CHEM MAJOR NEWS

In Conjunction with the American Chemical Society
Student Affiliates at the University of Pittsburgh

Volume 29, Issue 5 February 5, 2022

IMPORTANT DATES FOR REGISTRATION

February	**14**	Summer Term Registration (2227) begins for all degree students.
March	**6-13**	Spring Break!
March	**18**	Deadline for August 2022 (2227) graduation applications in 140 Thackeray Hall.
March	**21**	Fall Term (2231) registration begins and your on-line registration appointment will be sent to you based on credits earned.

Advisees who already have a permanent advisor should make their Summer registration appointments with their advisor on or after February 7th for Summer Term (2227).

Advisees who will be asked to select their permanent advisors (via an email to be sent February 1st) should do that after February 5th. Please follow directions in the email. See Dr. George C. Bandik or LaShawn Youngblood in 107 Chevron Science Center.

New advisees who have declared chemistry as their major within A&S should make an appointment with Dr. George C. Bandik, Dr. Ericka Huston for Dr. Michelle Ward after February 5th for Summer Term (2227) and March 14th for Fall Term (2231) via email.

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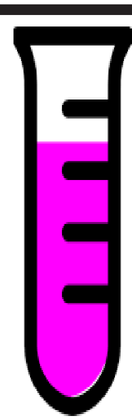

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Is Nuclear the Future?

Written by: Jack Levickas, *Newsletter Editor*

Talk of nuclear energy has been around for about 100 years now, and the same question still seems to be present: Is nuclear the energy source of the future? To answer this question is important to first make the distinction between nuclear fusion and nuclear fission. Nuclear fission is a term used to describe the splitting of atoms when an unstable isotope is bombarded with neutrons. The most common isotope used today is Uranium-235, which splits into two smaller isotopes and three high-speed neutrons, releasing a massive amount of energy. This energy is then used to heat water into steam to turn a turbine inside the reactor and produce electricity. Nuclear fusion is a term used to describe the joining of two low-mass isotopes, such as deuterium or tritium, to produce a neutron, a helium isotope, and again a massive amount of energy.

The energy that nuclear fusion can produce is several times that of the already massive amount of energy that fission is able to create, all while also producing less waste, and without the dangers of a meltdown. However, it has been stuck in the experimental phase for decades now and is not yet used to produce energy, not here on earth at least. So why can we not harness fusion yet? The first problem is that fusion requires immense temperatures and pressures, specifically those that are present at the sun's core. Furthermore, since we do not have access to any pressures remotely close to that of the gravity at the sun's core, we would need to supplement this with even greater temperatures than the sun. These problems are incredibly difficult to overcome on their own and are really only the tip of the iceberg, so while fusion research is very exciting and will hopefully come to fruition one day, for now, we are left with nuclear fission.

With many new systems for harnessing energy rapidly advancing, and fusion still years away, is it worth investing in nuclear fission? The main advantages of fission are that it does not release CO_2, a controlled reaction can continue to produce energy for years, and it can produce immense concentrations of energy. Nuclear fusion, however, does not come without its disadvantages, the main ones being the toxic radioactive waste it produces, the possibility of a catastrophic meltdown such as Chernobyl and Fukushima, and very high initial cost. These disadvantages seem like a huge stop sign on nuclear fission, however, only a small amount of the waste produced is "high-level" radioactive waste, the kind that stays radioactive for thousands of years, and meltdowns have become far less likely due to the development of systems designed within the reactors. As of today, the benefits seem to be about even with the downsides, making fission a good way to supplement other sources of energy, but unreasonable as the primary source. With technology and research rapidly improving the efficiency of nuclear fission, it isn't impossible that it can become our main source of energy, the real question is whether or not it can outpace other sources such as solar and wind.

For References, please go to 107 CHVRN

Breaking Down Vaccines

Written by: Michael Kosky

This is the 4th installment of the series of articles dedicated to discussing the COVID-19 pandemic. Please look for future articles in upcoming editions of the Chem Major News.

Our immune systems are the main driving forces in stopping viruses once infected. White blood cells are responsible for targeting infected cells and other byproducts of viruses in order to prevent the spread of the virus throughout the body. There are several mechanisms that our immune systems use to remove viruses from our bodies. Prior to infection, the body uses antibodies to identify pathogens then bind to them causing the virus to no longer be able to infect cells. Antibodies can also activate additional systems to destroy the virus altogether before or after they infect cells. The most important feature of the antibodies is to be able to recognize foreign invaders in the body. This is the primary basis for vaccines. Vaccines seek to imitate a specific virus for the body to recognize how to properly identify and dispose of the virus. There are several variations of vaccines that have proven to be successful at preventing viruses from infecting people.

The major types of vaccines are live and inactivated vaccines. Live vaccines contain a live virus that has been weakened in a manner that prevents them from being able to severely affect the body. The virus has been weakened by first modifying bacteria to be able to contract the virus and then allowing the virus to reproduce rapidly among the bacteria. Cultures that do not show disease are then determined to have mutated the virus into a weaker strain that can be replicated and eventually used as the vaccine.[9] Some examples of this kind of vaccine is the measles and mumps vaccine. As a result of the vaccine being still active, the person is likely to experience minor symptoms. Inactivated vaccines use the inactive or killed version of the virus for the body to identify what the live virus is. The virus is inactivated by applying heat or chemicals to the virus.[9] This causes the chemical bonds within the virus to breakdown while still maintaining the overall structure of the virus. Consequently, the virus is no longer able to function and can be used as a vaccine. A person receiving an inactivated virus is unlikely to feel any symptoms after receiving their dose. Our immune systems are still able to reapply the same antibodies into targeting a live version of the virus. These are the 2 most common types of vaccines used; however, the current COVID-19 vaccines use a different approach from these methods.

Both the Moderna and Pfizer COVID-19 vaccines use a small section of the mRNA that encodes the virus to be able to form only a piece of the virus. The mRNA encodes only a small part of the outer shell that the coronavirus would use to attach itself onto cells.[10] No other form of the virus is encoded into the vaccines. This small section is then recognized by the immune system to trigger the normal response to viruses. After the small fragment of the virus has been targeted, the fragment is degraded and reabsorbed by the body and antibodies capable of preventing COVID-19 from infecting cells have been formed. The vaccines have been successful at preventing the spread of the virus but still rely on the development of herd immunity. An additional concern is the ability for the virus to mutate at a rapid rate due to it being highly contagious and having spread so quickly. All vaccines are only effective for as long as there is no major mutation in the virus that causes it to differentiate itself from the past strains. The only way to counteract these changes is to monitor the changes in the genome while being diligent about slowing down the spread of the virus.

For references, please go to 107 CHVRN

Two-Year Mark

Written by: Quincey Johnston, *Green Chemistry Contributor*

Though I hate to use this month's article as a reminder, in just a few short weeks we will be approaching the two-year mark of living through a global pandemic. With that, the impact of the pharmaceutical industry on our daily lives is felt by a wider audience than ever before. So, I found myself asking myself the same question I wonder every month as I sit down to write these articles – where does green chemistry fit in?

Under a more pharmaceutical lens, green chemistry focuses on a "quest for benign synthetic process that reduce the environmental burden within the context of enabling the delivery of our current standard of living."[1] Here, we are seeking to eliminate the potential for any unnecessary and/or harmful environmental impacts while also still managing to provide life-saving medications and to retain value. The pharmaceutical industry was one of the first major chemical industries to embrace the ideas of green chemistry with the creation of green chemistry teams and the adoption of various metrics, tools, and trainings in order to advance a greener drug design and manufacturing process.[2]

Many of the twelve principles of green chemistry encourage those broad goals, and the result of a chemical synthesis with high levels of efficiency and reduced environmental burden are well within reach. There are, however, some principles that don't quite fit in under a pharmaceutical context; designing for degradation, for example, often works against drugs that contain an active pharmaceutical ingredient (API) that is reliant upon its specific chemical structure in order for the desired effect to be achieved. Then there is also the question of stability and reasonable shelf-life to consider when thinking about designing for degradation, and often times in combination with API-containing drugs, it just isn't feasible to consider.[1] Research has actually raised some concerns that API manufacturers, along with generic drug companies, have not embraced green chemistry practices to the same extent that large Research & Development companies have.[2] Additionally, while the principle of establishing renewable feedstocks are highly-sought for long-term medications, but within a rapidly changing family of drug products, it's often difficult to achieve realistically.[1] So, the twelve core principles of green chemistry acts more as a guide in the world of pharmaceutical green chemistry, as the principles don't wholly apply.

The synthetic and analytical chemist is often the one acting as the main "driver" of pharmaceutical green chemistry; pharmaceutical chemists are tasked with the generation of incredibly complex compounds in diverse arrays with little to no specialized engineering adaptation, and it is this high level of complexity combined with the limited flexibility in engineering that translates to the pharmaceutical chemist's responsibility for efficiency.[1] This is where the emphasis lies. The correct choice of starting material, ideal number and order of chemical steps, the appropriate use of solvents and reagents, and efficiency in isolation and purification is paramount for pharmaceutical green chemists. A balance must be found between the highest achievable efficiency, safety, and robustness while also still residing within the constraints of the existing engineering of the industry - in the holistic examination of these processes when searching to establish this balance, particular attention should be directed towards solvents, as 80% of waste generated by the manufacturing process of common APIs is related to solvent use.[1]

Pharmaceutical green chemists must be willing and able to challenge the “standard” processes and techniques of the industry if they are to try to improve them in search of greater synthetic efficiency. Many technologies that work to ensure cleaner energy consumption, abating emissions, and improving waste management have actually already been developed, so their implementation into these processes and techniques should be easier, and thus alleviating a lot of the ‘challenge’ pharmaceutical green chemists would face.[3] Despite the implicit high risk attached to this search, the implementation of green chemistry practices will be easily seen in the higher synthetic efficiencies and better chemical processes that will in turn reduce harmful environmental impacts.[1] As of 2018, most “big pharma” manufacturers have adopted at least some green chemistry manufacturing processes.[2]

Though we’ve come an incredibly long way since green chemistry was introduced back in the 1990s, if we are to achieve true sustainability, we must consider new ways to approach the ideas of green chemistry that exist outside of its twelve core principles. This could include the development of an effective waste management protocol to implement at the end of various processes, or to modify the supply chain by reducing chemical steps in the synthesis of APIs and by replacing existing methods with greener chemicals and greener materials.[3]

Given the notion that our lives are likely going to be dominated by the pharmaceutical industry for the rest of our lives, a notion that has increased tenfold by the ever-looming presence of the global pandemic that continues to ravage the world around us, finding a way to make the environmental impact less damaging is just as paramount as the existence of the industry itself. We may be battling a novel virus on a worldly front, but we’re also simultaneously battling the onslaught of climate change.

For references, please go to 107 CHVRN

image from Shutterstock.com

<u>Pitt Day of Giving 2022</u>

Written by: Kelsey Muchnok

The University of Pittsburgh was founded in 1787 by Hugh Henry Brackenridge. Originally known as the Pittsburgh Academy, the University is amongst a select group of universities established in the 18th century in the United States. The school began as a preparatory school. Brackenridge set out a charter for the school from the state legislature of the Commonwealth of Pennsylvania that was passed by the assembly on February 28, 1787.

In honor of the University's founding month, Pitt alumni, faculty, staff, and students give back to the school. Groups and individuals within the Pitt community spend the day gathering funding to continue to brighten future generations throughout the campus. The challenges consist of six different categories such as Schools & Colleges, Pitt Alumni Association, Athletics, Student Organizations, Places & Experiences, and Areas of Greatest Priority. (Holland, Johnson, & Yun, *PittNews 2021*)

There have been several areas that Pitt Day of Giving has impacted, however, there were some that stood out in February 2021 such as AAAC Scholarships that help Pitt recruit and retain African American students. Since 1997, the AAAC has been supporting Pitt's African American students with six different scholarships that help to fill financial needs. (*pittdayofgiving.com*)

Pitt Dental Med, the family of a dental medicine alumnus gave $200,000 in his name. Dr. George Joseph Shia spent half a century practicing orthodontics in Austin, Texas, where he treated some of the city's most at-risk and in-need patients, such as those born with cleft palates and special needs like his youngest daughter. (*pittdayofgiving.com*)

Pitt School of Social Work, Pitt Day of Giving was able to raise $90,000 by increasing donors, embracing the competitive spirit and winning challenges. Thanks for funds raised; the School was able to assist dozens of students. (*pittdayofgiving.com*)

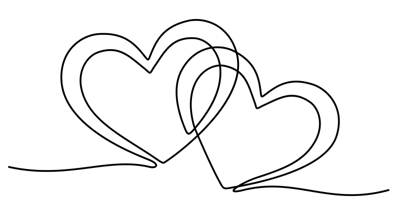
Panthers Forward was launched in the fall of 2018. It is a University of Pittsburgh initiative designed to support student success and reduce the burden of student debt. No interest rate. No one-size-fits-all repayment plan and no third-party companies. Panther Forward is an initiative of Chancellor Patrick Gallagher. It gives Pitt students the freedom and flexibility to contribute on their terms and give to directly to other students in need. (*panthersforward.pitt.edu)*

Men's Rugby, as a club sport at Pitt, every expense for Men's Rugby comes out of pocket. Pitt Day of Giving is an opportunity for the club to gain funds and support. Thanks to the generosity of friends, family, and fans, Men's Rugby Club received 230 gifts and $1500 in challenge funds. These funds covered expenses such as equipment, transportation, housing costs, and participation fees for competitions. (*pittdayofgiving.com*)

Last, but not least, Hillel Jewish Union participated in 2021's Pitt Day of Giving. Hillel Jewish Student Union has been the heart of Jewish student life at Pitt for 70 years. Pitt Day of Giving was an opportunity for the Union to gather financial support of donors who care deeply about the goal of the organization, to give cultural enrichment for student and the city's greater Jewish community. (*pittdayofgiving.com*)

Please join us as we collaborate with the entire campus to honor Pitt's founding day. Pitt Day of Giving will be held on Tuesday, February 22, 2022. For more information, please visit <u>pittdayofgiving.com,</u> to learn more on how you can be involved. Together, the community of the University of Pittsburgh can bring forth a better tomorrow and transform the future of Pitt students and the University.

For references, please go to 107 CHVRN.



ACS-SA Spring Term Schedule

FEBRUARY

February

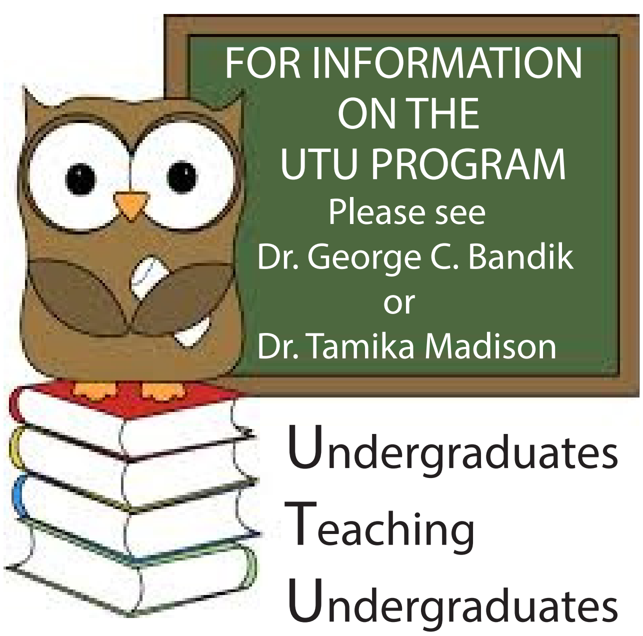
04 ***The Undergraduate Experience with our ACS-SA Members***

11 ***Preparing for Saturday Science***

18 ***All About Registration with George***

25 ***Spring Term Birthday Bash***

Ever wonder what it is like on the other side of the podium? Becoming a UTU is great way to find out. As a UTU, you get the chance to teach General, Organic or Analytical Chemistry. It is a great experience, no matter what your career path is!



The Kenneth P. Detrch
School of Arts & Scences

Summer Undergraduate Research Awards

The Summer Undergraduate Research Awards provide a $3,500 stipend to conduct independent research over the course of the summer. Titles of recent SURA topics range from Internet Memes and Popular Culture to The Mirror and the Mind: Medieval Literary Mirrors and the Neuroscience of the Mirror Response. SURA recipients also enroll in a 12-week summer SURA course to learn how to communicate their research findings to a general audience.

As part of the summer awards program, all SURA recipients participate in an ethics workshop where ethics case studies are discussed with Dietrich School faculty and staff members from the Academic Resource Center and OUR. Because ethical concerns are inherent in every kind of research, the ethics workshop provides students, faculty, and staff with a meaningful opportunity to reflect on the kinds of ethical concerns that will guide young scholars far into the future.

Speak with your departmental advisor to learn how to apply for a SURA or call the OUR at 412-624-6828.

Application:

https://www.asundergrad.pitt.edu/research

Deadline: February 26, 2022

REGISTER FOR

Summer SESSIONS

summer.pitt.edu

Dietrich School of Arts and Sciences
and College of General Studies

Reach your academic goals this summer!

Summer sessions allow you to catch up on needed credits, stay on track to graduate in four years, or get ahead of schedule.

- Take online courses*.
- Take upper-level courses to complete your degree.
- Wrap up your general education requirements.
- Focus on one class at a time.
- Enroll in classes that fill quickly during the school year.
- Connect with professors and peers in small classes.
- Choose the session that works around your summer plans.

* The majority of Dietrich School courses will take place online only and will not have an in-person option. Go to **summer.pitt.edu** for the most up-to-date information.

Registration opens February 15, 2022.
Visit summer.pitt.edu.

University of Pittsburgh