failure, ischemic stroke, congenital defects). Specifically, she is interested in unraveling how biochemical cues lead to changes in cellular organization and cell behavior. She has recently received the prestigious Scientist Development Grant from the American Heart Association to develop minimally invasive personalized reatment to patients suffering from peripheral arterial disease. Dr. Zeidan is dedicated to train and mentor the next generation of female engineers. The majority of her lab members are females. Dr. Zeidan teaches classes devoted to Tissue Engineering and Stem Cells in Tissue engineering.