CHEM MAJOR NEWS

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Student Affiliates at the University of Pittsburgh

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THE WELCOME BACK EDITION

Welcome back! Welcome back! Welcome back to another year of fun, laughter and of course, chemistry. For those of you who spent their summers working hard at internships, jobs, or summer classes: congrats! You're better than the rest of us. For the other lazy bums: guess what? It's time to brush the sand out of your hair, grab your backpack and sharpen your number two pencils.

The start of the fall semester is always a special time. You have that hunger in your belly again that makes you feel like you can tackle any class college throws at you. You are full of motivation, drive and half-filled notebooks from last semester. (You can still use those. Recycling is important.) This first week of school brings with it a sparkle in your eye and a spring in your step. The best thing to do is embrace it! Save up that sparkle and spring for November when everything starts looking grey and dreary. So you can try bottling it up in a mason jar and wrap it in a bow, or you can try a more practical approach.

Use this back-to-school motivation to make a plan for your future. Think about what you've done so far in college and what you still have left to do. Think about what worked, what didn't work, what plans fell apart and why. But most importantly, think about what you want to get out of you college plans. If you're a twinkly-eyed freshman, relax and take some time to really learn and explore different subjects, so you can find out what you're really passionate about. You can't be sure just by checking a box on a form. You have to go and find it! It might be kind of weird!

Sophomores and juniors can take this same advice. But I encourage you to stay on track and keep working hard. You know what college is like at this point. You know how challenging it can. And you also know how rewarding it can be. So if you've been doing well in your classes and have found some great extracurricular activities, then keep at it! Don't start slacking off now just because you think you've figured college out. None of us have figure out college. Probably no one will ever.

To my fellow seniors, we're almost there. We can do it. We have to grin and bear it for eight more months. And then we're out into the real adult world…yay? Finishing the year strong is obviously important, but maybe more so, is making plans for after graduation. Start now that you have the motivation and the time before your classes and your extracurriculars and your social life all get too demanding. Whether you're thinking about grad school, taking a year off, joining the work force or living in your parents' basement, now is the time to start making those plans. It'll only make graduating more fun.

So that's been my pep talk! If you're interested in learning more about the University of Pittsburgh chapter of the American Chemical Society (ACS) you can head to the main office of Chevron Science Center. There's tons of rewarding opportunities provided through membership in ACS, so if you're reading this newsletter, you might as well check it out. Welcome back to Pitt and I wish you all a great, successful year!

Best,
Nuria Marquez Martinez, *Newsletter Co-Editor*

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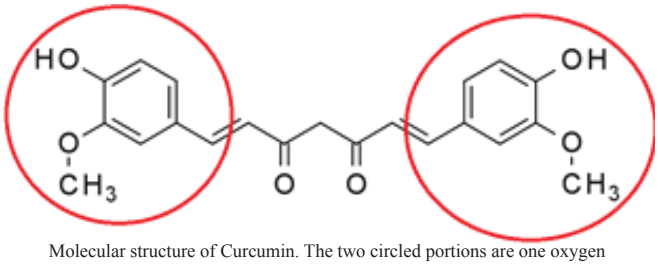
Hybrid Herbs, a Chemical Exploration

by: *Dan Willis, Co-Editor*

If you've visited a plant nursery in the past ten or so years, you may have noticed the growing popularity of plants that claim to taste like other plants. Chocolate mint, pineapple sage, lemon verbena, and many other breeds have come to dominate home gardens and 5-star kitchens alike with their enticingly complex flavors and aromas. But what makes these bizarre combinations possible. Let's talk phytochemicals.

The term 'phytochemical' refers to organic chemicals produced by plants which result in the plant's observable characteristics, although they have little known nutritional value. The fragrant oxides of the rose, the stimulating caffeine of coffee, and even the tearjerking acids of the onion are all examples of phytochemicals.

And what's fascinating about phytochemicals, is that their potencies and properties can vary with only minor variations in molecular structure. Here's an example: in not particularly harsh environments, curcumin--the chemical responsible for the yellow hue and piquant flavor of spices like ginger, turmeric and mustard--can oxidize in to vanillin--the primary component of imitation vanilla flavoring.



Molecular structure of Curcumin. The two circled portions are one oxygen away from vanillin.

Through mutations that scientists have yet to understand, many herbs can modify the phytochemicals responsible for their flavors and begin to approach the flavors of other foods. Simple chemicals like citral or carvone can imbue common herbs with exotic flavors like lime and caraway. And while we can't always predict how the mutation occurs, we can usually guess which phytochemicals are precursors for the unusual flavors in these new and exciting cultivars.

So now let's take a look back at chocolate mint, which many claim to have a flavor reminiscent of Andes-brand chocolate pillow mints. There's a broad family of phytochemicals called flavonoids, a collection of over 5,000 aromatic ketones that are responsible for the colors, flavors and aromas of many different species of plant. Eriocitrin is one such flavonoid commonly found in peppermint (as well as green tea and rose hips). But through careful breeding, botanists have been able to boost the plant's production of catechin, a very similar flavonoid more commonly associated with the dark, bitter flavors of wine, coffee and most notably cocoa.

And since its discovery, chocolate mint has become popular in herb gardens and fancy restaurants the world over. It even made an appearance earlier this year on TV's Top Chef, when finalist Melissa King prepared a "seared duck breast with walnut miso, pickled cherries and compressed celery with chocolate mint" that she would later describe as the dish she made on the show that she was most proud of. So, while you won't necessarily be seeing it on supermarket shelves anytime soon, you can certainly pick it up at a well-stocked nursery. You could also just pick up a box of Andes; those are great too.

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A Few Truths About Fracking

Keith Kennedy, Monthly Contributor

Fracking has been a hot topic in the news throughout the last few years. I'm sure that we all know the basics about fracking. Most know that fracking is a method of extracting natural gas from natural gas rich ground. Most will also probably know that the safety of this type of natural gas drilling is under constant debate. In order to form a more informed opinion on the matter let's take a look a few hard facts.

First, lets talk about how the fracking process works. Fracking starts with drilling. A well is drilled deep into the earth's crust, below ground water, into the natural gas or oil containing shale. The initial well is drilled straight downward. This well is encased in steel piping and concrete. Once the well is deep enough to meet the gas rich shale, horizontal drilling along the shale begins. After encasing the newly drilled well in steel, a perforating tool is used to crack or fracture the surrounding shale. Next, extracting fluid consisting of mostly water and sand is pumped into these cracks. When the fluid is pumped back out, the sand is able to keep the fractures open, allowing for the natural gas to flow intom and out of the well.

The extraction fluid used in 99.5% water and sand, but what is in that other 0.5%? Many drilling companies are conspicuously vague about the last 0.5% of the fluid, but perhaps this is just to protect their intellectual property from those who might steal it. When I looked into this further I found that this last 0.5% of fluid is composed of a multitude of chemicals. Some of the chemical such as Citric Acid (vitamin C) and Sodium Chloride (table salt) are harmless. Some of the other components seemed more menacing. For example, Triethanolamine Zirconate is listed as one of these chemicals. Triethanolamine Zirconate is also listed as a carcinogen. Methanol and other flammable substances are also among the 0.5%.

There is no harm in the use of these potentially dangerous chemicals as long as they are properly disposed of. Most drilling companies insist that the drilling is safe and no harmful chemicals from the extraction solution ever reach the surface. In many cases, however, the inhabitance of the areas surrounding fracking wells report major changes in the quality of their drinking water.

USA Today reported that Pennsylvania, Ohio, and West Virginia have all reported drinking water contamination as a result of natural gas drilling. Testing showed that a high concentration of heavy metals, as well as very high chloride concentration were found in the contaminated water. It is true that most drilling sites do not seem to affect the water quality, but those that are affected report some startling information. Those who ingest the contaminated water report feeling ill and fear long-term health effects. In one case, someone reported that the water pumped from their well became flammable as a result of fracking nearby.

So the real question is, is fracking worth it? It is no secret that fracking creates jobs and make drilling companies a whole lot of money, but at what cost?

References

http://fracfocus.org/chemical-use/what-chemicals-are-used
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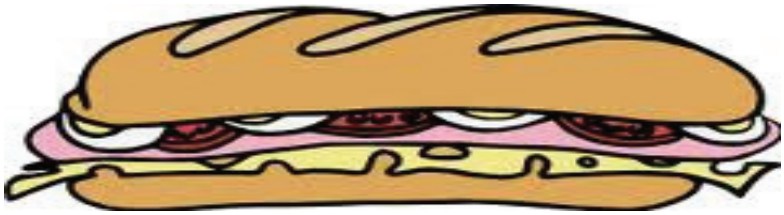
The ACS-SA will be selling hoagies every Tuesday at lunchtime in the lobby of Chevron Science Center. This year they will be from Uncle Sam's! Details are coming soon...Please support our ACS-SA. Thank you!



Green Chemistry

by: **Viktor Polites**-*Green Chemistry Contributer, 2015-2016*

My name is Viktor Polites. I am a junior chemistry major planning to pursue graduate studies in chemistry. This year I will be writing the Green Chemistry column for the ACS newsletter. Since the chemical industry touches our daily lives and makes modern life possible, it is imperative that we make strides to ensure the industry is sustainable for generations to come. This includes, but is not limited to, reducing waste, improving energy efficiency, replacing hazardous substances, switching to renewable feedstocks, and designing products which degrade into innocuous chemicals after they have fulfilled their role.1 The task ahead of us is challenging and requires creative thinking. I have learned this first-hand in my research under Professor Paul Floreancig to develop environmentally benign C—H functionalizations. Awareness of the Twelve Principles of Green Chemistry,2 outlined in this first article, is prerequisite. In the coming weeks, I will write articles detailing ingenious applications of the Principles of Green Chemistry towards sustainable solutions.

The Twelve Principles of Green Chemistry

1. **Prevention**—It is better to prevent waste than to treat or clean up waste after it has been created.

2. **Atom Economy**—Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. **Less Hazardous Chemical Syntheses**—Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.

4. **Designing Safer Chemicals**—Chemical products should be designed to affect their desired function while minimizing their toxicity.

5. **Safer Solvents and Auxiliaries**—The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.

6. **Design for Energy Efficiency**—Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.

7. **Use of Renewable Feedstocks**—A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.

8. **Reduce Derivatives**—Unnecessary derivatization (use of blocking groups, protection/ deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.

9. **Catalysis**—Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. **Design for Degradation**—Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.

11. **Real-time analysis for Pollution Prevention**—Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. **Inherently Safer Chemistry for Accident Prevention**—Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

[1]Green Chemistry Definition. http://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/definition.html (accessed August 15, 2015).

[2]Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30.

2161 Tentative ACS Fall Schedule

September

4 2015-2016 Officer's Meeting

11 Welcome to the New Term
with Pizza

18 The Pre-Professional Timeline
with Ms. Angela Illig

25 The Hows and Whys of Graduate School
with Professor Steve Weber

October

2 All About Career Services
with Ms. Emily Bennett

9 A Graduate Student's Experience

16 Preparation for National Chemistry Week

23 Pumpkin Painting

30 The Science Industry

November

6 Preparing for Saturday Science

13 Green Chemistry in Pittsburgh

20 Fall Term Awards Ceremony

27 Thanksgiving Break

December

4 Fall Term Birthday Bash

11 End of Term Meeting

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 135 Chevron Science Center. To join, complete the application form below and come to one of our meetings. Our first meeting will be <u>September 11, 2015</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.