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

CHEM MAJOR NEWS

Volume 32, Issue 2 October 2, 2023

REGISTRATION

SET Dates:

October 6:	**Fall Break - No Classes!**
October 27:	**Deadline to submit Monitored withdrawal to the Dean's Office.**
October 30:	**Registration starts for 2024 Spring Term 2244 based on earned credits. You will receive your registration appointments from the Registrar.**
October 31:	**Happy Halloween!**
November 17:	**Deadline to apply for 2024 April graduation.**
November 19-26:	**Thanksgiving Recess. NO CLASSES!!**
December 16:	**Have a great Holiday!**

IMPORTANT: WHEN SHOULD YOU SEE YOUR ADVISOR?

Advisees who already have a permanent advisor should make their registration appointments with that advisor on/after October 16th. Remember to bring a copy of your academic record with you to this meeting.

Advisees who (via an email to be sent October 1st) were asked to select their permanent advisors should do so after October 9th. See Ericka Huston or Michelle Ward in 107 Chevron Science Center.

New advisees (those who have NOT registered with the Chemistry Department before) should make an appointment with Ericka Huston, Michelle Ward, Tamika Madison, Hannah Morris, or Carol Fortney on/after October 16th in 107 Chevron Science Center.

2023–2024 ACS-SA Officers and Staff

Ahssan Sekandari – *Co-President*
Dhruthi Gunduaro – *Co-President*
Rebecca Babendreier – *Co-Vice President*
Shane Osborne – *Co-Vice President*
Christina Raad – *Secretary*
Dennis Skiba – *Co-Treasurer*
Donny Truong – *Co-Treasurer*

Holly Krug – *Technology Wizard*
Anna Welser – *Outreach Coordinator*
Joe Storey – *Outreach Coordinator*
Rebecca Hotton – *Feature Writer/Editor*
Victoria Zerbach – *Newsletter Editor*
Piper Read – *Green Chem Contributor*
Jimmy Rekowski – *Pharm Contributor*

Visit us at http://www.chem.pitt.edu/acs-sa/

Nuclear Science Week: What is Nuclear Chemistry & Why Should We Care?

By: Victoria Zerbach, *Newsletter Editor*

If you are anything like me, you love celebrating holidays, big and small alike. You might do some extra litter control on Earth Day, make sure to eat copious amounts of ice cream on national ice cream day, and never miss out on sharing Valentine's Day candy. However, I hope you agree that the best holidays are, in fact, science holidays—celebrations of discovery and innovation (something for us nerds)!

The third week of October is a special week for us chemistry nerds. October 15th through October 21st is both National Chemistry Week and Nuclear Science Week. National Chemistry Week (NCW) is a community-based annual event hosted by the American Chemical Society (ACS). NCW enhances public awareness of the importance of chemistry to our quality of life through educational activities hosted by local ACS chapters. For National Chemistry Week 2023 Pitt's ACS will be volunteering at the Carnegie Science Center and Schenley Heights Community Development. Outreach is one of the pillars of ACS at Pitt and every volunteer truly makes an impact. Make sure to contact our outreach coordinators, **Anna Welser** and **Joe Storey**, if you're interested in these outreach events!

Additionally, the week of October 15th only gets better, as it is also Nuclear Science Week. Nuclear Science Week is an international, week-long celebration to focus local, regional and international interest on all aspects of nuclear science. Nuclear chemistry is a small, underpopulated field within chemistry that I personally think is super cool. Nuclear chemistry includes the study of nuclei properties, radioactive decay, and decay kinetics. It also includes the study of chemistry related to nuclear reactors, nuclear weapons, and non-proliferation/policy. Nuclear chemistry also often involves particle accelerators and fission reactors to study the origin of the elements, which is quite fascinating. This field also considers the effects of radiochemistry, which deals with the chemistry of radioactive isotopes. Radiochemistry is an important and expanding field, with a great deal of medical applications. Nuclear Science Week strives to promote global education centered on the achievements of nuclear science.

I hope to share a bit about nuclear science in some of my following articles. This past year I spent six weeks at Brookhaven National Lab engaging in an intensive program, NCSS, a Nuclear Chemistry Summer School. I have been inspired by my experiences this summer to pursue a career in nuclear chemistry. I will be sharing some of the interesting science I learned this summer in the following newsletters. My experience in learning about nuclear chemistry here at Pitt has been limited to one or two brief lectures during general chemistry, and I am guessing you all share a similar experience. So, I hope what I share in later articles will be interesting to some of y'all.

Happy October!! & Hail to Pitt!

Current Events in Green Chemistry: This Summer's Canadian Wildfires

By: Piper Read, *Green Chem Writer*

As industry and exploitation of natural resources continues, anxiety around air quality rises. Particulate matter, nitrous oxides, and carbon dioxide represent a small number of the long list of air pollutants that require monitoring and mitigation in our atmosphere due to adverse effects on human and ecosystem health. Over the summer, one of the greatest threats to air quality in North America was the ongoing wildfires in the British Columbia, Nova Scotia, Quebec, and Alberta territories of Canada.[1] Dry, hot conditions increase capacity for wildfires by increasing the occurrence of fire triggering events and intensity of those fires. As such, we have seen a drastic increase in instances of wildfires as the climate has been warming. These wildfires then release large amounts of carbon dioxide, particulate matter, and ozone precursors out into the atmosphere to be transported, mixed, and reacted downwind. As such, a feedback loop continues to increase global temperatures and instances of damaging wildfires.

One of the primary wildfire pollutants, and in my opinion one of the most fascinating trace gasses in our atmosphere, is ozone. High up in the stratosphere, ozone works as a protective layer from the sun's harmful UV radiation. However, down in the troposphere, the lowest layer of the atmosphere where we live, ozone is a powerful oxidizing agent detrimental to human and environmental health. Ozone is formed through a series of chemical reactions that originates from the emissions of volatile organic compounds (VOC) and nitrogen oxides (NOx), which are primarily anthropogenic in origin. As fires burn the landscape, VOC such as benzene, toluene, isoprene, acrolein, furan, etc. are emitted and carried downwind where the troposphere acts as an oxidizing agent, producing ozone.[2] Resultantly, Pittsburgh and other northeastern areas saw a lot of ozone nonattainment events this summer. These are instances where the average ozone concentration exceeds the environmental protection agency's safe exposure threshold (currently 70 parts per billion for an 8-hour average).[2] Not only can ozone cause harmful respiratory effects to humans, but it can destroy plant life and decrease crop yields. During these harmful events florae will uptake ozone through their stomata instead of carbon dioxide, causing significant crop damage and further expanding the range of issues that global warming causes.

The second worrisome air pollutant that was threatening our health and environment this summer was PM2.5. This fine particulate matter is any solid or liquid particle smaller than 2.5 microns that remains suspended in air for several hours. Particulate matter composition can range from salts and metals, to soil, pollen, soot, ash, and other organic substances. Given the size, PM2.5 can easily be inhaled and will linger deep in your lung tissue causing respiratory irritation and decreasing the amount of oxygen reaching your vital organs.[3] As wildfires burn, soot and ash are generated and can be easily transported from their original source, which was made evident to many of us when we looked outside to see a dark, hazy skyline.

Over the months of July and August several "Code Red" air quality advisories were administered in Pittsburgh warning people not to spend extended periods of time outside. As concerns regarding air quality and its adverse effects on human wellbeing continue to increase around the world, including right here in Pittsburgh, changes need to be made to protect vulnerable populations and the health of our environment. Additionally, crises like these elucidate the gaps in research on the emissions and chemical processes that generate atmospheric pollution and confirm that efforts to mitigate global warning remain critical if we want to lessen the destruction of wildfires.

References:

1. A Record Breaking Boreal Wildfire Season | Copernicus Atmospheric Monitoring Service. (2023, August 3). https://atmosphere.copernicus.eu/record-breaking-boreal-wildfire-season

2. Georgios I. Gkatzelis, Matthew M. Coggon, Brian C. McDonald, et al.Observations Confirm that Volatile Chemical Products Are a Major Source of Petrochemical Emissions in U.S. Cities. Environmental Science & Technology 55 (8), 4332-4343(2021).

3. Why wildfire smoke is a health concern | US EPA. United States Environmental Protection Agency. (2022, October 20). https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern

How to Fake it 'Till You Make it: The Bloody Chemistry Behind Movie Magic

By: Rebecca Hotton, *Feature Writer*

When the fall months roll around and Halloween is right around the corner, most people, including myself, find themselves looking for a spooky costume to wear out on Halloween weekend. If you're anything like me, one or two of your costumes throughout the years has included at least a drop—or a whole packet full—of fake blood. As chemistry students, I'm sure we're all wondering—what chemical(s) is fake blood made of? How does fake blood so accurately imitate the color and viscosity of real blood?

Most fake blood consists of a mixture of potassium thiocyanate (KSCN), iron (III) chloride ($FeCl_3$), and water. However, there are some made-at-home recipes that include corn syrup and red food dye, but these are poor mimicries of real blood, and often are not those used in horror movies, theater performances, or in the fake blood packets that can be purchased from your local Target. This discrepancy between DIY recipes and store-bought fake blood is mainly because real blood is more reddish brown, rather than a strict vibrant, red color that could be reproduced by red food coloring. The iron present in blood is responsible for this reddish-brown color and is very hard to replicate with a simple set of dyes. Additionally, the corn syrup is too viscous to be considered similar in texture to real blood, and the color is often too transparent. So, what happens when we mix these three key ingredients that results in this "better" fake blood? The answer is much simpler than you think and can be understood through the knowledge you learn in general chemistry here at Pitt!

When KSCN and $FeCl_3$ are mixed, a chemical reaction occurs between the salts. Specifically, a double displacement reaction occurs between the two compounds, producing iron thiocyanate through the exchange of the Fe^{3+} ion onto the CN^- ion. This newly coordinated iron compound will appear a deep red color, much closer to the reddish-brown color that real blood presents as. It is also similar in its density when in its aqueous form and mimics the heme iron present in actual blood quite well.

I think this is such a playful, yet simple, example of how integral chemistry can be to disciplines even outside of STEM! It's amazing to think that there is chemistry be considered and studied even in the arts for movies, theater productions, and more! Now when you don your costumes this Halloween and decide to accessorize with a little fake blood, I hope you'll be reminded of the chemistry behind it and share it, perhaps at the behest of your non-chemistry friends, with everyone around you!

Making Fake Blood

If anyone is interested in creating their own fake blood this spooky season, below I have detailed the 'synthesis' steps for making your own fake blood at home, provided you can acquire all the ingredients!

1. Obtain 2 clean and dry bowls.
2. To one of these bowls, add $FeCl_3$ to a few mL of H_2O until no more $FeCl_3$ dissolves.
3. To the other bowl, add KSCN to a few mL of H_2O until no more KSCN dissolves.
4. Add in your KSCN solution directly into the $FeCl_3$ solution and mix until fully homogeneous.
5. Apply fake blood all over desired object/costume/person, *avoiding contact with eyes*.

October Drug of the Month: *Vivitrol*

By: Jimmy Rekowski, *Pharm Writer*

Alcohol and Substance Abuse Disorder (SUD) is an unfortunate, but common addiction plaguing the United States. SUD affects approximately 46.3 million individuals 12 and older, according to the Substance Abuse and Mental Health Service Approximation Survey in 2021. Even more worrisome is the fact that alcohol was the third leading cause of death in the United States in 2021. These frightening statistics only corroborate the impact alcohol addiction can have on the lives of people living with such a disorder, as well as the families of these individuals. Those suffering with SUD has devastating physical, mental, and social short- and long-term effects. The physical effects of SUD include damage to vital organs, a hinderance of cognitive function, and other serious medical problems. The mental effects of SUD include the onset of anxiety, depression, and acceleration of other mental health conditions. As for the social effects, SUD can result in the deterioration of relationships with family and friends, due to erratic behavior. Throughout the United States and the world, scientists are seeking to develop treatment plans for individuals with Alcohol and Substance Abuse Disorder through a combination of medication and therapeutic techniques.

One proposed treatment, specifically aimed at reducing the effects of opioids is Vivitrol. This drug was developed by Alkermes Pharmaceuticals and is a monthly treatment that is delivered to the patient via intramuscular injection. Vivitrol is the brand name of an extended-release drug properly known as Naltrexone. According to the FDA, Naltrexone the IUPAC name for the drug is morphinan-6-one, 17-(cyclopropylmethyl)-4,5¬ epoxy-3,14-dihydroxy-(5α). This medication is administered by a healthcare profession through a gluteal injection once a month. It should be noted that this drug has not been advertised as a cure for the disorder, but rather, a potential aid in treatment.

For example, Vivitrol can help a patient stay sober by aiding them in overcoming their physical dependence on the substance. Vivitrol functions by setting up a blockade of all the "feel-good chemicals" associated with using opioids and other substances, including dopamine and serotonin. Many drugs work by taking control of the reward system, giving the reward by binding to these receptors without having a true pleasurable experience, releasing the endogenous opioid peptides, ultimately leading to addiction through the pleasurable feelings. When Vivitrol later reaches the brain in the time after injection, it acts as an opioid antagonist. Specifically, according to the FDA CAS registry, Vivitrol has a high affinity for the μ opioid receptor. This blocking of the receptor may reduce endogenous opioid peptides, such as endorphins, which cause the "feel-good," reducing the potential for addiction to return.

However, Vivitrol is not an innocuous treatment for physical opioid dependance. One of the biggest dangers associated with Vivitrol is the potential for an overdose. Due to the competitive binding nature of the drug, this makes the blockade produced potentially surmountable. Essentially, Vivitrol will block the "feel-good" endorphins, but with enough of the opioids, the effects of Vivitrol can be negated, giving a new high for the user. The result of such a desensitization to the effects of opioids in many addicts may include addicts having to increase their intake of opioids or alcohol, to dangerous levels to get their "high," during a relapse.

There are many positives, but also many negatives associated with the treatment of Alcohol and Substance Abuse Disorder with Vivitrol. This conundrum reveals a constant debate in the pharmaceutical industry on whether the positive treatment options of drugs of this nature outweigh the risk for overdose. What do you think? Feel free to reach out to me to chat about it!

Our October Schedule

Everyone is welcome to attend our weekly ACS-SA meetings. Every Friday at noon we get together in 150 Chevron Science Center to hear interesting talks, learn more about science and enjoy each other's company. Come join us for all of the following meetings.

October

06 **Fall Break – NO Meeting**

13 **Industry Day with PPG – Discussing Sustainability**

15–21 **National Chemistry Week: *The Healing Power of Chemistry***

20 **All About Registration – with Ericka Huston**

27 **Pumpkin Painting on the Patio!**

Halloween Pumpkin Fest

Come join the fun this October 27, 2023 as we drink apple cider and paint pumpkins on the patio in front of Chevron. Bring candles, dress up or do other Fall like things as the mood strikes you! BYOB (bring your own **blankets**...preferably flannel since we have a theme going and all). Come to a meeting or see Tim with suggestions or for more details.

Who's This <u>BEN</u> <u>Guy</u>, Anyway??!!

Benzoyl Peroxide the Free Radical Man (affectionately known as Ben) is our ACS-SA mascot. You have probably seen him around the chemistry department and on our yearly ACS-SA T-shirt. From now on when you see Ben, think of the ACS-SA. Why not come to a meeting to learn more about what we are all about. Fridays at Noon in 150 CHVRN.

SOME COURSES JUST FOR YOU…

If you are looking or something new and different this term, why not try one of the following courses being offered this coming 2024 Spring Term (2244).

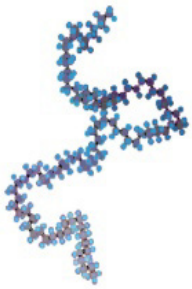
CHEM 1815
Chemical Biology Laboratory

Pre-requisite: CHEM 0345/0745

The course is designed to train students in techniques involved in chemical biology research as well as to educate them in fundamental principles on which these techniques are based. To maximize effective learning in a limited timeframe, the proposed course is designed as a research project with a cascade of well-connected experiments rather than being a series of disparate problems. This will provide undergraduates a 'research laboratory'-like environment and a 'graduate student'-like training to explore a scientific problem in depth. Students will get acquainted with the general research theme: How to address biological questions using principles and methods of chemistry. The course will promote an interdisciplinary research experience for students.

CHEM 1600
The Synthesis and Characterization of Polymers

What makes really long molecules behave differently from short ones? How can it be that everything from your socks to your laptop is made from polymers? What changes must you make in a polymer to go from making bullet-proof vests to making teddy bear fur? Did you know that every time you paint a wall or use super-glue you are doing polymer chemistry? In this course you will get an overview of all aspects of polymer science including synthesis (you need 99.9% yields to make polymers!); purification (you can't, so you have to make them right the first time); characterization (how can you figure out if your polymer weighs 10,000 or 1,000,000 g/mol?), thermal properties (you need to know that your plastic flip flops won't melt on hot pavement) and mechanical properties (elastic polymers make skinny jeans; rigid ones make motorcycle helmets—you don't want to mix them up!). Bonus: When you make a polymer in lab, you get to play with it!



A Few Important Reminders:

CHEM 1140-Preparative Inorganic Chemistry is our advanced inorganic laboratory course offered each Spring Term. **CHEM 1130-**Inorganic Chemistry is a pre or co-requisite for this course. If you are working towards an ACS-Certified degree, this course is a degree requirement.

If you have wondered about what goes on the upper floors of our building you might want to consider registering for **CHEM 1700**. This one credit seminar course allows two different faculty members each week to speak on their own research interests. Over 70% of our graduat-ing seniors in Chemistry participate in our undergraduate research program and this course is a great way to learn more about your options and your department.

Finally, if you are interested in pursuing an honors degree in Chemistry the requirements are:

- An overall GPA of 3.00 or better
- A chemistry GPA of 3.25 or better
- Completed at least 2 credits of CHEM 1710 Undergraduate Research
- Completed Chem 1711 Undergraduate Research Writing.

Good luck as you strive towards academic excellence!