the TEST TUBE

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A BIG YEAR FOR MINNIE S. PIPER PROFESSOR DOMINIC CASADONTE RECEIVING THE PRESIDENTIAL AWARD FOR EXCELLENCE IN STEM MENTORING AND ACS FELLOW AWARD

Professor Dominick Casadonte, Minnie S. Piper Professor was awarded the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring on Oct. 15, 2019 for his mentoring efforts in the science, technology, engineering and mathematics (STEM) field. He was recognized by the U. S. President Donald Trump.

"The Department of Chemistry and Biochemistry as a whole was excited to hear the announcement from the White House! Prof. Dominick Casadonte is a true academic who is devoting his life to educating and mentoring young minds (undergraduate and graduate students, postdoctoral fellows and young faculty). His ability to communicate with students is exceptional. He has impacted the lives of many students who are currently pursuing successful careers in science. He is, and his contributions are invaluable to the missions of the Department of Chemistry and Biochemistry, the College of Arts and Sciences, and Texas Tech University. It is a great honor to have such a colleague." said the Chairperson Prof. Yehia Mechref.

Prof. Casadonte has been a member of the Department of Chemistry and Biochemistry since 1989. His research in chemical education includes work in service learning, chemical safety, course flipping, and work force development, especially among underrepresented groups in STEM. "I have been a leader in the areas of service learning, intergenerational STEM education (as an NSF Discovery Corps Fellow), and course flipping. I was one of the first, if not the first, university chemistry faculty member in the country (independent and unaware of the term coined by Bergman and Sams in the summer of 2007) to flip my classes, a procedure which is now relatively common in the K-16 environment. I have organized a variety of symposia at various ACS and chemical education

Dr. Karen Marrongelle, Head of the Directorate for Education and Human Resources (EHR) for the National Science Foundation, Prof. Dominick Casadonte, Dr. Kelvin K. Droegemeier, Director of The White House Office of Science and Technology Policy (OSTP), Dr. F. Fleming Crim, COO of NSF, second in command of the agency.

meetings around this theme, and have been an active researcher in the area" said Professor Casadonte.

Prof. Casadonte also received the "American Chemical Society (ACS) Fellow Award" in 2019 in recognition of his outstanding achievements, contributions to science and the profession, and equally exemplary service to the society. Prof. Casadonte says, "I have a joy for chemistry and research, especially in promoting an interest in the chemical sciences. I am humbled by the honors and recognitions I've received this year and I will continue to strive."

Prof. Casadonte has spent a good amount of time over the past 30 years in student mentoring, chemical demonstrations and outreach, and National Chemistry Week Coordination. He has been National Chemistry Week (NCW) coordinator for the South Plains region since 1995. His work with the ACS student affiliate and NCW has been recognized by the ACS on several occasions, including, in 1998, an American Chemical Society Phoenix ...*CONTINUED INSIDE*

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INSIDE THIS ISSUE

CHEMISTRY FACULTY MEMBER STUDYING MOLECULES THAT BUILD THEMSELVES

Story by Glenys Young
Office of Communications & Marketing

Imagine picking up a box of LEGOs, shaking it and watching as the bricks assemble themselves, creating the object they are supposed to comprise.

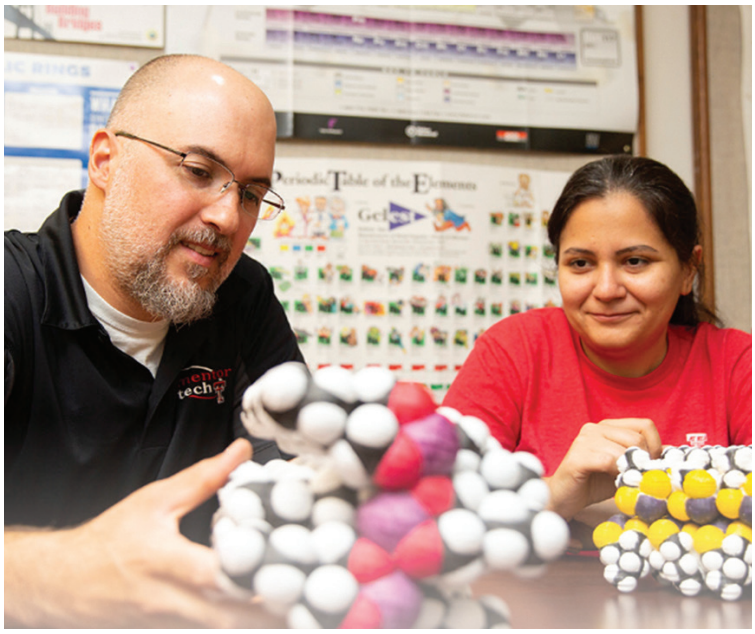
That's what Texas Tech University's Anthony Cozzolino is doing – but with molecules. He's being recognized for it with one of the National Science Foundation's (NSF) most prestigious awards.

The Faculty Early Career Development (CAREER) Program is a foundation-wide activity that offers the NSF's most prestigious awards in support of the early career-development activities of teacher-scholars who effectively integrate research and education within the mission of their organization and build a firm foundation for a lifetime of scholarly contributions. Cozzolino, an assistant professor in the Department of Chemistry & Biochemistry, recently received a five-year, $655,710 CAREER Award to further his research into the design and synthesis of molecules containing the elements antimony and bismuth.

"We design these for molecular recognition, the ability of these molecules to specifically recognize other molecules in solution and self-assemble into more complex structures," he said. "We design different pieces so they will fit together in a specific way to make something more complex, but they do it on their own."

Nature does this all the time using hydrogen bonds, Cozzolino said, but he's exploring a new type of interaction, called a pnictogen bond, using the heavy p-block elements antimony and bismuth instead of hydrogen. This allows them to target unique properties.

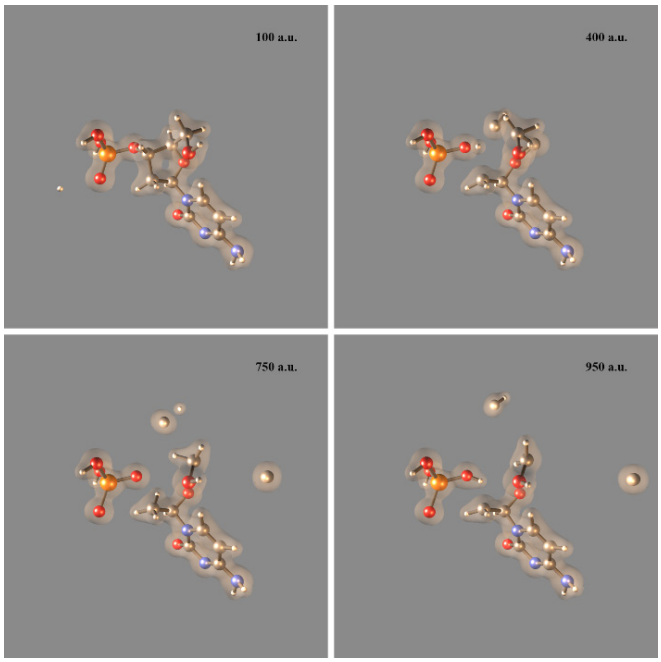
"There are lots of exciting directions this research may take, but we are at the initial exploration and discovery stage. We are probing the utility and limitations of this new class of supramolecular interactions." ■



Dr. Cozzolino (L) with graduate student Shiva Moaven discussing structural connectivity using 3D printed models

THE FIGHT AGAINST CANCER GOES VIRTUAL

Proton cancer therapy (PCT) uses high-energy proton projectiles to kill cancerous tumors with minimum damage on healthy tissues and without the side effects of X-ray therapy. PCT is effective on non-spread cancers in the eyes, head, neck, lungs, prostate, and breast. The healing action of the protons results from their damage on cellular DNA. Because of their high rate of division and reduced ability to repair damaged DNA, cancerous cells are much more vulnerable to DNA attacks than normal cells and are killed at a higher rate. Despite established clinical use, PCT mechanisms remain elusive. That has prevented a rational design of PCT that can maximize its therapeutic power and minimize side effects. The poor characterization of PCT processes is due to the fact that even the most advanced experimental/clinical techniques cannot completely reveal the microscopic details of PCT, especially without putting human subjects at risk. Inspired by the research of the 2013 Chemistry Nobel Laureates for computational biology research, the Morales group will conduct computer simulation of PCT chemical reactions by using novel quantum-dynamics models. Thus, dangerous PCT reactions that cannot be tested in the human body will be innocuously run on computers. The proposed quantum-dynamics models were created by the Morales group following the electron nuclear dynamics theory and are implemented in the powerful computer code PACE. The Morales group will elucidate three essential types of PCT reactions: (1) fragmentations of cell water by colliding protons into electrons, radicals, and ions; (2) DNA damage in cancerous cells by colliding protons; and (3) DNA damage in cancerous cells by the electrons formed in (1). These simulations will provide the much needed data to improve existing codes for critical PCT procedures such as radiation dosimetry, radiotherapy sessions, radioprotection protocols and medical imaging. In this way, computer simulations by the Morales group will help to effectively improve PCT treatments. ■



Computer Simulation of a proton inflicting a DNA single-strand break on a cytosine nucleotide.

STUDENT **HIGHLIGHTS**

TTU iGEM TEAM COMPETES IN BOSTON

The undergraduate student organization iGEM Raiders recently represented TTU at an international synthetic biology research competition known as iGEM (International Genetically Engineered Machine) in Boston, MA. The original iGEM competition started in 2004 at MIT with 5 teams, but now has grown to host over 300 teams from more than 40 countries. The competition cycle spans the spring, summer, and fall semesters, culminating with the Giant Jamboree research conference held in Boston at the end of October. During the competition, teams work on designing, building, and testing genetic circuits to solve various challenges. Along with research, the competition also includes fundraising, community outreach, ethics, and safety.

For this year's iGEM competition, the TTU iGEM team focused on the metabolic engineering of biosynthetic pathways using synthetic biology principles in E. coli to produce the intermediate metabolites necessary for tropane alkaloid production. Tropane alkaloids are specialized metabolites produced in plants with a wide diversity of pharmacological and medicinal properties. Their work this year resulted in the team receiving 1 of the 5 possible 2019 GenScript Proposal Competition grants.

The iGEM competition provides students the opportunity to experience independent graduate-level research in an environment that heavily relies on teamwork. Along with gaining research experience, iGEM members also gain skills in teamwork, project planning, management, entrepreneurship, international networking, public speaking, scientific writing, and teaching. These vital skills when applying for graduate schools, professional schools, and industrial opportunities. ■

***From Left to Right: Brandon Palomo** (graduate student)**: Physics, Sebastian Valbuena:** Mechanical Engineering, **Jordan Chasteen:** Biochemistry, **Paula Garavito:** Biochemistry, **Bliss Bizzell:** Biochemistry, **Brittney Barrios:** Biochemistry, **Coltyn Wagnon:** Biochemistry, **Pranathi Bingi:** Microbiology*

THE INSPIRATION OF UNDERGRADUATE RESEARCH

It was during her first year of college, that Kaylen Meers says she was "blessed" to find herself in Dr. Hutchins lab studying the co-crystallization of acetazolamide. Now in her junior year as a Clinical Laboratory Sciences major, Kaylen believes that her past three years conducting undergraduate research in the Chemistry and Biochemistry department gave her the confidence to seek out new educational opportunities.

This past spring, Kaylen applied for and received a fellowship from the Atlantis program to shadow doctors in Genoa, Italy. The program offers American pre-med students an opportunity to study medical care in other countries. For three weeks, Kaylen worked alongside doctors in three different specialties: Cardiothoracic surgery, General surgery, and Urology. During their time in Italy, students experienced a variety of surgical techniques and instrumentation used in medicine and explored how various modifications were positively effecting the overall wellbeing of the patients.

It has been through these various transformative experiences, both in the research lab and abroad, that led Kaylen to her educational journey. It is her hope to join a graduate program with a combined PhD/MD, focused on improving medical care. ■

Kaylen Meers (L) with other students from the Atlantis program

YANGXUE LIU RECEIVES THE JAMES D. AND MARY HAZLEWOOD MEMORIAL GRADUATE FELLOWSHIP FOR 2019-2020

Yangxue Liu is currently a Ph.D. student under the direction of Paul Whitfield Horn Professor Guigen Li in organic chemistry. She obtained her B.S. degree at Tianjin University, one of top universities in China, prior to joining Texas Tech University in 2016. Her research has focused on Group-Assisted Purification (GAP) chemistry and multi-layer 3D chirality (organic sandwich chirality). GAP chemistry involves introducing special auxiliaries onto starting materials during organic and medicinal reactions. This process results in creating target molecules that are purified by simply washing with common solvents, avoiding costly purification steps. The latter of Liu's two focuses, multi-layer 3D chirality, is an architecture chirality that makes DNA/RNA mimic possible and shows enormous potentials in chemistry, medicine and material sciences. To date, Yangxue Liu has co-authored six manuscripts with Dr. Li, with future submissions in the works. The Hazlewood Memorial Graduate Fellowship also consists of a $3,000 stipend for the student. ■

THE COINAGE METALS **DONATION PAGE**

As with any remodeling project, funds are a necessary part of the equation and it is not always possible to do everything at once. While we have been extremely appreciative of previously received monies for small projects from the University, we are looking towards the future and what would be possible with more of our proposed projects finished and being fully utilized by our undergraduates, graduate, faculty, and staff. As we continue to strive for student excellence and research recognition, your support is always appreciated and will be used to the fullest.

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DEPARTMENT **GRANT AWARDS**

Professor Jorge Morales received an award from the National Institute of Health (NIH) for his grant application entitled **Computational Studies of Ion-Induced Water Radiolysis and DNA Damage.** The award is funded at $440,768 for three years and will focus on quantum dynamics simulations of fundamental reactions in proton cancer therapy (PCT), such as water radiolysis, proton-induced DNA damage, and electron-induced DNA damage. Results of this research will elucidate various microscopic details of PCT without putting human subjects at risk and will help to improve patients' treatments.

Professor Carol Korzeniewski (Principal Investigator) along with Prof. Shelley Minteer from University of Utah, as co-PI, have received a grant award from the National Science Foundation (NSF) for the project titled **Advancing Strategies for In-Situ Determination and Spatial Mapping of Components within Membrane Systems for Energy Conversion**. This award is funded at $558,362 with $302,300 to Texas Tech. This three-year project supports the construction a confocal Raman microscope with oil-immersion optics to enable high spatial resolution imaging and measurements on single, micron-scale particles in the Korzeniewski lab.

Professor Bill Poirier has had his Welch grant renewed for another cycle, $195,000. Grant entitled **New Methodologies for Accurate Quantum Calculations of the Dynamics of Atomic Nuclei.** This is his seventh Welch cycle, which will mean 21 years of continuous funding to support his research into methods that defeat the traditional exponential scaling of computational effort with system size. The new methods developed as part of this grant thus encompass: (a) *large* molecules; (b) *many* quantum states; (c) *high* accuracy.

Professor Anthony Cozzolino has been awarded the National Science Foundation (NSF) CAREER grant titled **Pnictogen Bonding in Solution: Developing Tools for the Self-assembly of Inverted Bilayer Membranes, Heteromolecular Dyads and Supramolecular Catalysts**. This award will be funded by the Macromolecular, Supramolecular and Nanochemistry (MSN) Program in the Division of Chemistry. The award is funded at $655,710 for 5 years and will support his research into the design and synthesis of molecules containing the elements antimony and bismuth.

Professor Michael Findlater and Professor Kristin Hutchins, along with Professor Weile Yan from University of Massachusetts - Lowell, have received a grant award entitled **Chemically Enhanced Electrodialysis (CEED) for Recovery of Rare Earth Elements** from the Department of Energy (DOE). The total funding of the award is $402,733 for two years. This grant will support the development of a class of electro dialysis membranes functionalized with macromolecular ion sequestrants that will be used to selectively extract valuable lanthanides via molecular recognition in tandem with a conventional electro dialysis strategy.

Professor Dimitri Pappas has received an award from the National Science Foundation (NSF) for his grant application titled **Nanoparticle Probes for Super-Resolution Imaging of Transferrin Receptors**. The award is funded at $389,963 for three years. This grant will allow his group to develop novel nanoscale reporters for imaging cell surface proteins with super-resolution.

In Memoriam

Dr. Richard E. Wilde
Emeritus Professor

The Department of Chemistry and Biochemistry expressed deepest sadness and loss as Dr. Richard E. Wilde, Emeritus Professor, passed away on November 1, 2019. Prof. Wilde started his career as a physical chemist at TTU in 1963 and retired in 1995. He served as associate chair and spearheaded the renovation of the north wing. He encouraged the department to begin cumulative exams and he was involved with instituting a program in chemical physics that helped to recruit Wilse Robinson and Richard Redington to the department. Professor Wilde's research interests included Statistical Mechanics, Applications of Memory Function Analysis, Raman and NRM Spectra, Heterogeneous Photocatalysis, and the Origin of Life. After retirement, he wrote four books: Statistical Mechanics – "Fundamentals and Modern Applications", "The Immortal Self", "The Many Faces of Jesus", and recently published "A New View of the Universe". To view Professor Wilde's obituary online visit https://www.legacy.com/obituaries/lubbockonline/obituary.aspx?n=richard-edward-wilde&pid=194404684

CONTINUED FROM COVER...

Award Honorable Mention for "Best Activity with Underrepresented Minority Students and/or Organization", and CHEMLUMINARY awards in 1999 ("Best Activity With A Student Affiliate Group"), 2001 ("Best National Chemistry Week Contest"), and 2002 ("Outstanding Event for a Specific Audience ").

In the area of outreach, he has performed over 400 chemical demonstration shows to more than 35,000 people, ranging in age from 3 (pre-school) to 92 (senior citizen's center) in Texas, New Mexico, and Oklahoma. He has been featured by the local NBC affiliate as part of a National Chemistry Week activity. Prof. Casadonte has traveled throughout the state of Texas for presentations in K-12 schools, ranging from simple chemical demonstration shows to discussions about careers in the chemical sciences and why one should consider becoming a chemist.

Prof. Casadonte has mentored more than 75 students in undergraduate research and 14 high school students in summer research programs. He also mentored 6 Goldwater Scholars (the top 200 undergraduate research students in any given year). He has been a mentor or advisor to the ACS Student Affiliate group (ACS-SA) since 1995, and has been primary advisor since 2008. In 2005, he began the Chemistry Graduate Student Organization (CGSO) at Texas Tech, a group that helps to fund travel to national and international conferences for the chemistry and biochemistry graduate students at TTU. Prof. Casadonte's advice to students is "Value and develop the ability to explain things to a variety of people of varying backgrounds, and always be a learner and a teacher." ■

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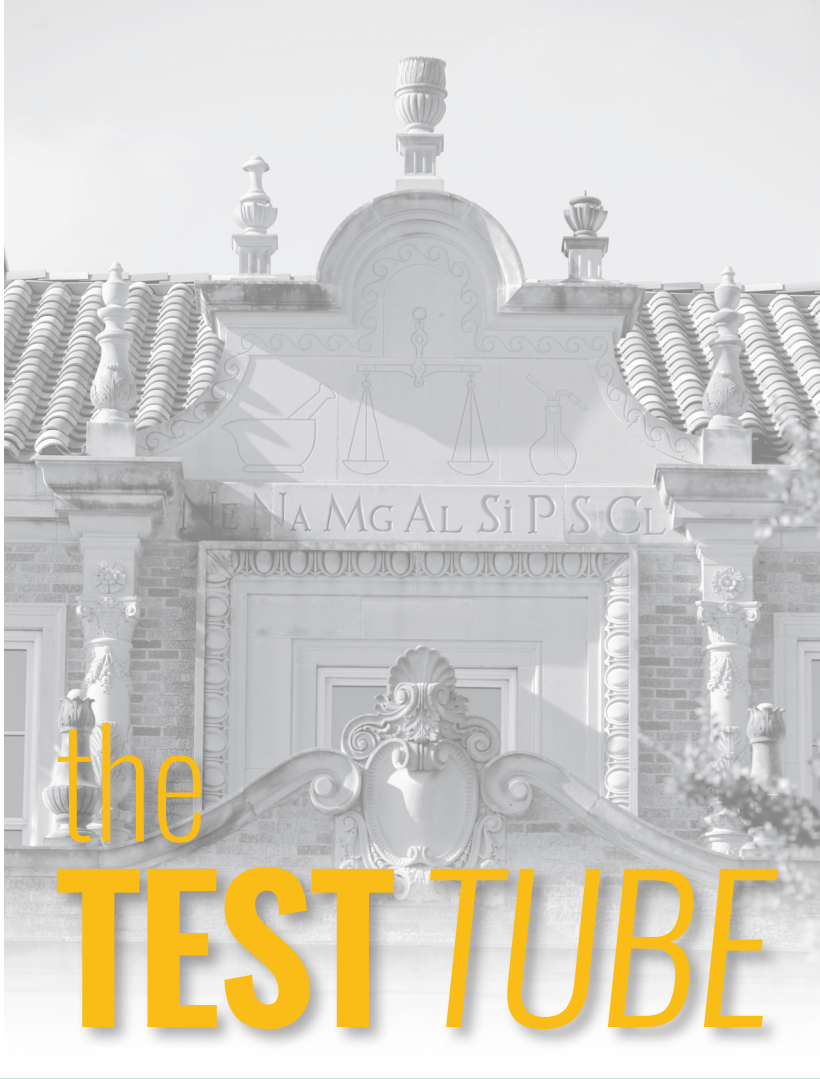

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The Department of Chemistry and Biochemistry will strive to be recognized locally, nationally, and internationally for the quality of the education of the undergraduate and graduate students; vibrant, synergistic, and inventive interdisciplinary and multidisciplinary research programs; and impactful community engagements.

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