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 2018 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:

Environmental factors in highway safety
Dr. Junran 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.

Robotics laboratory
Dr. J.C. Diaz, Tandy School of Computer Science. The work in robotics incorporates several areas of engineering and computing. It potentially involves design, building prototypes, manufacturing, electronics and programming. There are several projects that are being investigated in the Robotics Lab to which a TURC Junior Scholar could contribute. A potential Junior Scholar should have some basic knowledge of programming.

Applications of nanoparticles in real-world processes
Dr. Todd Ocanicar, Mechanical Engineering. Desalination and Solar Energy: Access to freshwater is a growing problem as populations expand, and in many parts of the world the only option is to take salty water and desalinate it for human use. Unfortunately, desalination is extremely energy intense. Ongoing research in our lab focuses on developing novel desalination techniques that can use solar
energy. Projects range from experimental testing to fabrication of new membranes to computational work often crossing many disciplines such as chemistry, engineering, and physics.

**Evolutionary questions in biology**
Dr. Warren Booth, Molecular Ecology. Mitochondria play a fundamental role in cellular respiration and are essential for the existence of animal life. They are inherited uniparentally, with maternal transmission. This transmission of a single mitochondrial lineage is termed homoplasmy and is the classical model of mitochondrial inheritance. However, with advances in DNA sequencing it has been shown that individuals may possess multiple, distinct lineages of mitochondria, termed heteroplasmy, and this may be an integral part of the biology of many species. Medically, it has been linked to severe genetic conditions in humans. Whereas, evolutionarily, it may provide the genetic variation upon which selection may act. Furthermore, heteroplasmy may present opportunities for mitochondria to exchange genes, termed recombination, promoting mitochondrial evolution. Despite growing recognition of the potential significance of heteroplasmy, this fundamental aspect of mitochondrial evolution remains poorly understood. As part of a National Science Foundation funded research project, we aim to address key questions relating to how heteroplasmy is generated, how long it can be maintained, and if recombination occurs. The researchers will use the bed bug as a model species as it exhibits unusually high levels of heteroplasmy. Resolution of these questions may fundamentally change how we look at inheritance and recombination of mitochondrial DNA in animals. This project will include DNA extraction, mitochondrial gene amplification through PCR, and whole mitogenome sequencing using next-generation methods.

**Reaction discovery and development**
Dr. Angus Lamar, Organic Chemistry. 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.

**Biofuels**
Dr. Hema Ramsurn, Russell School of Chemical Engineering. Renewable or Non-renewable: Which shall it be? The Ramsurn lab works in two distinct energy-related areas: biofuels/biobased products and gas (methane)-to-liquid conversions. Some of the ongoing projects that students can work on include: (1) biofuel production in supercritical (high temperature and pressure) water as a green solvent, (2) synthesis of biomass-derived carbon supports that can be used as catalysts and for water filtration, (3) co-liquefying biomass and coal to produce fuels and chemicals, and (4) gas-to-liquid conversions like methane to benzene (fuel) using catalysts prepared in-house. The proposed projects provide the students with an opportunity to work in a number of engineering areas including catalysis and reaction kinetics.

**3-D printing**
Dr. Gabriel LeBlanc, Department of Chemistry and Biochemistry. Chemical Compatibility of 3D Printed Parts. 3D printing is poised to change the way we think about…everything. This includes the way we perform chemical reaction and analysis. While the excitement about 3D printing is sky-high, there is surprising little information out there about the interactions between the materials we 3D print with and the chemicals we (as chemists) are interested in using with them. In this project, we
Design and development of devices to aid persons with disabilities
Dr. John Henshaw, Department of Mechanical Engineering. Design and development of devices to aid persons with disabilities. 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.

Neanderthal extinction
Dr. Miriam Belmaker, Department of Anthropology. A “who-done-it” mystery – Did climate kill the Neanderthals? Neanderthals roamed the earth from 500,000 – 35,000 years ago. Why they became extinct is still a mystery. Did they succumb to the cold climate of the ice age? Did they lose the battle to modern humans coming from Africa? To test if climate was really cold during a time period of Neanderthal extinction, we can study rodent, shrew and bat species found in caves across Israel and inhabited by Neanderthals. Small mammals are great indicators of climate and environmental change. If we find “cold loving” species in the period of Neanderthal extinction, we can infer that climate may have been a factor in this extinction event. If we don’t… well, then we need to look for other reasons (modern humans maybe?). Over a period of four to six weeks you will learn how an anthropologist works. You will learn to identify the different species of rodents, shrew and bats through the shape of their teeth using a stereomicroscope, an environmental scanning microscope and a white light confocal microscope. In addition, we need to look at other factors that may affect the number and type of small mammal species found in the cave. For example, an owl, raptor or carnivore which eats the small mammals, deposits prey bones in the form of pellets or scats. What most people don’t realize that each type of predator leaves unique tell-tale markings on the teeth and bones. You will learn how to identify these and figure out which predator was responsible for the accumulation of all the bones! Knowing which predator “done it” can help us understand climate and climate change.

Biochemistry of disease
Dr. Robert 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.

Experimental nanotechnology
Dr. Erin 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 complementary 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. Michael 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.

**Stability of sports supplements**

Dr. Gordon Purser, Department of Chemistry and Biochemistry. l-Arginine ethyl ester (LAEE) is a nutritional supplement available as a substitute to l-arginine for athletes looking to improve endurance or performance. It is hypothesized that there is a higher efficacy associated with LAEE due to an assumed higher bioavailability and stability in physiological environments, though this is not confirmed in the scientific literature. The hydrolysis of LAEE into l-arginine and ethanol is a pH dependent reaction that occurs readily at physiological pH values. However, the mechanism is not well understood. This project explores the kinetics and mechanism of that hydrolysis.

**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 is eight weeks in duration. All TURC Junior Scholar Program projects will be scheduled between June 4 and July 27, 2018.

**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/](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 Tuesday, March 27, 2018.**

- **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.