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Chemistry Outlook

An Activity of
The Committee on Chemistry in the Two-Year Colleges
Division of Chemical Education
American Chemical Society

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Scott Donnelly, Chair

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Nitrogen

Notes From The Chair

Scott Donnelly
Arizona Western College
Yuma, AZ

First, some much deserved Thank Yous. In March, Front Range Community College outside Denver hosted the 209th 2YC₃ conference and in May Windward Community College in Kāne'ohe, Hawaii hosted the 210th. It takes a lot of dedication, organizational and people skills, and attention to details to host a conference. And I am pleased to say that Denis Kissounko, Mary Mattson, and Jason Jadin, organizers of the 209th, and Letty Colmenares, Christopher Guay, Bradley Ashburn, Kathleen Ogata, and Michael Ferguson, organizers of the 210th, rose to the challenge and pulled off highly successful and memorable conferences. On behalf of the 2YC₃ organization, its officers, and its members I want to extend a heartfelt 'Thank You' to these folks whose commitment to quality chemistry education is worthy of emulation.

The academic year has ended and during the next two months no doubt you'll spend some time thinking about what adjustments to make in lecture and lab for the coming year. Perhaps some of what follows can be used to pique student curiosity about chemistry.

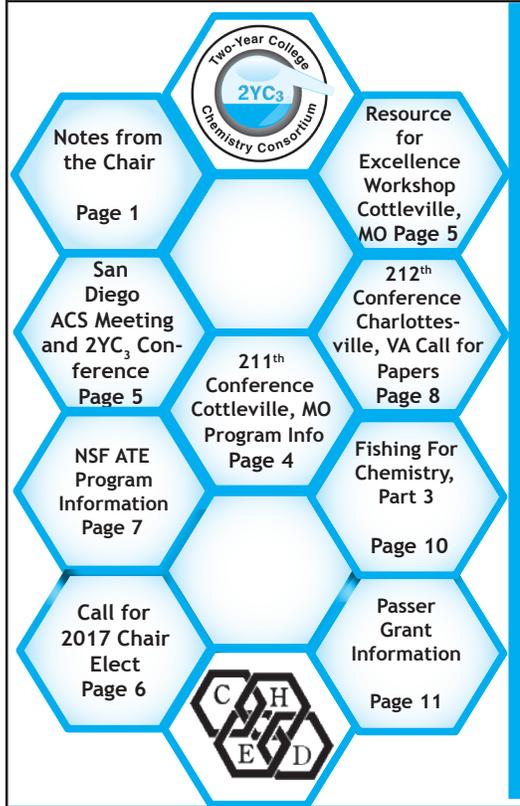
Inorganic nomenclature and accompanying atom stoichiometry in general chemistry does not have to be an ashen, pallid topic. Add a riot of color by using the stunningly colorful infographic associated with the article Terra Cotta Army: True Colors in the June 2012 hard copy issue of National Geographic magazine. The award-winning infographic shows a reproduction of a terra cotta warrior in what are believed to be the original pigment colors used when first painted 2,000 years ago. Only a few terra cotta warriors had enough paint still intact for accurate analysis of the pigments' chemical composition- red (cinnabar, HgS), blue (azurite, $\text{Cu}(\text{OH})_2 \cdot 2(\text{CuCO}_3)$), green (malachite, $\text{Cu}(\text{OH})_2 \cdot (\text{CuCO}_3)$), and purple (Han purple, $\text{BaCuSi}_2\text{O}_6$ and Han blue, $\text{BaCuSi}_4\text{O}_{10}$)¹⁻⁴.

Note that for azurite and malachite the charge on copper is the same. So why the difference in color? Ask students to propose a plausible starting point to

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INSIDE THIS ISSUE!

Vol. 2015 – Issue III



ACS
Chemistry for Life®

211th CONFERENCE

September 18-19, 2015

St. Charles Community College

Cottleville, MO

Contact: Beth Michael-Smith

Email: bmichael-smith@stchas.edu**212th CONFERENCE**

November 6-7, 2015

Piedmont Virginia Community College

Charlottesville, VA

Contact: Barbara Heyl

Email: bhey1@pvcc.edu**213th CONFERENCE (Tentative)**

March 11-12, 2016

San Diego City College

San Diego, CA

Contact: Robert Kojima

Email: rkojima@sdccd.edu**“Notes from the Chair” ...continued from page 1**

this question based on stoichiometry. Also, interject some geography. Use Goggle Earth to show them the location of the terra cotta warrior site in China.

A brief overview of the Periodic Table is usually on the menu early in the general chemistry curriculum. How then can one use the Periodic Table and the elements as perhaps a delectable appetizer before cooking up the main course on the general chemistry menu? Perhaps a few bites of the British Broadcasting Corporation (BBC) program entitled Elements⁵ will stimulate their chemistry taste buds. The Elements is built around three pragmatic questions: 1. Where do we get them?, 2. What do we use them for?, and 3. How do they fit into our economy? At the moment downloadable podcasts from the BBC website are free and available indefinitely. I don't guarantee it but I'm fairly sure that you'll be licking your fingers and asking for another appetizer of the elements before preparing the main course this fall.

And speaking of food, ask your students this- Which cooks an egg faster- water at 165°F, or olive oil at the same temperature? Better yet turn this thought question into the real deal (and then eat it). Do the test to support or refute your students' answers. But before doing it ask students to design the experiment that will demonstrably answer the question. Curious, eh? Take a look at the write up, What

Is Temperature and How Does It Differ From Heat on Guy Crosby's The Cooking Science Guy website⁶. He's the science editor for America's Test Kitchen, which includes the well-respected Cook's Illustrated magazine.

Getting hungrier? Below is a tasty morsel of other articles, among others, found on his website that may whet your chemistry teaching appetite:

The Science of Onion Flavor

Food Science- Macaron

Copper's Influence on the Formation of Egg White Foams

A Common Misconception About Frying Food

Darn, the piezoelectric igniter on the gas grill is not sparking (the piezo crystal is a ceramic perovskite, lead zirconate titanate)⁷. The air is too humid. Time to get out the ol' reliable Strike-Anywhere matches. But what's the pyro chemistry behind the spark that fuels the flame? It's a secret just like your mom's recipes. Actually, the chemistry is not a secret. Check out Wired magazine's section What's Inside⁸ which explores the science behind the everyday stuff that surrounds you -from Strike-Anywhere Matches to what's inside a Slim Jim to what's so instant about instant hot chocolate.

In closing, I hope to meet you at either of the two fall 2YC₃ conferences at St. Charles Community College in Cottleville, Missouri (Sept 18-19) or at Piedmont Virginia Community College in Charlottesville, Virginia (Nov 6-7). For more information about these two conferences, go to <http://www.2yc3.org/php/meetings.php>.

Slán go foil (Goodbye in Irish Gaelic)

Scott Donnelly

Works Cited:

1. Purple Reign: How Ancient Chinese Chemists Added Color to the Emperor's Army, Samir Patel, Archaeology, 60(5), September/October 2007. (downloaded from https://www.ldeo.columbia.edu/edu/eesj/gradpubs/GeneralMags/patel_chinesepurple_Archeology.pdf)
2. A Purple Barium Copper Silicate Pigment from Early China, Elisabeth West FitzHugh and Lynda A. Zycherman, Studies in Conservation, 37(3), August 1992
3. <http://www.asianart.org/collections/han-purple>
4. Terra Cotta Soldiers on the March (www.smithsonianmag.com/history/terra-cotta-soldiers-on-the-march-30942673/)
5. <http://www.bbc.co.uk/programmes/p01rcn6/episodes/downloads>
6. <http://www.cookingscienceguy.com/pages/> (click on the link, Cooking Science Notes)
7. <http://piceramic.com/piezo-technology/fundamentals.html>
8. <http://video.wired.com/series/what-s-inside>

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2YC₃ Membership Form

Please consider supporting the 2YC₃ by becoming a member or renewing your membership. Annual dues are only **\$25**.

There is no longer a special rate on joint membership with DivCHED. If you are interested in joining DivCHED, please go to <http://www.divched.org/> and click the Membership link on the left.

I wish to: _____ Become a member of 2YC₃
_____ Renew my 2YC₃ Membership

I am a: _____ Two-Year College Teacher _____ Four-Year College Teacher
_____ High School Teacher _____ Other

Your Name: _____

Institution: _____

Address: _____
Street City, State 9-Digit Zip Code

Phone: _____ **Email:** _____

Current Member of: _____ ACS _____ DivCHED

Names of current members are posted on the 2YC₃ website. The list includes names, institutional affiliation, and membership expiration date only. Email addresses and phone numbers are NOT listed. If you do NOT want your name listed, check here _____.

- **Secure electronic payments for membership dues now accepted. Select 'Membership Form' on the 2YC₃ website to become a member.**

- **If paying by check, please send your check, payable to 2YC₃, for \$25 to:**

Thomas Higgins, Harold Washington College, 30 E Lake St, Chicago, IL 60601

210th 2YC₃ Conference

Gateway to the Future: Preparing Students for the Next Step

September 18-19, 2015

St. Charles Community College

4601 Mid Rivers Mall Drive, Cottleville, MO 63376

Call for Papers

We invite you to attend the 211th 2YC₃ Program September 18-19, 2015. The conference will be held on the campus of St. Charles Community College in Cottleville, MO located west of St. Louis. We currently are looking for colleagues who would like to contribute to our program by giving a presentation, leading a workshop, or participating in a panel discussion. We encourage topics related to our theme which is focused on serving as a bridge for students to move forward into their career or academic futures. If you would like to present on a different topic, please do not hesitate to submit an abstract, as we encourage as diverse a program as possible. The due date for submitting abstracts is September 1, 2015.

Program Highlights

Friday Keynote Address – “Gateway to the Future: Preparing Students to Earn a Baccalaureate Degree in Chemistry” presented by Dr. Tim Walston and Dr. Barbara Kramer

Dr. Barbara Kramer is a Professor of Chemistry at Truman State University. Dr. Tim Walston is an Associate Professor of Biology at Truman State University. Both serve as Co-Directors of Truman’s STEM Talent Expansion Programs (STEP) Office, working to increase opportunities for degree attainment in science and math for both traditional and transfer students.

Friday Banquet Speaker – Dr. Christopher Spilling

Dr. Spilling received his B.Sc. (Hons.) degree and Ph.D. degree from the University of Technology, Loughborough, England. He was a Postdoctoral Fellow at Northwestern University before joining the UM-St. Louis faculty in 1989.

Saturday Keynote Address – Presented by Dr. Tamara Janke and Dr. John Bookstaver

Dr. Tammy Jahnke is Dean of the College of Natural and Applied Sciences at Missouri State University. Dr. Bookstaver is Dean of Business, Science, Education, Math, and Computer Science at St. Charles Community College.

Travel/Directions

Lambert-St. Louis International Airport (STL) is the closest airport to the conference venue located about 18 miles away. Car rental, shuttles and taxis are available at the airport. St. Charles Community College is located on Mid Rivers Mall Drive taking Exit 222 from Interstate-70.

Lodging

The Drury Inn in St. Peters is accommodating 2YC₃ with a special rate of \$106.95 or \$109.95 plus tax. Online reservations can be made using the link from the conference website. Phone reservations can be made by calling 1-800-325-0720 using group number 2238373 or asking for the 2YC₃ room rate.

Registration and Conference Website

The latest conference updates are available on the 211th conference website: <https://www.stchas.edu/2yc3/>

Conference Chairs: John Bookstaver jbookstaver@stchas.edu &

Beth Michael-Smith bmichael-smith@stchas.edu

Local Arrangements: Heather Stueben hstueben@stchas.edu

Exhibits: Mara Vorachek-Warren mvorachek-warren@stchas.edu



Need ideas?

211th Two-Year College Chemistry Consortium
St. Charles Community College, Cottleville, MO
September 18-19, 2015

Using the ACS Guidelines for Chemistry in Two-Year College Programs: A Resources for Excellence Workshop

At this workshop, you will

- Get ideas for using ACS guidelines to strengthen education at your college
- Connect with other two-year college chemistry faculty
- Discover resources to foster excellence

There is no charge for conference participants.

www.acs.org/ResourcesforExcellence



213th 2YC₃ Conference and 251st ACS National Meeting in San Diego March 2016

The **213th 2YC₃ Conference** will be held in San Diego in March 2016. It is tentatively set to be held at San Diego City College on March 11-12, 2016. If you would like more information, contact Robert Kojima (rjokima@sdccd.edu).

The **251st ACS Meeting** will also be held in San Diego from March 13-17. The program theme will be “Computers in Chemistry”. If you have any questions, please contact the meeting co-chairs: Iona Black (diblack4@gmail.com) or Denyce Wicht (dwicht@suffolk.edu). Current sessions of interest include: *Chemistry Education Research (Peer-reviewed and General)*, *Chemistry Education Research (Graduate Student Research Forum)*, *Curricular Innovations in Undergraduate Chemical Education Impacted by NSF*, *Faculty Development Initiatives*, *Implementing Discovery-Based Research Experiences in Undergraduate Chemistry Courses*, *Molecular Modeling at the Undergraduate Level*, *Online Chemical Education*, *Polymer Ambassador Program for K-12*, *Process-Oriented Guided Inquiry Learning (POGIL)*, *Research on Learning in the Lab*, and *Undergraduate Research Posters*.

Call for applications for the office of 2017 Chair Elect of 2YC₃

The Committee on Chemistry in the Two-Year College (COCTYC), 2YC₃'s executive governing board is actively seeking interested applicants for the 2017 Chair Elect.

Application for Chair-Elect for 2017 must include:

- A. Pertinent personal data such as name, college, job title, address, etc.
- B. A brief statement of pertinent qualification, signed by the nominee.
- C. A statement indicating a willingness to serve signed by the nominee.
- D. A statement of support from an appropriate person in the applicant's school- Department or Division Chair, Dean, Vice President, or President/Chancellor.

Failure to include all four items above will automatically disqualify the applicant from the election process.

To be eligible to be nominated an individual must:

1. be a two-year college chemistry faculty
2. have been a dues paying member of 2YC3 a minimum of three years prior to nomination
3. be a member of Division of Chemical Education (DivCHED)
4. have demonstrated leadership and organizational ability by serving as Chair or Co-Chair for a conference and in one or more of the following capacities:

- a. served three years on the (COCTYC).

- b. served as Program Chair, Local Arrangements Chair, or Exhibits Chair for a 2YC3 Conference.

- c. chaired a sub-committee of the COCTYC.

- d. contributed within the past three years two or more ways such as:

- acted as local industrial sponsor coordinator,

- chaired a conference section,

- presented a paper at a conference,

- moderated a panel at a conference, and

- other ways an individual has contributed.

Applications must be received by the current Chair Scott Donnelly (scott.donnelly@azwestern.edu) no later than October 1, 2015.

-The COCTYC will serve as a nominating/screening committee to generate a slate of candidates.

-Each 2YC₃ member shall vote for one nominee per office and the candidate who receives the greater number of votes shall be declared elected.

National Science Foundation (NSF) Grant: The Advanced Technological Education (ATE) Program

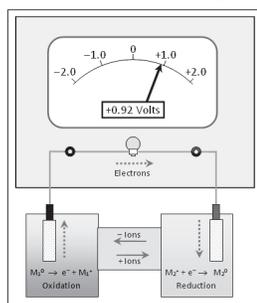
The Advanced Technological Education (ATE) program focuses on the education of technicians for the high-technology fields that drive our nation's economy. The program involves partnerships between academic institutions and industry to promote improvement in the education of science and engineering technicians at the undergraduate and secondary school levels. The ATE program supports curriculum development; professional development of college faculty and secondary school teachers; career pathways to two-year colleges from secondary schools and from two-year colleges to four-year institutions; and other activities. Another goal is articulation between two-year and four-year programs for K-12 prospective STEM teachers that focus on technological education. The program invites research proposals that advance the knowledge base related to technician education. The proposal deadline is **October 8, 2015**.

More information about the program can be found at:
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5464

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**212th 2YC₃ Conference
Conference Announcement
Call for Papers**

Creative Strategies for Teaching and Learning

November 6-7, 2015

**Piedmont Virginia Community College
501 College Drive, Charlottesville, VA 22902**

We currently are looking for colleagues who would like to contribute to our program by giving a presentation, leading a workshop, or participating in a panel discussion. We especially encourage topics related to our theme, which is focused on creative strategies for teaching and learning in chemistry. If you would like to present on a different topic, please do not hesitate to submit an abstract, as we encourage as diverse a program as possible. The due date for submitting abstracts is October 2, 2015.

The latest conference updates will be available on the 212th conference website:
<http://www.pvcc.edu/212th-2yc3-conference>

Conference Chairs

Co-Chair: Barbara Heyl

Co-Chair: Frances Rees

Exhibits Chair: Edward Funck

bheyl@pvcc.edu

frees@pvcc.edu

efunck@pvcc.edu

Science Coach *noun*

A chemist who volunteers with a teacher to enhance students' science education throughout one school year.

Example of SCIENCE COACH:

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Plan how chemist can help teacher



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Chemist helps teacher with **science courses**

Students **learn** and **love** science



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Fishing for Chemistry, Part 3

by Scott Donnelly

Arizona Western College, 2020 South Avenue 8E, Yuma, AZ 85365

In the previous newsletter I wrote about some chemistry behind one of the most extreme, energy-intensive migrations in the animal kingdom, that of Pacific salmon to their home waters in the final race of their lives. When salmon start their migration back to their natal birth waters, they are in peak physiological condition, a culmination of years at sea preparing for their high octane, energy-intensive death swim.

As if the journey isn't dangerous enough, numerous predators anxiously await their return. Among them is the grizzly (aka brown) bear, the largest and most widely distributed terrestrial predator of salmon. We've all seen the iconic photos of salmon leaping directly into the wide open mouths of grizzlies in Alaska. Let's though take a closer look at why coastal grizzly bears gorge themselves on salmon. During the latter half of organic chemistry 2 I talk about the chemistry of bear hibernation.

Imagine weighing 400-800 pounds and then taking a nap for six to seven months, during which time you don't eat, drink, urinate, or defecate, your heart rate drops from around 50-60 to as low as 10-15 beats per minute, and your metabolism is reduced by more than 50%. And to add to this metabolic miracle your core body temperature drops no more than 12°F below normal active body temperature of 100°F. When you wake after a long slumber, you've lost up to 20-30% of pre-nap body mass^{1,2} and not surprisingly, your stomach is angry. These are the reasons why coastal grizzlies gorge themselves on salmon, an oily fish loaded with unsaturated fatty acids and an impressive protein and consequently nitrogen biomass index.

In preparation for their winter nap in mid-summer to early fall grizzly bears enter hyperphagia, an eating binge period lasting 2-4 months when grizzlies ramp up their daily energy intake- estimates range from 10 to 20,000 calories per day depending on habitat resources- in order to put on weight and build sufficient fat reserves to survive the long winter denning period. During hyperphagia bear researchers estimate that grizzlies can consume 80-90 pounds of food per day and in doing so gain three to six pounds of fat a day³. Inland grizzlies of the Rocky Mountains, isolated from salmon migration runs, eat upwards of 10,000 fat laden moths (lipid 'Chiclets') per day, equating to an energy input of 5,000 calories⁴. To get to the moths they flip over large rocks on steep mountain slopes as if they were mere stones.

Using grizzly bear hibernation as a lead in, now students are primed for some organic chemistry. A grizzly survives hibernation basically by eating itself, namely its fat, which is oxidized to fatty acids. And one of the metabolic pathways utilized by hibernating bears is the enzyme dependent beta-oxidation of fatty acids, which at the end of the four reaction cycle produces acetyl-CoA, which enters into the ATP-energy producing Krebs's Cycle.

The four reactions are ubiquitous to organic chemistry- dehydration to form a trans (not cis) alkene, regiospecific hydration (1,4 but not 1,2-conjugate addition) across the trans alkene followed by oxidation of the secondary alcohol to a ketone, and ending with nucleophilic addition (thiolysis) to the previously formed ketone. The two carbon acetyl-CoA produced enters the Krebs's cycle, which eventually produces the energy needed for bear survival. The beta-oxidation cycle then repeats itself with the fatty acid minus two carbons until all the carbons in the original fatty acid tail are 'consumed'. I ask students to identify each type of reaction taking place during

the beta-oxidation of fatty acids.

Now ask students the following: Hibernating bears don't drink but they breathe continuously, exhaling water vapor. So how do they stay hydrated? Namely they don't urinate but also oxidation of fats (not fatty acids) releases water, which replenishes water vapor lost during breathing.

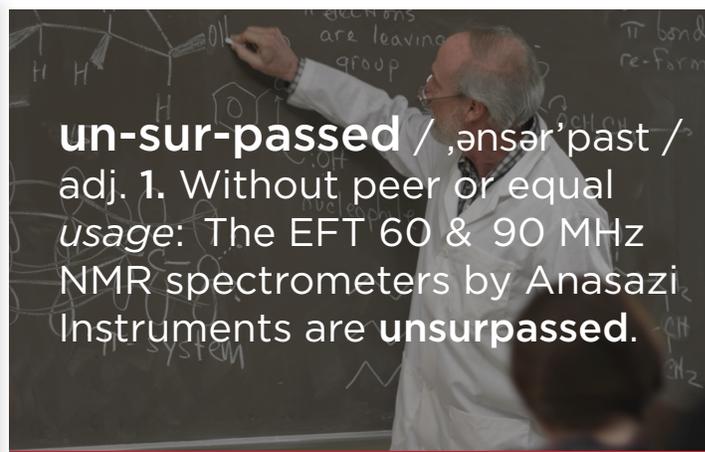
End the lecture with a teaser- How are camels able to go weeks without water? Spoiler alert- their hump(s) are not filled with water.

Citations:

1. Hibernation in Black Bears: Independence of Metabolic Suppression from Body Temperature, Øivind Tøien, John Blake, Dale M. Edgar, Dennis A. Grahn, H. Craig Heller, and Brian M. Barnes, Science 18 February 2011: 906-909.
2. Denning and Hibernation Behavior, <http://www.nps.gov/yell/learn/nature/denning.htm> and references therein.
3. www.nps.gov/kefj/learn/nature/brown-bear.htm
4. www.yellowstonegate.com/2013/10/grizzly-bears-find-fall-feast-in-well-traveled-moths/

Passer Education Grants

The Passer Grant is available to full time chemistry faculty at 2 or 4 year US colleges without graduate programs to help support continuing education. Awards may be used for short courses, advanced courses, or workshops (such as the cCWCS workshops held throughout the country). Upcoming applications for the program are due on September 1. If you would like more information, visit: <http://www.divched.org/awards/dorothy-and-moses-passer-education-fund-0>. You may also contact the Chair of Passer Education Grant Review Committee, Sue Nurrenbern, at nurrenbe@purdue.edu or scnurrenbern@gmail.com.



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