OVERVIEW

Summer 2019 Lab Offerings
Tuft Summer Research Experience (TSRE)

Advanced high school juniors and seniors with prior research experience will gain proficiency in authentic research practices as they work side-by-side with the faculty, postdoctoral scholars, and students at Tufts University. You will spend six weeks at Tufts under active mentorship to learn hands-on laboratory techniques and/or data and processing skills. You will receive information in workshops to conduct rigorous and ethical research, as well as exposure to a plethora of research topics currently being explored at Tufts; additionally, you will attend journal clubs to increase your ability to critically read literature. You will have the unique opportunity to actively contribute to ongoing research projects; and learn about research ethics and how to evaluate information objectively.

The application for Summer 2019 will open on December 1st at which time you will be asked to select and rank your top three choices of lab. After you are accepted, we will process your selections on a first-come, first served basis, following the order of your course preferences. If all of your selections have already been filled, we will communicate that to you and give you the opportunity to make another selection.

Please find the list of available labs below. Each listing includes the department in which the lab is housed, the name of the faculty running the research project, a description of the research, and the area of study with a link to the lab’s website. For a more in-depth description of the research being done in each lab, please follow the link to the lab’s website.

Please note: students must be 16 years of age by the start of the program to be eligible.

Summer staff are available if you need advice when selecting your lab preferences or if you have general questions about the program. To contact us, please email summer@tufts.edu or call 617-627-0609.
Biology: **Evolution**  
*Faculty*: Erik Dopman  
How do new species form and adapt to rapidly changing environments? Research in the Dopman lab centers on understanding these two fundamental questions about the origin and persistence of biological diversity.

Biology: **Genome Instability**  
*Faculty*: Sergei Mirkin  
The Mirkin lab studies the mechanisms responsible for the instability of DNA repeats in various genomes. It is particularly interested in the mechanisms of expansions of triplet DNA repeats that cause numerous hereditary disorders in humans, including Fragile X mental retardation, Huntington’s disease, myotonic dystrophy, and Friedreich’s ataxia.

Biology: **Microbiome**  
*Faculty*: Benjamin Wolfe  
The Wolfe lab uses synthetic and natural microbial communities to study the ecology and evolution of microbiomes. Many experimental systems in the lab come from fermented foods such as cheese, sourdough, and kombucha. Their work seeks to develop principles of microbial community assembly that can guide the design and manipulation of microbial communities in agriculture, industry, medicine, and nature.

Chemistry: **Chemical Biology/Drug Design**  
*Faculty*: Krishna Kumar  
The Kumar laboratory uses molecular design to construct molecules that have therapeutic potential. The range of ailments targeted span both non-communicable diseases such as cancer, type 2 diabetes, obesity, Alzheimer’s and Parkinson’s diseases and those caused by resistant bacteria. The laboratory uses the techniques of organic chemistry, molecular and cellular biology, biophysics and translational work in animals to assess the biological function of the molecules.

Chemistry: **Functional Polymers and Nanoparticles**  
*Faculty*: Sam Thomas  
The Thomas group applies the philosophy of physical organic chemistry to organic materials, in the forms of polymers, crystals and surfaces. The lab harnesses light to control plastics in real time. Applications include triggered drug delivery, self-assembly, and chemical detection.

Chemistry: **Inorganic Materials Synthesis**  
*Faculty*: Luke Davis  
The Davis research group works to discover new compounds and fabrication routes which contribute to increased sustainability and greater chemical understanding. Their efforts focus on synthesis, screening, and characterization, with additional opportunities for learning and collaboration in device construction, theory, and advanced characterization methods.
Child Study and Human Development

**DevTech: Coding and Robotics in Early Childhood**
*Faculty:* Marina Bers

The Developmental Technologies Research Group aims to understand how new technologies that engage in coding, robotics and making, can play a positive role in children’s development and learning. Their research involves three dimensions: theoretical contributions, design of new technologies, and empirical work to test and evaluate the theory and the technologies. Their long-time commitment is to inspire sustainable and scalable evidence-based programs for young children that promote the learning of programming and computational thinking with a playful, developmentally appropriate approach.

Child Study and Human Development: *Child and Adolescent Health*
*Faculty:* Sasha Fleary

The CHERLab aims to understand risk and protective factors for preventive health and mental well-being for children, adolescents, and families at risk for health disparities and inequity. The CHERLab develops interventions that promote social justice and positive youth development.

**Engineering**

**Biomedical Engineering: Materials at the Interface between Technology and Life Sciences**
*Faculty:* Fiorenzo Omenetto

Structural proteins are Nature’s building blocks, conferring stiffness, structure, and function to ordinarily soft biological materials. Such proteins are polymorphic which allows controlling the end material format through their self-assembly. These biomaterials provide a unique opportunity by being simultaneously “technological” and “biological” making them ideally suited for applications at the interface between these two domains. The Silk Lab’s goal is to provide innovation for new advanced material processing and manufacturing based on sustainable carbon-neutral technologies, and imagine a new class of applications for living materials that operate seamlessly at the interface between the biological and the technological worlds.

Biomedical Engineering: *Regenerative Medicine*
*Faculty:* David Kaplan

The Kaplan Lab focuses on biopolymer engineering to understand structure-function relationships, with emphasis on studies related to self-assembly, biomaterials engineering, tissue engineering and regenerative medicine. The studies include a variety of structural proteins, including collagens, elastins, resilins and silks. The lab has pioneered the study of silk-based biomaterials in regenerative medicine, starting from fundamental studies of the biochemistry, molecular biology, and biophysical features to the impact on stem cell functions and complex tissue formation.

**Chemical Engineering: Gel Electrolytes**
*Faculty:* Matthew Panzer

Research in the Green Energy and Nanostructured Electronics Lab seeks to develop an understanding of how solution-processed materials, including nonvolatile and flexible ionic liquid-based gel electrolytes in particular, can be effectively designed and incorporated into novel electrochemical devices for the efficient storage and responsible use of electrical energy. From a chemical engineering perspective, the lab seeks to discover, better understand and improve upon a variety of next-generation technologies for energy applications. These research efforts are driven by the significant challenge facing the world today to develop cleaner, safer, and more sustainable energy solutions.
**Mechanical Engineering: Educational Robotics**  
*Faculty: Chris Rogers*

The Rogers lab works on researching how the brain learns engineering and then try to apply that learning into developing educational robot kits. The lab also works with LEGO Education to develop new ways of teaching engineering with these kits, including new sensors and actuators as well as ideas around cloud-based intelligence (IoT), cameras, and AR.

**Mechanical Engineering: Human-Robot Interaction**  
*Faculty: Matthias Scheutz*

The Tufts Human-Robot Interaction (HRILab) Laboratory performs research in artificial intelligence, robotics, and cognitive science to develop algorithms that allow robots to better interact with humans. In particular, the lab focuses on ways for robots to learn new skills and knowledge quickly from natural language instructions and to make decisions that are ethical, i.e., that conform to human norms. In addition to algorithm and software development, the lab carries out human-robot interaction studies to both evaluate algorithms but also to determine requirements.

**Psychology: Multitasking**  
*Faculty: Nathan Ward*

The Ward lab’s objective is to investigate the underlying mechanisms of cognition, with a particular interest in multitasking, and whether cognition can be altered through the use of brain stimulation and other interventions. Their overarching goal is to better characterize multitasking and to explore ways of mitigating multitasking costs using a variety of behavioral tasks and cognitive neuroscientific methods.

**Psychology: Stereotyping, Prejudice, and Discrimination**  
*Faculty: Keith Maddox*

The Maddox lab conducts social psychological experiments to explore ways to better understand elements of interracial perception and judgment. Research topics include using emotion regulation and humor to minimize interracial anxiety, exploring methods to encourage and empower efforts to confront expressions of racial bias, and exploring how within-race variation in facial characteristics can affect social judgments.

**Urban & Environmental Policy & Planning**

**Land Use Regulation: How Far Can Government Go in Regulating Private Property**  
*Faculty: Jon Witten*

The focus of this research project will be to identify legal challenges to local government regulations designed to limit the development of private property. Researchers will identify appeals brought against municipal governments for exercising their land use authority and briefly summarize the results of the litigation. While it is anticipated that municipal zoning regulations will be the primary focus of the litigation, researchers will also be free to identify other challenged regulatory mechanisms such as those intended to protect natural resources (e.g. wetland and ground water resources).

*All lists are subject to change*