CHEM MAJOR NEWS

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

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Welcome Back!

Welcome Back Everyone!!

Winter break has come and gone as fast as Pittsburgh weather changed from 13 °F with frigid winds to 64 °F and rainy. And while we all might be sad to leave the delicious holiday food and extra nap times at home, Chevron waits for us to join her in more Chemistry fun. This spring semester is sure to be full of many great experiences and fun ACS meetings. George claims that this is his last semester. After many years of waiting, I think we are finally about to be rid of him. In light of our dear friend abandoning us, I think we ought to make this semester the most amazing yet. Be sure to show up with your lovely smile to as many ACS meetings as you can!!!

It is kinda crazy to think that it is already the new year. Reflecting back on 2022 makes me realize how much I have grown in the last 12 months. This year I took on new leadership roles, joined a research group, developed a more honest relationship with myself, started seeing a therapist, and even began writing this newsletter. Despite all this growth, I also had some of the most difficult setbacks of my life that left me feeling absolutely alone. We all had our ups and downs last year. Our resilience is something to be proud of. I think the new year is an important time to reflect love back onto ourselves. Think about what you've done in the last year, maybe the last few years. Recognize all the strength you possess to have gotten over the obstacles that stood in your way. Show compassion to yourself. Be honest with yourself. Take some time to recognize how you would like to grow this next year. What feels like the right path for you right now? Recognize that your goals may have changed. Write down the steps that you can take to reach those goals and remind yourself that progress takes time.

The spring semester can be brutal. Finding motivation while it is so cold and dark is difficult. Remember to be kind to yourself and others this semester. You absolutely should give yourself a break, take care of your physical and mental health, and dedicate some time to the meaningful relationships in your life. School is important, but don't forget that your wellness is more important. I like to think, "nothing is that big of a deal, the only thing that matters is the way you treat people." Don't forget that you are included in people.

Take kindness into the new year and don't forget to stop by an ACS meeting for snacks and the good vibes. Can't wait to see you all there!

Your Newsletter Editor,
Victoria Zerbach

Let's go Skiing!

Dhruthi Gundurao-*Feature Writer*

Winter means that whether we like it at some point snow will fall. But it also means that many of us begin to grab our skis to participate in snow associated sports. At first glance winter sports may not appear to have much, if anything, to do with chemistry. But upon further examination we notice that chemistry is in fact their one commonality.

To most of us skiing is an outdoor activity and chemistry only takes place in a lab, but the reality is that nearly every activity or process involves some aspect of chemistry. There is clearly chemistry in skiing; one cool example is the science behind ski wax. Fast skiers are a result of fast skis, and these skis must be waxed properly to ensure enhanced performance. But this does not mean you can just use the same wax in all conditions, each skiing condition requires its own type of ski wax. You would not want to use wax meant for fluffy snow in wet snow and these different types of waxes would not exist without their varying chemical components. Even the wax necessary for downhill racers and cross-country skiers differs. Downhill skiers just need wax that allows them to glide downwards whereas the wax on cross-country skis must allow the athlete to go both up and down. These different conditions require wax that can make skis slippery, grip, or both. Using the wrong type of ski wax can mean that the skier will lag behind others.

Ski waxes vary in their composition to provide varying effects. Often the first layer of wax used by skiers especially professionals is wax made up of hydrocarbons, molecules containing a chain of carbon and hydrogen atoms. The initial layer of wax added to the base of the skis will keep out dirt and water. Interestingly most modern ski bases are acts of chemistry in action. They are typically composed of 100% polyethylene, often with an ultra-high molecular weight, which provides the base of the ski with some prominent characteristics that contribute towards the utility of the skis. Particularly the polyethylene is a porous, smooth, hydrophobic, resistive abrasion material thus contributing its characteristics to the ski base. The porous nature of the polyethylene is key to the ski base as it allows for waxes to stick and create a typically impenetrable layer.

Ski waxing certainly does not end there, especially for professionals. Most often a second layer of wax containing fluorocarbons is added and as the name suggests these are molecules which contain a mix of fluorine, carbon, and hydrogen atoms. Fluorocarbons are an essential ingredient for increasing skiing speed because they can decrease the friction between the ski and snow thus allowing skiers to move at a faster pace in comparison to when friction is present. Since fluorocarbon waxes are softer than other waxes they can be used as fluids or powders. However, while the types of waxes can be generalized even amongst fluorocarbon waxes the exact composition of molecules within each wax varies as they serve different purposes. For example, in shorter downhill races, waxes may be more slippery as this allows for the fastest speed to be achieved. But, with cross country skiing multiple layers of stiffer wax tends to be used for easy up and downhill movement. Regardless of what fluorocarbon wax is used, one must be wary of the presence hydrocarbons that are harmful to touch or via inhalation over long periods of time,

such as toluene. While the wax will wear off the ski it is still necessary to be careful when handling these fluorocarbon waxes.
Interestingly, Olympic and competitive skiers often tweak wax formulas in attempts to achieve max speed to secure a gold medal. While these changes are typically not revealed to the public maybe next time you go skiing for fun you might want to experiment with your waxes to see if you can go faster!

For references: Please go to CHVRN 107

January Drug of the Month: Rybelsus(Semaglutide)

George Fritze – *Pharm Contributor*

As the United States moves past the holiday season, trash bags of gift wrapping, and tattered party decorations may not be the only straggling consequences of this festive time of year. One markedly affected demographic post-holiday season happens to be the ~1 in 10 individuals in the US diagnosed with Type II diabetes. A recent paper analyzed the trend of increased HbA1c levels in January recorded by diabetes clinics, leaving the question of whether this phenomenon requires immediate treatment, or if doctors should hold off to see if it comes down after the effects of holiday indulgences have worn off. HbA1c is a form of a particular protein found in the blood called hemoglobin, which can be qualified as A1c when it is bonded to a sugar molecule. The relative concentration of HbAlc in a patient's blood can give insight into their past dietary choices from around 3 months prior, and shows how diabetes has affected their ability to manage glucose levels (Jones, McDonald, Hattersley, and Beverley, 2014).

HbA1c(often shortened to just A1c) has now become the characteristic measurement associated with type II diabetes. One of the most advertised drugs in the US which aids in the fight to lower A1c is Rybelsus(Semaglutide). Rybelsus is a prescription oral tablet, which is taken once a day to improve blood sugar in adults with diabetes (Novo Nordisk 2022). Introduced in 2019, the medicine has exploded in popularity due to its efficacy and ease of use. While the website mentions that the drug should be used in addition to healthy diet and exercise, there is growing concern that patients may be using it for other purposes altogether. Rybelsus belongs to a class of drugs known as agonists, meaning it mimics the structure of a naturally occurring hormone in the body known as GLP-1. GLP-1 is responsible for triggering the release of insulin from the pancreas after blood sugar spikes. Increased blood sugar will be urinated from the body. Additionally, this hormone will suppress appetite by binding to multiple neuroreceptors in the brain, inducing a feeling of "fullness" in the stomach.

Overall, these agonistic effects immensely help improve the blood sugar content of patients as well as support more healthy dietary habits. However, Rybelsus is being increasingly used as a weight loss supplement although it has not been approved for this particular use(Caporuscio, 2022). Despite being a diabetes medication, Rybelsus heavily advertises this feature of their drug and touts this as a selling point to many of their customers. The multifaceted impact of GLP-1 agonists on the body is currently being studied extensively as recent research

has suggested the protein impacts the development of inflammation, Alzheimer's disease, and depression (Detka and Glombik).

While humanity is lucky to have such a versatile and useful drug, it is important to recognize the intricate design and testing which went into developing Semaglutide. One of the most prominent features of the molecule (shown below) is the long fatty acid tail. Knudsen and Lau, in their paper, *The Discovery and Development of Liraglutide and Semaglutide*, discuss the finicky process of the fatty acid tail and its role in helping the drug perform its goal. One of the largest problems in the testing of semaglutide was that the half-life of the molecule in the body was extremely short. Upon the addition of a fatty acid tail, the half-life of the molecule jumped rapidly (9 to 50 fold). The addition of more carbons and more chains was introduced and it did expand the half-life of the molecule, but also decreased the potency of the active binding. After careful testing, the amount of carbons was optimized to one chain consisting of 16 carbons (Knudsen and Lau, 2019). Overall, Rybelsus stands as a fascinating ethical, scientific, and cautionary case study of the experimental use of agonists in the marketplace with an increasingly impactful role in a variety of uses.

For references, please stop by CHVRN 107

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Some say love lasts forever, but chemicals should not!

By Sophia Bazydola, *Green Chem Writer*

From medications that allows us to live longer lives to pesticides and herbicides that protect crops, chemists have allowed us to progress forward. Because of that, chemistry is good; it allows for innovation and improvement by building new chemicals from existing ones. But, for many of the same reasons, chemistry is dangerous. Many of humanity's manufactured chemicals have caused harm to us and our planet, despite their intention for good. One such example are PFAS, or per- and polyfluoroalkyl substances, which, in less than 100 years since their creation, have polluted nearly every body of water in the United States.

PFAS were created in the 1930s and are designed to be extremely durable heat- and water-resistant chemicals. The functional groups of PFAS vary, but they all consist of a carbon backbone where some or all hydrogens are replaced by fluorine, resulting in extremely strong bonds. An estimated 9,000 unique compounds are believed to exist[1]. PFAS were initially believed to be inert, posing no risk to humans or the environment. As a result, their use became widespread. Some of their major usage was during the 1940s and 1950s, when they were a major component of firefighting foam and were used to make uniforms worn by firefighters and military members flame-resistant. In household goods, they are mostly used to make items water-resistant or to prevent sticking[1]. Common examples of objects that may include PFAS are stain resistant clothing and furniture, makeup, food wrappers, and cookware (pots, tupperware, etc.; typically coated with the compound named Teflon). These chemicals were regarded as "a miracle of modern chemistry"[3] following their creation and during the period of their peak usage. This view on PFAS would soon fade; in the 1960s, it was first suggested that these chemicals may be toxic to humanity and the environment, which later would be proven to be true.

The characteristics of PFAS that make them so useful are also what make them so dangerous. The strong carbon-fluorine bonds are so durable that these compounds do not naturally break down, earning them the title of "forever chemicals". The inability for them to naturally degrade has led to accumulation in water, soil, air, and even our own blood: a survey in the early 2000s by the CDC estimated that PFAS were at detectable levels in 97% of Americans[2]. They are also found at high levels in aquatic animals, especially fish, rendering them inedible in areas where contamination is high. Much of the contamination in the United States originates from firefighting foams, industrial runoff and waste, and military bases[4]. Due to widespread use and contamination of water and soil, exposure to PFAS was nearly inescapable in the United States, and their toxic effects would become apparent. PFAS exposure has been linked to many health issues, including an increased risk of multiple types of cancer, increased risk of pregnancy complications, thyroid disease, reduced antibody response, and abnormally high cholesterol (dyslipidemia)[1]. By the time any health complications were known, it was too late; pollution and exposure were already epidemic in the United States.

As the toxicity of PFAS became more known, the public pushed back against the industries that were recklessly mass-producing PFAS and putting millions at risk of health complications. Soon enough, the EPA and other government agencies were involved in the response to the threat, and by 2006, the EPA came to an agreement with nine major producers

of PFOA and PFOS, two major types of PFAS, to phase out production. Some local and state governments further banned or restricted other PFAS, and governments on all levels lowered the safe concentration of PFAS in drinking water to parts per trillion, showing just how dangerous even minimal exposure can be. Banning the use of PFAS in other products has been proposed, such as in food wrappers and cosmetics. Despite the efforts taken, contamination is still at dangerous levels in the environment, and more work remains to be done. Without further policy development, restrictions, and holding PFAS producers accountable, the water we drink and soil we grow our food in will continue to contain these toxic chemicals and exposure will continue. Government response, especially at the federal level, has been too slow, but one driver of policy implementation is social awareness[4]. Getting more people invested is an important part in moving policy forward and is necessary to ensure that our health and environment are protected.

Beyond writing policy and expanding existing restrictions, scientific methods need to be employed to clean up contamination. Water remediation is effective, and we already have much of the infrastructure for it. There are many existing methods for water remediation that are able to break down PFAS into safer compounds or remove them from water that should be expanded to more of the country. The issue with many of these processes is that they are expensive and energy-intensive, so implementation is slow. Another promising form of remediation is bioremediation using microbes. This is effective in both soil and water but is limited to specific types of PFAS that microbes will consume. Still, it is a promising method that is better for the environment due to lower energy usage, efficiency, and having the ability to naturally degrade. There are also various chemical treatment methods, such as one that is able to mineralize PFAS into sodium fluoride and other salts[1]. But no matter what method of reducing pollution is utilized, chemistry will play an essential role and be used for good in order to prevent further harm to us and our planet.

For References, please see 107

American Chemical Society

Student Affiliates, University of Pittsburgh

Membership Application

This is a powerful professional organization for the benefit of individuals interested in chemistry and related fields. Our organization offers exciting extracurricular activities and many outstanding opportunities for our members, including:

1. **WEEKLY MEETINGS**-to plan activities, provide interesting speakers, discuss ideas, and keep students aware of what is happening in the scientific community.

2. **ANNUAL TRIPS**-Each year we sponsor (a) trip(s), to external chemistry environments, as well as for social enjoyment. Significantly reduced rates are available to active members. In the past few years we have traveled to New Orleans, Atlanta and New York.

3. **PROFESSIONAL NETWORKING**-Our organization has many opportunities to make contacts with professionals in both the scientific industry and academia. Student affiliates also have the opportunity to join the National ACS.

4. **SOCIAL ACTIVITIES**-We sponsor many activities throughout the year just for fun.

Our meetings are held every Friday at 12:00 noon in Room 150 Chevron Science Center. To join, complete the application form below and come to one of our meetings. Our first meeting will be <u>January 13, 2023</u> but you may join any time throughout the year.

Name: _____

School Address: _____

_____

Permanent Address: _____

_____

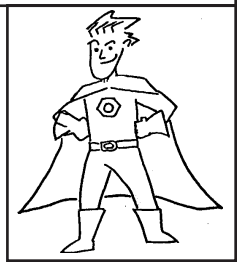
School Phone: _____ Home Phone: _____

Major: _____ Year in School **Fr.** **So.** **Jr.** **Sr.**

E-mail: _____

May we include your name, number and e-mail on the published phone list? **YES** **NO**

To submit this form by mail, send it to ACS-SA, Box 24, Chevron Science Center, University of Pittsburgh, Department of Chemistry, Pittsburgh, PA 15260. Be sure to include the $15.00 dues <u>(make checks payable to the University of Pittsburgh)</u>. It is possible to be active even if you can not attend the meetings. For more information, see our display case in the lobby of Chevron Science Center.



The University of Pittsburgh Department of Chemistry

is proud to announce

The Siska, McKeever, & Wass

Summer Undergraduate Research Fellowships

- These Undergraduate Research Fellowships will be awarded this Summer 2023.
- These Fellowships will provide a Summer stipend of $4,500.00 to the recipient for work work carried out in the research lab of one of our faculty members.
- Please submit a letter of recommendation from a Faculty Mentor which includes your qualifications and details of the planned research project (1-2 pages) and a **one** page personal statement of your future goals to **Dr. George C. Bandik in Room 107 Chevron Science Center by February 13, 2023.** All nominations will be reviewed by our Undergraduate Curriculum Committee and the recipients will be recognized at our Undergraduate Spring Terms Awards Ceremony within the University of Pittsburgh, Department of Chemistry.

Deadline to receive all materials for these Fellowships is February 13, 2023.

January 2023 ACS-SA Schedule

All Meetings are at Noon on Friday in 150 CHVRN

1/13 Welcome to the New Year -*with Pizza*

1/20 Meet our new Faculty-*with Dr. Xin Gui*

1/27 A Medical and Dental School Roundtable

New Student Organization:
Women in Research

Women in Research is a new student organization open to any non-man identifying students. Our goal is to help students who might feel unwelcome and uncomfortable in research explore and pursue their interests. We offer internship placement in Pitt and non-Pitt labs, a mentorship program with graduate students and professionals, and a safe space to discuss discrimination in the research field. We host guided research conferences and competitions, which includes many opportunities for awards. If you're interested in joining our email list, email **LKS51@pitt.edu.**