Tennessee TECH

Fall 2016

Department of Chemical Engineering

The Start of Something New

When Ms. Becky first mentioned the idea of a newsletter for alumni, I thought it sounded like a great idea. At the time I was ending my freshman year, and graduation seemed so far away. Now, as I begin to finish my junior year, I'm realizing just how close it is. I'm sure I will want to see how all of my college friends are doing and where everyone ended up!

We hope to accomplish several things with these newsletters.

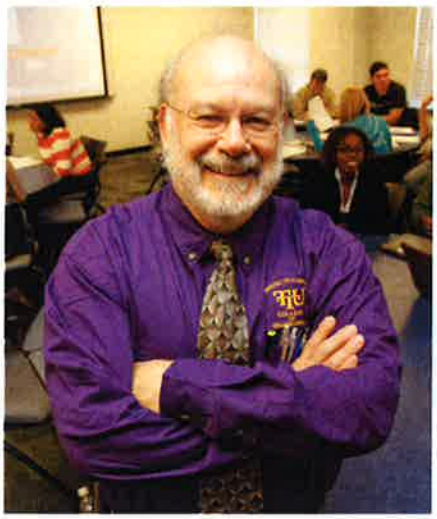
First, we hope to reconnect alumni by allowing them to see each other's accomplishments. We would like you to send your information by email to Mrs. Becky, rasher@tntech.edu. We don't need a biography, just some facts about your life since you've left Tennessee Tech University. For example, who you married, where you work, live, or a major project you have been working on to share with alumni and current students to show the successes of TTU's chemical engineering graduates. A picture you think sums up what you've said would be nice as well.

Second, we want to let you see what is happening in the department at Tennessee Tech right now. A lot has changed since you've graduated and we want to tell you about it! For example, the department is increasing and expanding. Just in my short three years here, our department has added two new faculty members.

Finally, we want to connect alumni with current students. You've been in our shoes and now you are in the job field. Maybe you can shed some light on what is important and what we shouldn't worry about. You are a vessel full of helpful information you can share with the next group of ChemEs who are working their way to that title.

Caplenor Awarded to Pedro E. Arce

This year Dr. Pedro Arce, Department of Chemical Engineering chair and professor, received Tennessee Tech University's Caplenor Faculty Research award. This honor is awarded based on general success in, according to a TTU news release, "scholastic impact, mentoring and publications and letters of recommendation." Arce joined Tennessee Tech's family in 2003, and since the department has seen great improvements. It has seen an increase in enrollment (especially female enrollment), retention, and both undergraduate and graduate research. The department currently holds the university's highest ration of doctoral graduates to faculty members. In addition to the many research projects Arce has mentored, his own research group has



Pedro E. Arce, 2016 Caplenor Award recipient

high electrical fields for water and soil purification. Overall, Dr. Arce has worked hard to help future chemical engineers leave Tennessee Tech very well prepared for wherever their degree may take them.

Keep up with Tennessee Tech AICHE!

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TECH'S AICHE CHAPTER

Tennessee Tech University's American Institute of Chemical Engineers chapter is excited about their new endeavors. As an organization, AIChE is dedicated to the advancement of chemical engineering on campuses and the guidance and professional development of chemical engineering students. Tennessee Tech's AIChE chapter sponsors various events throughout the year including seminars, plant tours, volunteering projects, social events, and tutoring sessions. Looking forward, TTU's chapter president, Elizabeth Bickel, hopes to promote the professional growth of the chapter by hosting career building events and encouraging chapter participation in AIChE conferences such as the regional car team competition.

Your Gifts in Action

Your gifts assisted Robyn Varner '17 when she most needed help.

A few months ago, I was able to personally experience the benefits of your generosity. My computer stopped working and it could not have happened at a more difficult time: right before exams. In order to obtain the warranty to cover repairs, I had to trek a three-hour round trip home twice in two months and ship my computer once. I also ended up having to leave it at the store while heading home over fall break. They would call, and say it was fixed, I went and picked it up and sure enough, as soon as I returned to campus it did not work. As you can imagine, this was very frustrating for me and it didn't take long, less than a day, for me to realize how dependent I am of my computer.

Since several of my classes use online homework programs and other online software, borrowing computers from the library was extremely inconvenient. Students are only allowed to check-out laptops for a few hours and they are due back before the library closes, which is very early on the weekends.

On the second day of having no computer, I dropped by the ChemE office to explain to Ms. Becky that I may have lost all of the old Department of Chemical Engineering newsletter files. When I explained the situation to her she suggested I check out a computer from the department. She explained to me that through several gifts to the department they were able to purchase several Lenovo ThinkPad Yoga 12 computers for students to check out and use for special situations like my own.

I was beyond excited! I had no clue the process of fixing my laptop would take so long. Honestly, I don't know what I would have done without the borrowed laptop. I cannot imagine trying to complete the last few weeks of school without this loaned laptop. It would have been an extremely more difficult semester. I truly appreciate your gifts that made this possible! Thank you!

To help Chemical Engineering students like Robyn, make your tax-deductible gift to the department by visiting www.ttualumi.org/give-to-engineering. Select "Chemical Engineering" from the drop down menu. To send a check, please make the check payable to "TTU Foundation," and in the memo line put "Chemical Engineering Department." Mail to: Tennessee Tech University, Box 1915, Cookeville, TN 38505

A Peak in the Classroom

In fluid mechanics, students were challenged to build. One group saw the opportunity to use an idea similar to a pyrolysis reactor. These reactors use a "fluidized sand bed" to decompose organic material, such as switch grass, to produce bio-oil. According to group member Mary Forde, "We discussed multiple possible uses for a fluidized sand bed and decided using it for a security system would be the most creative way this technology could be applied. Obviously, we couldn't build a giant ten foot pit on our project budget, so we constructed a 1/8th model to demonstrate the concept."

The sand bed works as follows: a rectangular, plexiglass box with 100 micron mesh in the bottom is filled with sand and then compressed air is pumped through the bottom to begin fluidization. Essentially, as air is pumped through the sand it creates space between the particles so they can "flow" past one another and take on the properties of a fluid, such as water.

For the presentation, a metal bolt and Styrofoam cup were placed on top of the sand bed. As air was pumped into the bed, the bolt sank to the bottom, while the Styrofoam floated above the sand. This demonstrated how the sand had basically become a fluid in which lighter objects float while denser objects sink. The principle modeled in the prototype could be scaled up to a bed large enough to contain a person. The group's idea was a sand bed could be built into the exits of high-security facilities. In a situation such as a bank robbery, a silent alarm could be triggered, causing a sand bed located at the exit to fluidize. Group member Alex Otts said, "The overall goal of this bed is to stall the robber in the entryway, which would allow enough time for the police to arrive and catch the robber."

Group member Brandon Schreiber said, "We don't expect banks everywhere to start integrating sand pits into their security systems, we just wanted to show the concepts we learned in our classes aren' limited to chemical engineering applications. Renaissance Engineering is all about being well-rounded and pulling your experiences from within the world of engineering, as well as outside of it."

An Internship to Remember:

Kayla Dean, class of 2017

One of Dr. Pascal's former undergraduate research students, Kayla Dean, was honored with an internship at the Tennessee Oak Ridge National Laboratory. Dean worked under the mentorship of Tom D. Hylton with Dennis E. Benker, Clarice E. Phelps, and Julie G. Ezold.

The team at the Radiochemical Engineering Development Center at ORNL led by Tom Hylton and Dennis Benker works to develop a method for dissolving curium oxide solids without using hydrofluoric acid. Californium-252, an element important in various fields ranging from research, nuclear fuels, mining, cement, even national security. All require the dissolving of curium oxide in their production.

In the abstract to the technical paper "Dissolution of Curium Oxide Using a Catalyzed Electrolytic Process," it states the problem with using "fluoride ions to catalyze the dissolution" is "fluoride ions are corrosive to glass and many metals." The team is optimistic "a promising alternative for dissolution is the Catalyzed Electrolytic Plutonium Oxide Dissolution technology." This process uses nitric acid and strong oxidizing ions (AG2+, CO3+, or Ce4-) as catalyst for the dissolution.

After the research was conducted, it was concluded while the CEPOD method was effective, the method did not dissolve the solids at an expected rate. She also states, "Literature indicates the dissolution rate could be improved by changing certain parameters, such as increasing the surface area of the oxide material and using a different membrane to separate the catholyte and anolyte." In further experiments, CEPOD technologies will continue to be a promising alternative for dissolution.

Dean said, "The internship was a life-changing experience. I was also able to witness and become a part of the amazing teamwork that happens at the Radiochemical Engineering Development Center. I thoroughly enjoyed the experience and hope to return to ORNL next summer."

Faculty Spotlight

Jennifer Pascal, class of 2016

For this faculty spotlight, I had the pleasure of interviewing someone who is not only a professor here at Tennessee Tech University, but is also an alumnus. Dr. Jennifer Pascal earned all of her degrees, bachelors through doctorate, from Tennessee Tech.

After graduating from Red Bank High School in Signal Mountain, Tennessee, Pascal began her journey at Tennessee Tech to pursue her degree in chemical engineering. She stated her feeling of a "good successful environment" at Tennessee Tech, was an attribution for her prolonged stay. Pascal worked for the National Institute of Health undertaking a post doctorate study at the University of New Mexico for several years. It wasn't long before she found her way back to Tennessee, and back to Cookeville. Pascal said she enjoys the "nice balance between teaching and research." Dr. Pascal was welcomed back to TTU, except this time as a professor rather than a student.

Pascal has received several honors and awards while at Tennessee Tech. Her most recent is the "Society for Mathematical Biology Travel Grant" award in 2013. The department is blessed to have her on its team.

"Dr. Pascal is very understanding when it comes to being a student at Tech because she has been in our shoes. In research, she wants us to work on a topic that interests us. She is wonderful at guiding us in the right direction that will allow us to be successful in our future endeavors," said Autumn Douthitt, sophomore chemical engineering student.

A Brief Introduction

Dr. Laura Arias Chavez

Last year, Tennessee Tech University's Department of Chemical Engineering welcomed a new faculty member, Laura Arias Chavez. Chavez and her research group work to create a more sustainable and clean world through the use of membrane technologies. She is currently working with the start-up company, Proton Power, to help minimize waste and make their processes more sustainable. Proton Power is an emerging energy company developing technology to generate hydrogen and synthetic liquid fuels for electrical and thermal energy from biomass. Their headquarters is currently in Lenoir City, Tennessee, but they hope to enable their technology and spread to other parts of the world. By using membrane technologies, Chavez and her research group hope to enable a more complete separation of liquid fuel components from water. Proton Power, Chavez, and many others are working toward a cleaner, more efficient, renewable energy source for our ever industrializing world. Chavez and her research will be covered more fully in the next edition of our newsletter. For more information regarding Proton Power, visit their website: protonpower.com.

Returning to His Roots

Dr. Joseph J. Biernacki

Dr. Joseph J. Biernacki, professor of chemical engineering at Tennessee Tech University is best known for his research on Portland cement, but recently has extended his work into the realm of bio-fuel. Biernacki explains working on energy returns him to his roots, having worked 15 years for British Petroleum, however, the biomass aspect is totally new to him. Biernacki was inspired by one curious student, Tiffany Hughes, chemical engineering class of 2010 who wanted to do research with him on biofuels, so he dove into the area of biomass pyrolysis, a process that produces a synthetic form of crude oil. He explains the endeavor is complex, interdisciplinary and has assembled a team of both undergraduate, and graduate students, and colleagues including: Dr. Scott Northrup (Chemistry, TTU), Dr. Lachelle Norris (Sociology, TTU), Dr. C. Pat Bagley (Agriculture and Human Ecology, TTU) and Dr. Tyler Ley (Civil and Environmental Engineering, Oklahoma State University).

When discussing the significance of his work Biernacki said, "The important thing about our work is we're doing fundamental science to try to help enable this technology, the use of pyrolysis, to emerge and become a commercial envy."

Pyrolysis is a process that uses woody crops such as switch grass, as opposed to food chain commodities like soy beans or corn, to produce biofuel precursors. Making fuel precursors from biomass via pyrolysis also promises the potential to be carbon negative, removing carbon from the atmosphere, which to anyone worried about our industrial world's "carbon footprint" is very exciting news.

While continuing his cement research, Biernacki is putting to use his 15 years of experience with British Petroleum and returning to the world of figuring out how to fuel our ever growing need for clean energy sources.

In one of Biernacki's recent publications1, "The Southern Grassroots Biofuels Project: A Participatory Study of Conservationists and Stakeholders From Two Upper Cumberland Counties," recent TTU doctoral graduate Jessica Murillo, Norris and Biernacki discuss the willingness of farmers in the Upper Cumberland to cultivate switch grass as a feedstock for the emerging biofuels industry.

Biernacki's work on pyrolysis is currently funded by the National Science Foundation under a grant entitled, "A Multi-Scale Environmental and Kinetics Study on the Pyrolysis of Sustainable Biomass Feedstock." The chemical engineering student body and faculty at Tennessee Tech are excited to see what this research will lead to. The opportunities here are boundless. For more information about Biernacki and his team's research, visit his web page at: http://blogs.cae.tntech.edu/jbiernacki/

Alumni Spotlight

Jeff Smythe, President of Warren Paint and Color Company in Nashville, Tenn. Graduate of the class of 1983.

Jeff Smythe, BS ChemE 1983, is married to Pat Parker of Madison, Tennessee, since 1984. Their home is in Hendersonville where they raised two sons, Warren and Parker, both Eagle Scouts. Smythe is a PADI Dive-master, private pilot, active in church and scouting, and enjoys cycling.

After several disappointing attempts to land a ChemE dream job at the big chemical producers, Smythe began his career at Warren Paint and Color Company, a small catings, manufacturing company in Nashville, a few months after graduating from Tennessee Tech University in 1983

Smythe reported directly to another Tennessee Tech ChemE graduate of 1969, Jim Allen. Smythe remembers Allen describing paint manufacturing as applied physical chemisty. Allen was right. Jim's industry experience and tutelage quickly brought Smythe up to speed in so many skills needed to formulate and manufacture paints and coatings.

Smythe is now president of Warren Paint and Color Company. Warren was founded in 1909 and was a household name in the southeast in the middle of the 20th century. One evening in 1947 the company sponsored the WSM Grand Ole Opry where Hank Williams debuted on the Opry singing LoveSick Blues. Other guests in that segment were Ernest Tubb, Lew Childre, and Bill Monroe.

Smythe attributes success in part to a combination of the company's long history and implementation of new technology. Warren evolved from being a producer of architectural and industrial maintenance coatings to specializing in custom coating formulas and private labeling. Many of the challenges in paint formulation today center around producing greener coatings that are less toxic to humans and the environment...His understanding of chemical and physical processes enabled by his bachelor of science in chemical engineering from TTTU, has proven indispensable in these tasks.

Smythe is co-inventor of single component, dry erase coatings named in two US patents. Consulting for Dr. Dave Yarbrough, Professor Emeritus at TTU in chemical engineering, he has produced radiation control coatings for evaluation by the Department of Energy at ORNL. Smythe developed special binders for aqueous suspension and application of elemental metal powders for laser induced surface improvement (LISI), a process developed by the University of Tennessee Space Institute. Another notable project involved the manufacture of an anti-corrosive coating for the Brooklyn Bridge main cables.

Smythe presided over, and continues to serve, on the board of directors of the Southern Society for Coatings Technology, a group of professionals dedicated to the advancement of coating technology. Smythe was also the founding chairman of the Nashville section of the SSCT.

Smythe's advice to ChemE grads is, "Your first job may not be exactly what you imagined. Keep learning. Keep reaching. Keep evolving. Empowered with an awesome education and the yearning for growth, you will succeed.

A Fulfilling Career

Andrea Perkins, class of 1981

Mrs. Andrea Bolinger Perkins retired several years ago from a very purposeful career with TVA and Oak Ridge. Here is a link to the article from "The Oak Ridger" about her: http://www.oakridger.com/article/20090219/NEWS/302199988/o/SEARCH and below is an update from Mrs. Perkins herself:

"I am Andrea Bolinger Perkins but I go by "Cissy" and did so my entire time at Tech. I graduated in December, 1981. As I recall, there were 36 graduates in 1981 for the entire year--6 of which were female. I had been working, during school, at Tennessee Valley Authority during the summers. A week after graduation I was hired at TVA as a chemical engineer in the Nuclear Engineering Division, Mechanical Engineering Branch doing industrial water treatment design work – condensate colishers and makeup water demineralizers. When TVA started downsizing, I saw the "writing on the wall" and decided I needed to expand my knowledge base and moved to the environmental engineering group.

That turned out to be the best career decision of my life. In 1989, I left TVA and went to work for the Department of Energy, Oak Ridge office in the newly formed Environmental Management organization. I spent the next 19 years with the DOE working my way up from a project manager. I managed the off-site program which resulted in many private properties, that were radiologically and chemically contaminated as a result of Cold War activities being cleaned up. I can honestly say that I made a difference in the world we lived in every day when I went to work. It was a wonderful, fulfilling career I was very, very fortunate to have. I have attached a newspaper article that was published February 19, 2009, about my retirement.

I spent the last 6 years working with Navarro Research & Engineering, Inc in Oak Ridge, Tennessee, providing engineering, quality assurance, and senior management support to a variety of DOE contracts throughout the country with a large part of my time spent in Las Vegas working on the National Nuclear Security Site (previously known as the Nevada Test Site) and Y12 on the Uranium Processing Facility (UPF) project.
I am married to Gene Perkins, a University of Tennessee graduate. I spend my free time with Gene and our three Scottish terriers – LuLu, Delano, and Winston."

Don't trust atoms, they make up everything.

Did you know that you can cool yourself to -273.15°C and still be okay?

H2O is water and H2O2 is hydrogen peroxide. What is H2O4?
Drinking.

Have you heard the one about a chemist who was reading a book about helium?
He just couldn't put it down.

How about the chemical workers... are they unionized?

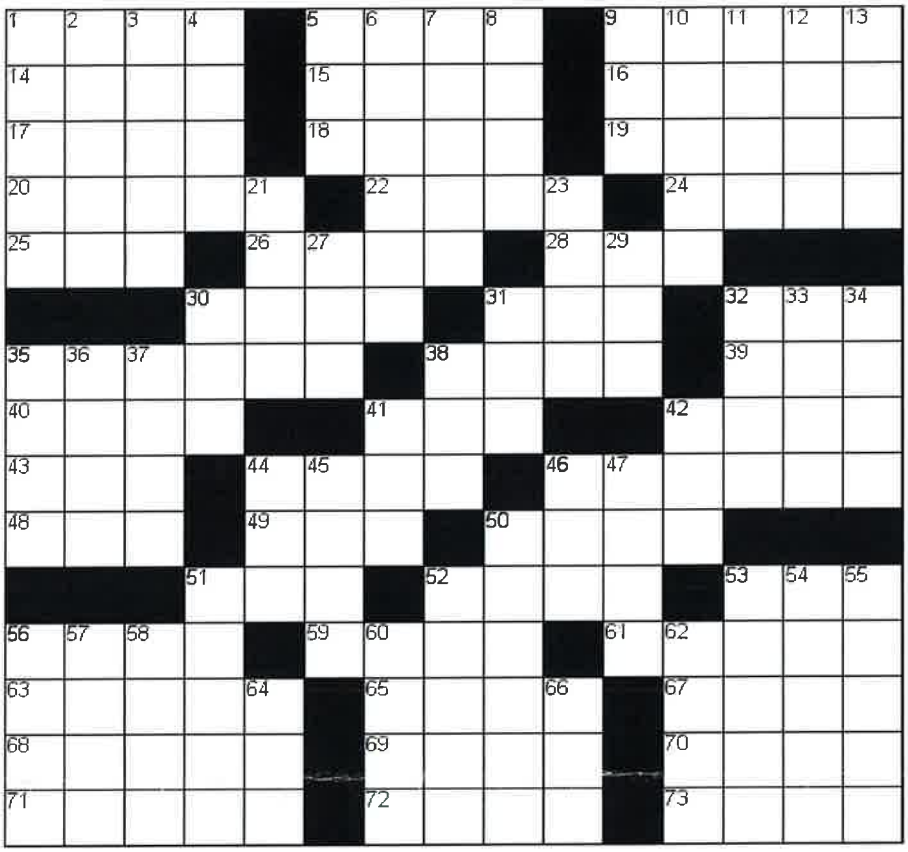
Did you know that oxygen went for a second date with potassium?

What do you call a periodic table with gold missing?
"Au revoir"

What do you call a scientific plant?
A chemis-tree.

Chemical Engineering Crossword Puzzle

Courtesy of Emily Gawel



Across

1 ChE leader
5 Taylor Swift, for one
9 Cause of radioactivity
14 Average
15 Piece that can't be performed alone
16 Aromatic hydrocarbon
17 Facts and figures
18 Standard PC peripheral port
19 Largest decimal unit prefix
20 12/24 repertoire
22 Choice command: If..__
24 Two-thirds of DIY
25 Letter after ar
26 Amino acid transporter
28 All organisms do this once
30 Five carbons
31 Recurrent twitch
32 About to get a PhD, definitely, in the near future
35 Ionized gas
38 What is done to a reference
39 'I apologize', briefly
40 Gene address
41 Tucker Stadium seat warmer
42 Computer picture
43 Tech sports league, abbr.
44 HNO_3 minus Nitric
46 To attach, as by a bond
48 Where science and engineering meet
49 Thinclad Tech coach
50 Dam for diverting water
51 Cousin of et al.
52 Sniff out, as in knowledge
53 Healthy agency
56 (P)
59 Room temperature liquid triglycerides
61 e
63 Make parallel
65 Captain Jack Sparrow, to Johnny Depp
67 Trig ratio
68 Pep producer
69 Optimal mind condition
70 Asteroid, as in 13436
71 Patella topper knees
72 Phonetic horse sound
73 X-ray measurements

Down

1 NR_3
2 Nevada city, if there were multiple
3 Have coffee here instead of Starbucks
4 Formally, an alkenol
5 None in paid apps
6 Auroral
7 AC man
8 Big name in vertical transport
9 86,400 seconds
10 Diminish by degrees
11 Mother of the Gorgons
12 More of this than the regular kind of matter
13 Fellow Newburyporter
21 Oakley Center subject matter
23 Perfecting a term paper
27 Cell's copy of the original instructions
29 Solidified dihydrogenmonoxide
30 Unit of stress based on avoirdupois units
31 Bronze constituent
32 Spore sac
33 After aceing an exam
34 Newton's smaller cousin
35 World's largest scientific journal
36 A combination of testoster one, estrogen, dopamine, oxytocin and vasopressin; according to one theory.
37 Check these to see tuition owed, abbreviation
38 Machine assist, acronym
41 What engineers do to problems
42 Basic regression, abbr.
44 36 is just perfect
45 Nutty palm
46 Lean production acronym
47 Sustainable campus transportation
50 Star Trek ensign
51 Most common bird on campus
52 Run under rise
53 Continuous gradient
54 Popular campus clothing
55 Goal is 120, abbr.
56 Sherlock is one
57 Passionate enthusiasm
58 Shuttle protector
60 Earth's most common element, by mass
62 Beta tester, e.g.
64 Buffalo's home: abbr.
66 50's rank, abbr.

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