

## **RUI Impact Statement**

Texas A&M University-Commerce (TAMUC) is the largest university east of Dallas, Texas. As a result, we have a unique opportunity to make a significant impact on the education of students in the region and beyond so that they are exceptionally prepared to become the next generation of scientists and leaders. The primary service area of the university is extremely diverse with 13 rural counties to the east of the sprawling urban and suburban Dallas-Fort Worth Metroplex. This region is made up of a large percentage of economically disadvantaged communities and diverse demographics.

**1. Texas A&M University-Commerce.** The ongoing mission of TAMUC since 1889 has been to nurture and educate our students for success and provide academic, research, and service programs of the highest quality. Recently, the Chronicle of Higher Education ranked TAMUC as the 17<sup>th</sup> fastest growing college. The present enrollment is in excess of 12,000 students, which is the highest in the university's history. TAMUC has a 125-year legacy of serving the students of northeast Texas, the state of Texas, the nation and the world. The university is engaged in a multi-year effort to strengthen the quality of research and teaching. A new 110,000 square foot \$28 million science building was constructed recently; this building houses the Chemistry, Biological & Environmental Sciences, and Physics departments, as well as a planetarium. To better serve the science, technology engineering and mathematics (STEM) disciplines, the College of Science, Engineering & Agriculture recently divided into the College of Science & Engineering, and a separate School of Agricultural Sciences. This new structure allows our college to better concentrate on STEM disciplines and to provide additional and needed support for undergraduate research within each of the STEM departments, including Chemistry.

At TAMUC, greater than a third of our undergraduate students are classified as low-income and first-generation and the minority enrollment is 36%, with a Hispanic enrollment of 13%. With a rapidly growing Hispanic population in the region and the State, increasing the Hispanic enrollment at the university is a top priority, and one of the goals of the university is to become a Hispanic Serving Institution (HSI) within the next few years. This is an ambitious goal, but one that the university is committed to achieving owing to the importance of recruiting and graduating a broader cross-section of students that reflects the population that we serve. Owing to the large number of community colleges that we serve, approximately 75% of students at A&M-Commerce are transfer students from regional community colleges. As a result, we have an excellent opportunity to make a significant impact on these students. With the rapid increase in our enrollment, especially minority students, we are poised to educate a large number of diverse students in STEM disciplines, especially chemistry.

**2. Record of commitment to educating undergraduates.** Within the past few years, our university has aggressively sought and received funding for several research programs to involve undergraduates in research and help them persist in the educational pipeline to graduation. For several years, TAMUC has implemented a successful *Research Experiences for Undergraduates* (REU) program in the chemistry department, which continues to receive funding from NSF. Our REU program capitalizes on the well-established partnerships with approximately 18 community colleges that are in close proximity to the university. The Physics department also has a very successful REU program, funded from the NSF, and attracts students from across the nation. Another of our very successful programs is the Ronald E. McNair program, which provides an avenue for economically disadvantaged students to become involved in research as they pursue

advanced degrees. Through our various mentoring programs, our undergraduates are better prepared to pursue and be successful at doctoral programs.

**3. Undergraduate Research in the Department of Chemistry.** The Chemistry Department has provided leadership in getting grants for the various undergraduate research activities mentioned in the previous section, as well as provided leadership in the overall university planning and administration of other undergraduate research initiatives. The Department of Chemistry has six faculty members conducting research in the fields of catalysis, ionic liquids, sensors, proteomics, metal peptide complexes and chemistry education. Our undergraduate enrollment has been increasing over the past few years and we presently have an enrollment of 54 majors, this represents an increase of approximately 40% over the past two years. Over the past three years, the department has graduated 16 chemistry majors. Of these, three students are presently pursuing PhD degrees in chemistry, one is in medical school; four are in various allied professional careers, four are working in industry, one is a high school teacher, and three have chosen other professions. For the previous three-year period, 17 students graduated in chemistry and of these, nine pursued advanced graduate programs; five are working in industry; and three pursued other professions. Our undergraduate research programs are geared towards the effective training of our students, not only in conducting and communicating meaningful research, but also in learning research ethics, acquiring the vital skills of working effectively in a research team, and specifically to become scientists for a diverse workforce.

As part of our six-year program review, student data are routinely and constantly collected and used to improve our program. The review process includes getting input from external reviewers about the improvement of our program. In addition, qualitative surveys are designed and administered to collect information on student perceptions after being engaged in meaningful research activities in the department.

**4. Recruitment plan and student selection criteria.** The involvement of a greater number of students in meaningful research is a high priority of TAMUC, the chemistry department and of the PIs. The PIs are constantly and aggressively recruiting students, especially under-represented students, to become involved in our research. Our recruitment efforts have always been and will continue to focus on visiting the neighboring community colleges to talk with the students of the various science classes about the research opportunities at the university and also in our research groups. We will also continue to visit various classes on campus to talk to students about this exciting research; and to work closely with the McNair program on campus and our REU program to offer research opportunities to these excellent students. Another aspect of getting more students, especially at an early stage, exposed to research at the university and the type research carried out in our labs, is to visit neighboring K-12 schools when invited to give chemistry demonstrations and talk to the students about the excitement of science and the benefits of becoming scientists. We strongly believe that the benefits and importance of being involved in research must be communicated early to students so that they can start thinking of careers in the STEM disciplines. Students who have expressed an interest in working in our research groups are given a full description of the research project and a tour of the research lab and the various instrumentations. We accept students with appropriate chemistry background to work in our research groups and they are given projects based on their chemistry background and their professional interest. This proposal will provide an additional opportunity for more students to become involved in research.

**5. A track record of undergraduate mentorship.** The PIs have been successful in mentoring both undergraduate and graduate students, this is especially true of the PI, who has mentored a number of undergraduate and graduate students over the years, as shown in his CV. A large percentage of our students over the years have remained at the university to complete their undergraduate and master's degrees before pursuing their doctoral degree at another university. Some of our undergraduate students upon graduation become science teachers and others pursue careers in health-related fields, but the majority of our graduates continue at graduate programs across the state and nation. We have trained a diverse student population, for example, three of our female students are now in the doctoral program at Baylor University, University of Missouri and Southern Methodist University. There are two female Ronald E. McNair Post Baccalaureate Achievement Scholars presently working in the Co-PI's research group and one minority male McNair student working in the PI's lab.

Based on the training and research accomplishments that our students receive, they are highly sought after to join prestigious research group across the state and nation. Within the past few years, our students have been recruited to pursue PhD degrees in chemistry at the University of Texas, Austin; Texas A&M University, College Station; Texas Tech University; Baylor University; Southern Methodist University; the University of Missouri; and the University of Illinois, Chicago. Funding of this proposed research will have a tremendous impact on the number of students who are attracted to our research groups and eventually gain advanced degrees in chemistry.

**6. Measuring student outcomes.** For the research groups of the PIs, projects are geared towards effective training of undergraduate students, not only in conducting and communicating research, but research ethics and acquiring teamwork approach to research. It is the goal of the PIs that all students who participate in our research groups will be positively impacted by their involvement. Measures of success for students working in our groups include persistence to graduation, participation of women and groups underrepresented in the sciences, we work closely with the undergraduate advisor to monitor their GPAs and encourage each student to succeed in the courses that they are taking. Students with sufficient research results will be co-authors and be involved in the publication of peer-reviewed manuscripts. This opportunity serves to teach the students the process of publishing their research results in peer-reviewed journals and this mode of communication. At our joint weekly research group meetings, students get feedback from their peers and PIs on their results and challenges they encountered over the past week; they also get input on the presentation of their research results, especially as they prepare to attend and make presentations at scientific meetings. We strongly believe that when students are involved in research from not only the perspective of carrying out the actual experiments, but from all aspects of research, they are more inclined to pursue and achieve degrees in STEM disciplines. Students from our research groups are highly encouraged to present their research results at American Chemical Society regional and national meetings, ACS meeting-in-miniature conferences, the Texas A&M University System annual *Pathway to the Doctorate* Research Symposium, Annual research symposia, which are held at TAMUC campus. At these scientific meetings, our students get the opportunity to also network with students of similar interest from across the state and nation. Recently, one of our undergraduate students established a Facebook page for the research group so that past students can remain connected with our research.

**8. Contribution of New Research.** The proposed research will: (a) provide new categories of recyclable organocatalysts for a wide variety of asymmetric reactions; (b) determine an effective process to extract and recycle these organocatalysts; (c) elucidate possible paths for the modes of action by which these and similar organocatalysts influence the yields, rate, and selectivity of asymmetric reactions; (d) provide methodologies for the synthesis of enantiomerically pure compounds that are of importance to industry, especially the pharmaceutical industry; (e) provide an eco-friendly methodology for key steps in the total synthesis of natural product and biologically active compounds; (f) provide excellent research opportunities for undergraduate students, and (g) provide an excellent platform for training and developing young scientists to pursue professions in STEM disciplines. The students engaged in this research project will be well equipped to pursue and complete undergraduate and graduate degrees based on the research experience gained.

As emphasized throughout this statement, the proposed research initiative has the potential to have a tremendous impact of a large cross-section of students, including a large number of under-represented minorities and economically disadvantaged students to be influenced to pursue advanced studies in STEM disciplines by participating as a member of our research groups. Owing to the fast-growing population of our university and the rapid changing demographics of our region, we have a unique opportunity to influence a large population of students to become scientists through research. Funding for this project will place our research groups in a much better position to attract, retain and graduate a larger number of students, who will be much better prepared to pursue advanced graduate degrees and compete for quality jobs as scientists. The Department of Chemistry stands to benefit from the funding of this proposal due to the expansion of research productivity of the department and as a result provide more students the opportunity to be involved in research. A&M-Commerce stands to benefit because based on the increased research productivity of the university, more students will be attracted to pursue degrees in STEM disciplines at the university. As a result, the university will be even more equipped to continue recruiting and preparing top-quality academicians, industrial and government scientists, and the next generation of leaders.