2017 Tulsa Undergraduate Research Challenge
JUNIOR SCHOLARS PROGRAM

The TURC Junior Scholars Program recognizes high school juniors with outstanding potential for a career in research by providing opportunities to participate in cutting-edge research projects. The program builds upon the nationally recognized Tulsa Undergraduate Research Challenge (TURC) program and includes in-depth work with a research team, access to modern instrumentation, and potential opportunities to participate in the research dialogue through publications and presentations.

Benefits of Being a TURC Junior Scholar
TURC Junior Scholars are immersed in a research atmosphere that is usually reserved for graduate students. Each scholar works with a faculty research mentor and research team on a nationally significant research project. In addition to working closely with a faculty mentor, each Junior Scholar is paired with a TURC undergraduate mentor who has considerable experience with the project from a student’s point of view. A range of modern equipment is available to support the research – such as facilities for materials fabrication, modern chemical and biological analysis facilities, and electron microscopy resources that are among the best in the southwest. TURC Junior Scholars participate in summer research presentations and are invited to TURC lectures and functions during the academic year.

Junior Scholar Research Opportunities
Research opportunities for the summer 2017 program span a range of disciplines and involve a variety of time commitments. At this time, we anticipate providing opportunities in the following project areas:

**Evolutionary questions in biology**
Dr. Booth, Department of Biological Science
Within the Booth lab we use molecular tools to investigate a variety of questions relating to three main biological themes: 1) Invasion biology - with studies relating to metapopulation dynamics, island biogeography, and local adaptation; 2) The genomics of host-lineage formation – primarily using a comparative whole genome sequencing approach of nuclear, mitochondrial, and endosymbiont genomes; and 3) The evolution of facultative parthenogenesis in snakes – We are currently interested in the phylogenetic distribution of this trait among snake lineages, the emerging properties within and among these lineages, and the evolutionary significance in natural populations. Our research is therefore primarily motivated by broad evolutionary questions, and addressed through the generation and analysis of genetic and genomic data. Students will integrate within our research group and will have the opportunity to work on one or more projects relevant to their interests.

**Investigations in the health sciences**
Dr. Clutter, School of Nursing
A variety of health-related projects are possible. One involves work on a publication about Zika and latest current findings for the US, one on a qualitative study about the “peanut ball” that is used in labor and delivery to reduce laboring time and need for c-sections, one focuses on a retrospective...
study of centenarians and medications, and the last about a yet to be determined topic of women’s health. In each project the student will work with an upper-level undergraduate.

**Design and development of devices to aid persons with disabilities**
Dr. Henshaw, Department of Mechanical Engineering
Dr. Henshaw's TURC projects generally relate to the MADE at TU organization (Make a Difference Engineering). MADE at TU students work on a wide variety of projects aimed at improving the lives of persons with physical or developmental disabilities. TURC junior scholars will collaborate with TU students and Dr. Henshaw to design, fabricate, and test various devices for persons with disabilities.

**Development of a synthetic organic chemistry method**
Dr. Hussaini, Department of Chemistry and Biochemistry
The research focus will be the discovery of a synthetic method for the preparation of enaminones - compounds that contain a N-C=C-C=O functional group. These compounds are important intermediates in organic synthesis and have been used in the development of pharmaceuticals. We will use copper catalysts to explore the formation of enaminones. The method will provide an economical method for the preparation of enaminones. The successful completion of the project has the potential to impact the discovery of new drugs, insecticides and other chemicals.

**Experimental nanotechnology**
Dr. Iski, Department of Chemistry and Biochemistry
In the Iski group we use a Scanning Tunneling Microscope (STM) to study processes which occur at a distance of a few nanometers (10-9 m). There are two complimentary projects. The first investigates amino acid molecules on a gold surface with a particular focus on how strongly the molecules are binding to the underlying surface. The second uses electrochemistry to form a single, silver halide layer on a gold surface. This layer is unusually stable and the factors leading to its stability are of great interest. Both projects utilize the microscope and require computer optimization of the images. The projects provide an unusual blend of physics, physical chemistry, nanotechnology, and materials chemistry.

**Composite and bio-inspired materials**
Dr. Keller, Department of Mechanical Engineering
Students participating in research in Dr. Keller’s lab will work on materials science and solid mechanics projects. Ongoing research includes preparation and testing of fiber composites (carbon fiber and glass fiber), self-healing materials, self-sensing materials, nano composites, and general polymer science. There are also opportunities for pursuing computational and computer-based simulation projects on the behavior of functional and biological structures. These materials have a wide variety of potential applications and are examples of materials which will be an important component in manufacturing in the future.

**Reaction discovery and development**
Dr. Lamar, Department of Chemistry and Biochemistry
Nitrogen is a key atom found in nature, materials science, and synthetic pharmaceuticals. It is of great desire in the drug discovery community to install nitrogen functionality at late stages in the synthetic pathway to a bioactive core. In the Lamar Research Group, we aim to develop practical methods to accomplish this challenging goal by selectively inserting carbon-nitrogen bonds into relatively complex molecules. Our approach employs a mild, visible-light-promoted generation of nitrogen-centered radicals from readily available, inexpensive sources. The projects involved cover a range of disciplines and provide experience in the fields of catalysis, drug discovery, organometallic chemistry, organic synthesis, and medicinal chemistry.
Modern instrumentation for challenging chemistry
Dr. LeBlanc, Department of Chemistry and Biochemistry
Walk into any academic research lab and you will find equipment that would make MacGyver proud! This is because research is at the cutting edge of science, while instrumentation has been designed with particular applications in mind. This means that new experiments often require altering the instrument or purchasing expensive accessories that make it challenging for other researchers to replicate published studies. The LeBlanc research group is interested in using rapid prototyping technologies, such as 3D printing, to develop simple tools to make unique experiments easier and more reproducible.

Environmental factors in highway safety
Dr. Li, Department of Geosciences
The Li group studies factors which govern dust hazards that typically threaten much of the southwest. The TURC student will work in a group involved in the development of GIS skills to map hazards. Using powerful GIS tools, students will produce and polish land use, land cover, geomorphology, and dust emission hot spots maps in the states of Texas, New Mexico, and Oklahoma, where blowing dust has frequently caused highway accidents.

Applications of nanoparticles in real-world processes
Dr. Otanicar, Department of Mechanical Engineering
The Otanicar group focuses on nanoparticles for enhanced heat and mass transfer. Nanoparticles, ultra-small particles, possess many interesting properties that larger particles do not. One important area where they have impact is within the transfer of heat. Our group performs a wide range of experiments with these types of particles for trying to limit and enhance heat transfer, control the evaporation from liquids, and selectively absorb solar radiation. Students will assist in creating and running experiments in the lab related to these types of projects.

Stability of sports supplements
Dr. Purser, Department of Chemistry and Biochemistry
L-Arginine ethyl ester (LAE) is a sports supplement derived by the esterification of the amino acid, arginine. While little evidence of efficacy exits, the hypothesis is that LAE has a greater bioavailability than does the underivatized amino acid, and therefore can increase the production of nitric oxide in the blood. This research project will examine the stability of LAE under a variety of conditions of pH and temperature. It is anticipated that nuclear magnetic resonance will serve as the primary tool for this investigation.

Intelligent agents
Dr. Sen, Tandy School of Computer Science
The Intelligent Agents group theoretical underpinnings and practical applications of intelligent agent technology. We investigate theoretical issues ranging from how and when multiple agents can learn to cooperate and compete, development of norms through peer-to-peer interactions, how agents can learn to trust each other, and negotiation techniques with outcome guarantees. Practical applications that we have developed include recommending movies and shopping options, automated meeting schedulers, purchasing items from simultaneous online auctions, crowdsourced book recommendations, detecting and responding to cyberbullying. Students of varying interests and background, ranging from freshman undergraduates to experienced PhD students continue to research at the forefronts of the intelligent agents field and publish their findings at premier international venues.
Biochemistry of disease
Dr. Sheaff, Department of Chemistry and Biochemistry
Students may work on one of three projects. 1) Drug characterization: Identifying the biologic target of novel chemotherapeutic agents. 2) Cancer biology: Investigating the role of the tumor suppressor protein p27kip1. 3) Ethanol toxicity: Investigates how ethanol inhibits protein synthesis. All projects involve working with tissue culture cells and various biochemical assays to measure cell viability and activity of bio-molecules.

Responsibilities of a TURC Junior Scholar
The summer research experience is intensive and each Scholar is expected to participate five full days per week (Monday through Friday, 9:00 a.m. to 5:00 p.m.) for the duration of the program. Applicants should be aware of the requirements and time commitments when they apply.

Program Duration
The research experience may be six, eight, or ten weeks in duration, depending upon the needs of the scholar and the mentor. Generally speaking, all TURC projects will be scheduled between June 5 and July 28, 2017.

Requirements for Applicants

- Applicants must be juniors. Freshmen, sophomores, and seniors are not eligible.
- Applicants must have at least a 3.5 cumulative GPA in a rigorous high school curriculum.
- Applicants must have a composite ACT score of at least 28 or a combined score of at least 1260 on the Critical Reading and Math portions of the SAT.
- Other requirements are listed on the TURC Junior Scholars Application Form.

Program Details

- Application Procedure. TURC Junior Scholars Program Application forms are available online at http://utulsa.edu/research/turc/turc-junior-scholars-program/. Applications must be postmarked by, delivered to, or emailed to the TU Office of Admission no later than 4:00 p.m. on Monday, March 20, 2017.
- Decisions on Applications. All applications will be reviewed by a faculty selection committee, and decisions will be based on merit, taking into account all information provided by applicants.
- Cost. This is a zero-credit non-residential program; therefore, there is no tuition. Each scholar will be responsible for his or her own housing and personal expenses.

The University of Tulsa does not discriminate on the basis of personal status or group characteristics including, but not limited to individuals on the basis of race, color, religion, national or ethnic origin, age, gender, disability, veteran status, sexual orientation, gender identity or expression, genetic information, ancestry, or marital status. Questions regarding this policy may be addressed to the Office of Human Resources, 918-631-2616. For accommodation of disabilities, contact TU’s 504 Coordinator, Dr. Tawny Rigby, 918-631-2315. To ensure availability of an interpreter, five to seven days notice is needed; 48 hours is recommended for all other accommodations.