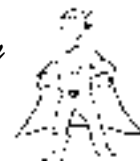




*In Conjunction with the American Chemical Society
Student Affiliates at the University of Pittsburgh*

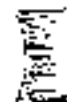


Volume 24, Issue 6

March 6, 2015



It's Back!
REGISTRATION



Fall Term (2161) Registration

March 23 Fall Term (2161) Registration begins based on credits earned.

→ *You will be notified of your registration time on your my.pitt.edu page.*

March 27 Deadline for applying for August 2015 graduation (140 Thackeray Hall).

*Advisees who already have a permanent advisor should make their registration appointments with that advisor on or after **March 16** for Fall Term (2161).*

*Advisees who were asked to select their permanent advisors (via a letter sent Feb. 1) should schedule their Fall term registration appointment with their new advisor after **March 16**.*

*New advisees who have declared chemistry as his or her major within A&S should make an appointment with Dr. George Bandik, Dr. Ericka Huston, or Dr. Michelle Ward after **March 16** for Fall Term (2161) in 107 CHVRN.*

Departmental Honors? Here's How...

Students who wish to graduate with Chemistry Department honors must satisfy four departmental requirements. Students must have:

- (a) an overall QPA of 3.00 or better
- (b) a chemistry QPA of 3.25 or better
- (c) have completed at least 2 credits of
Chem 1710-Undergraduate Research
- (d) completed Chem 1711-Undergraduate Research Writing.

Good luck as you strive towards academic excellence!

2014-2015 ACS-SA Officers and Staff

Josh Casto-Co-President
James McKay-Co-President
Keith Carpenter-Co-Vice-President
Sam Ministero-Co-Vice-President
Ben Barnhart-Co-Secretary
Ian Dale-Co-Secretary
Alex Abram-Co-Treasurer
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Chase Moon-Outreach Coordinator
Ryan Rothman-Outreach Coordinator
Drew Tout-Outreach Coordinator
Trevor Hyland-Newsletter Co-Editor
Anisa Mughal-Newsletter Co-Editor
Raissa Berry-Green Chemistry Contributor
Sara Obringer-Tech Team
Amber Peck-Tech Team

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

CHEM MAJOR NEWS

ACS-SA Schedule for the Spring Term



MARCH

- 06 Registration Again!!!
with George**
- 13 SPRING BREAK-Have Fun!**
- 20 Spring Term Birthday Celebration**
- 27 Officer Nominations**

APRIL

- 03 Open Meeting**
- 10 Elections**
- 17 SENIOR FAREWELL**

CAMPAIGN! VOTE! WIN!

Have you ever wanted to lead a nationally acknowledged award winning student group? If you aspire to such things why not consider running for an office with our ACS-SA group. We boast some 80+ members and have been recognized for the past 23 years by the national ACS for outstanding programing.

Nominations for our 4 elected positions: president, vice president, treasurer and secretary will be held on April 03 at our weekly meeting, 12:00 Noon in 130 CHVRN, and elections will be held on April 10th.

Yue Shao and Dan Willis have agreed to be Co-Editor's of next year's Chem Major News,Zach Eddinger and Pat Asinger have agreed to serve as Outreach Coordinators. Thanks to these great folks!

Get involved and help a great group maintain its reputation! We need you!

SMALL GRANTS FOR YOUR PROJECTS.

The A&S Office of Undergraduate Research, Scholarship and Creative Activity is offering small grants for your individual research or teaching projects, presentations or creative endeavors. These grants of up to \$500 are available for the following kinds of expenses:

- research/project supplies
- travel if you are going to present a paper at a conference or perform in an artistic endeavor.

To apply for a research/creative endeavors or travel/presentation grant, you must:

1. Find a faculty sponsor for your project.
2. Complete the application form. Include a detailed description of your project or travel plans and budget.
3. Return the signed form to the Office of Undergraduate Research, Scholarship and Creative Activity, 209 THACK.



Try Something Different...

Need something new and exciting in your life? Tired of the same old thing? How about some new (or not always offered) courses for the Fall term? Three elective courses being offered this fall may bring that zing back into your life! May we suggest:

Chemistry 1310-"Organic Synthesis"

This course fills in the gap between the basic undergraduate organic chemistry courses and the graduate school level. Organic synthesis is the scientific backbone of organic chemistry, and though often neglected in the undergraduate curriculum due to their complexity, synthetic tactics and strategy are among the most creative and useful expressions of scientific excellence.

The course will use modern organic synthesis as a framework to learn about advanced organic structures, organic reactions and organic reaction mechanisms. Outside class, you will learn how to critically read the original literature through periodic assignments.

The course is ideal for anyone who plans to look for a job or continue for an advanced degree in organic chemistry or any area associated with organic chemistry. A reasonable (B or better) knowledge of introductory organic chemistry is expected, but we will open each new topic with a refresher.

CHEM 1460-"Computational Drug Discovery"

This course for advanced undergraduates addresses the recent and emerging roles of computation in drug discovery. In addition to having the opportunity to integrate concepts from biology, chemistry, and physics toward applications in the highly interdisciplinary field of computational drug discovery, students will learn how to critically read research articles and give effective oral presentations. Students will have a hands-on introduction to the latest tools of computational drug discovery by learning how to use the MOE software package. This course will provide a valuable experience for students planning to pursue graduate school, medical school, or careers in industry. Prerequisite: Organic Chemistry.

CHEM 1620 - "Atoms, Molecules, and Materials - Introduction to Nanomaterials"

This will be a course designed to increase students' knowledge and understanding of emerging field of nanotechnology. Nanotechnology deals with materials in nanometer scales, typically one to 100 nanometers. One nanometer is one billionth of a meter; approximately the length of five silicon atoms placed side-by-side or the width of a single strand of DNA. On nanometer scale, materials may possess new physical properties or exhibit new physical phenomena. For example, band gaps of semiconductors can

be effectively tuned by adjusting their nano-dimensions. For nanomaterials, number of surface atoms becomes a significant fraction of the total number of atoms and the surface energy starts to dominate. This changes thermal stability and catalytic properties of many materials as we know them.

During the course, the students will gain a sound appreciation of different techniques and instruments involved in the preparation and characterization of nanomaterials. Current and future applications of nanomaterials in medicine, defense, energy production, and computation will be also discussed.

Chemistry 1810-"Chemical Biology"

Revolutionary transformations in chemistry and biology have led to a merging at the boundary of these disciplines where contributions from both fields impact our molecular and quantitative understanding of biology. Rapid growth in this area has been driven in part by researchers applying synthesis, quantitative analysis, and theoretical reasoning to the study complex cellular processes. This course focuses on enzyme mechanisms in biological pathways, kinetics and thermodynamics, and chemical tools to probe and screen components of the cell. Other topics that will be discussed include DNA/RNA processing, macromolecular interactions, chemical signaling, posttranslational modifications, chemical syntheses of biomolecules, and the development of assays for high throughput drug screening.

This course is ideal for students interested in the interface between biology and chemistry. You will first learn to recognize sufficient unresolved problems in biology that will benefit from a whole system chemical and molecular approach to analysis. Chemical tools from all areas of chemistry (analytical, inorganic, organic, and physical) will be employed to characterize and elucidate biological processes. This course will be taught from both a "top down" and "bottom up" approach to characterizing cellular responses. Individual interactions and mechanisms of biological pathways ("bottom up") will be discussed in addition to and in context with the analysis of a global cellular response ("top down") to chemical agents such as drugs, inhibitors, or chemical probes.

Chem 1810 fulfills one of the two elective biological courses for the chemistry bioscience option. Prerequisites include both Biosci 160 and Chem 320. Students can only receive credit for one of the following courses: Chem 1810, Biosci1000, or Biosci 1810.

So as you can see, there is something for every chemical taste available to you this Fall!!



Green Chemistry

by: Viktor Polites, *Green Chemistry Contributor*



Choosing Greener Solvents

As an essential component of chromatographic separations, extractions, and reactions, solvents constitute the bulk of waste produced by research and by industry. Therefore, it is necessary whenever possible to choose solvents that are minimally toxic or carcinogenic, do not persist in the environment, carry minimal risk of forming explosive peroxides, and which can be derived from renewable feedstocks. In practice, the use of traditional solvents persists in spite of their personal and environmental hazards.

One particularly attractive green solvent is 2-methyl-tetrahydrofuran (2-MeTHF). It will often dissolve compounds soluble in dichloromethane (DCM), and as a cyclic ether, can often replace tetrahydrofuran (THF) in organometallic chemistry. DCM and THF are derived from petrochemicals—non-renewable resources. DCM also exhibits high acute toxicity, is potentially carcinogenic, and easily contaminates the atmosphere due to its high volatility. Despite these drawbacks, DCM and THF are common laboratory solvents.

The major advantage of using 2-MeTHF is that it is derived from biomass, namely corn husks, sugar cane bagass, and oat hulls. In addition, by forming an azeotrope with water, reactions done in 2-MeTHF can be easily dried by evaporation. Unfortunately, 2-MeTHF, like many ethers such as THF, can form peroxides over time once exposed to air. If an ether solvent must be kept for an extended length of time, cyclopentyl methyl ether (CPME) is a suitable choice as a green solvent since it resists peroxide formation.

Once written off as a ludicrous concept, water is finding increasing use as a solvent for organic reactions where no reagents and products are water sensitive. Water is obviously advantageous as being environmentally benign, and has the unexpected benefit of achieving relatively fast reactions due to the generally poor solubility of organic reagents in water. A more unusual choice of green solvent is supercritical carbon dioxide. Its advantage is its ease of removal since it exists as a gas at ambient temperature and pressure. Herein also lies its disadvantage; supercritical carbon dioxide only exists at high temperature and pressure.

When selecting a solvent to run a reaction, an extraction, or a chromatographic separation, it's important not only to consider what solvents are appropriate for the situation, but which one(s) will be pose the least hazard to oneself and to the environment. Even though it's not always feasible to employ a "green" solvent, researchers and industrialists alike can certainly employ green solvents more frequently in routine processes.

References:

Organic Process Research & Development – "Solvent Applications of 2-Methyltetrahydrofuran in Organometallic and Biphasic Reactions" (<http://pubs.acs.org/doi/pdf/10.1021/op060155c>)

https://www.sigmaaldrich.com/content/dam/sigma-aldrich/docs/Sigma/Brochure/greener_solvent_alternatives.pdf

http://www.chem.uoa.gr/courses/organiki_1/greenchem/PDF_en/GREEN-CHEMISTRY-PDF-5-TOXICSOLVENT-2012.pdf

Popping into March

Anisa Mughal

Spring is going to “pop” in soon! I am excited for the weather to warm up and potentially start riding my bike back into campus instead of waiting for a bus. As I was spending a recent Saturday night in my apartment due to the cold weather, I curled up on my couch to watch a movie and spend my evening relaxed. Seeking a goodie, I went into the kitchen to get a snack—and what goes better with a movie than popcorn? So I made myself a bag of popcorn and started browsing Netflix. Though it seemed like a simple question, I started wondering how popcorn actually popped. I mean, heat is needed—but why does that make the kernel explode? Turns out someone somewhere has had that question before, because I found many different sources and articles online detailing how exactly popcorn pops.



The process is quite simple. Each corn kernel contains water, starch, protein as well some oil. As we already know, microwaves radiate a wave with a frequency that vibrates the bonds of water (300 MHz, according to Wikipedia). These microwaves heat water molecules in foods put in the microwave because the water bonds are vibrating. As the water in a corn kernel is heated, pressure inside the kernel builds up. The water within turns to steam and increases the pressure by pushing against the hard “shell” of the kernel. As the water within the kernel is heating up, the oil is also heated from the water trying to evaporate and then condense. Together, the oil and water begin to gelatinize the starch, making it softer and more pliable. At approximately 180 °C (356 °F), the pressure within the kernel reaches 135 psi (930 kPa) and the hull of the kernel breaks open, expelling the starch contents. The formerly gelatinous proteins and starch are turned out very quickly and also cool quickly, forming the familiar “puff” shape we see in each of our popcorn pieces today.

Of course after reading this much about popcorn, I wondered what else I could possibly pop. I thought rice might be a good potential candidate since many cereals contain some kind of puffed rice. Though rice contains carbohydrates just as popcorn did, it does not contain enough water within each grain to work in the microwave. It also does not have a hard outer hull, and so is not “popped” so much as “puffed” because its contents are not suddenly expelled. I was surprised to learn that it is commonly made in India—talk about global snack foods! Unmilled rice is mixed with hot sand in a pan, and the rice “puffs” in a few seconds. The sand is sifted and shaken out after the rice is puffed. I am not so sure I would make puffed rice like that, but there is a common process in the US that was commercialized in the early 1900’s. Today, there is a “rice gun” that heats the rice with steam and then engineers a fast pressure drop. This is done at much higher temperatures and pressures than popcorn, however, and so likely won’t work in a microwave. But, if you want to get more adventurous, some have had success popping barley, quinoa and amaranth seeds—all grains that are similar to corn and arguably contain more nutrition! So if you are stuck inside on another cold night and want to eat a snack, get creative and try popping some grain—after all, what’s more fun than doing an experiment?

A Phone You Can Count On

By: James Toye, BS 2014

Imagine, you're sitting in that class. You know which one I'm talking about – you're only in it to get that general education credit, it was your fifth choice, and attendance is mandatory. It's a struggle to stay sane, as the minutes drag by, but you have an ace in your pocket to keep you grounded. You take out your phone, wake it up... and nothing. You forgot to charge it last night, and now is the time to suffer for it.

Thanks to chemistry, your unfortunate situation could be a thing of the past. In the past year, many developments have been made in battery technology, and we can expect to see drastic improvements in the life of our battery-powered electronics in the near future.

A group of researchers from Northwestern University improved the lithium ion battery by creating a high-capacity anode material with graphene – a densely packed, single-atom thick sheet of sp² hybridized carbon. They layered these sheets with silicon, then oxidized to create holes to increase the charge capacity and reduce the charge time, respectively.

By both increasing the length of charge, and allowing the battery to charge quickly, the researchers made large improvements to two of the larger problems with previous iterations of graphene batteries.

Silicon is used since it has a higher charge capacity, it can hold four lithium atoms for every silicon atom, whereas graphene can only hold one lithium atom per six carbon atoms. Silicon cannot be used alone however, because silicon clusters have a tendency to fragment, which reduces its charge capacity. The graphene sheets brace the silicon, and reduce the impact of fragmentation.

The holes, which measure only 10-20 nanometers, in the graphene sheets reduce the charging time by providing a shortcut to the interior of the stack of graphene and silicon. These holes reduced the time to charge by as much as 10 times.

Now that your phone will be able to hold its charge for nearly a week and only have to be plugged in for half an hour to get a full charge, (battery) life couldn't get better, right? In short, yes it could. In addition to future research by the team from Northwestern on improving the cathode, a group of Korean researchers has independently developed a process to create a better graphene structure to use in batteries.

Graphene, as mentioned above, is produced in sheets that are effectively two-dimensional. These sheets can be stacked, making very ordered, compact structures, but this also reduces surface area, which increases charging time. The NU team approached that problem by making holes in their structure, but would a different structure make better use of all of graphene's qualities?

The Korean team's process, dubbed “spray-assisted deep-frying” borrows from the culinary world to create graphene microspheres, which have a much larger surface area than a graphene stack. They used a graphite oxide and silicon suspension which was sprayed into an organic solvent held at a temperature of 160° C, in which the microspheres self-assembled. The microspheres precipitated in the solvent, and were collected. Observation and testing of the microspheres found that they held more charge over time and could also put out a larger charge.

While you may have to struggle through those long Saturday morning lectures this semester, you can do so and look forward to the future, where you'll never be without your phone to save you from your boredom, as long as you didn't leave it at home.

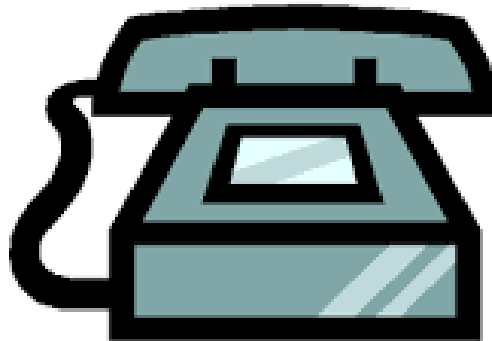
The author in no way condones using your phone during class... especially when you could be reading this newsletter.

References:

Zhao, X., Hayner, C. M., Kung, M. C., Kung, H. H. (2011), In-Plane Vacancy-Enabled High-Power Si-Graphene Composite Electrode for Lithium-Ion Batteries. *Adv. Energy Mater.*, 1: 1079–1084.

Park, S., Kim, H., Yoon, S., Lee, C., Ahn, D., Lee, S., Roh, K. C., Kim, K. “Spray-Assisted Deep-Frying Process for the In Situ Spherical Assembly of Graphene for Energy-Storage Devices” *Chemistry of Materials*, 21 Dec. 2014. Web

<<http://pubs.acs.org/doi/pdf/10.1021/cm5034244>>



The Troubles with Tanning

As the winter comes to a close and the sun starts to show its face, you can bet that there will be crowds of people exposing their skin to the sun or tanning beds in order to get that perfect bronze that is so desired. However, tanning often comes with a price. Those who tan subject themselves to a much higher chance of developing skin cancer, or melanoma. There are many misconceptions about the safety of tanning, both in the sun and artificially. As the male and female youth of Pitt flock to darken their skin tone I think it is important to highlight a couple cold hard facts about tanning.

First, let's talk about what it is, exactly, that causes the darkening of skin pigment. This darkening of pigment is the result of an UV radiation triggered reaction of the body's melanocytes. Melanocytes are cells that create melanin or skin pigment. They can produce either a red or dark brown pigment. When UV radiation comes into contact with the melanocytes they release melanin, which is then able to react with oxygen in order to produce the darker pigment. This reaction is the body's way of protecting it from the harms that the radiation can cause.

There are two classifications of UV light, the first is UV-A. The two types of UV radiation have different interactions with the body. This radiation is the type that actually facilitates the production of the desired dark pigment. UV-A radiation does have some carcinogenic qualities. Due to the reaction that it facilitates, oxygen radicals are created which can impact cell chemistry.

The other type of UV radiation is, not surprisingly, named UV-B radiation. This is the "bad" UV light. If this higher energy type of radiation comes into contact with a cell's DNA it can facilitate a reaction that creates pyrimidine dimers. These nitrogenous base dimers can result in improper replication and the resulting mutation can affect the cell replication cycle. If the regulation of the cell replication cycle is disturbed, cells can reproduce uncontrollably. This uncontrollable replication is cancer. UV-B light does serve at least one positive purpose. UV-B

radiation is essential to the synthesis of vitamin-D within the body.

So you may be wondering "Keith, how do I avoid getting cancer while still getting an even bronze during the summer months?" The easy answer to this question is, plain and simple, you can't. According to all of the research that I have done, the only way to avoid the harmful effects of UV radiation is to avoid it completely. This means absolutely zero tanning beds. Using artificial tanning before the age of 35 increases your chances of melanoma by 87%. The direct exposure is too dangerous to be worth the tan. Don't do it! When you are in the sun, sunscreen is able to block the UV rays. The safest way to get a tan is to expose yourself to the sun while wearing sunscreen. Some UV rays will pass through the protective cream, giving you a tan.

So now that you know the harm that sun and artificial tanning can cause, hopefully you will think twice before going out in the sun without sunscreen. Is a tan really worth the risks involved?

References

<https://www.ncbi.nlm.nih.gov/pubmed/20979596>

<http://www.fda.gov>

