Washington College Chimica Acta

An Alumni Journal of News From and About
The Chemistry Community of Washington College

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VOLUME 1.0: ISSUE 2.0

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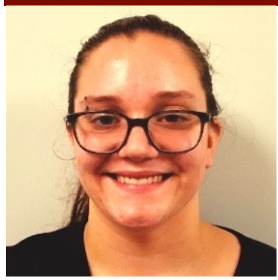
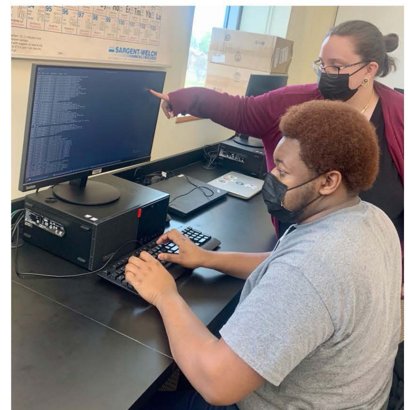
FACULTY NEWS: *Sarah N. Arradondo, Ph.D.*



SARAH N. ARRADONDO, Ph.D, who joined the Washington College Faculty in August 2019, has been appointed ***Clarence C. White Assistant Professor of Chemistry.*** Sarah holds a Ph.D. in Physical Chemistry from the University of Mississippi (2019) and a B.S. in Chemistry from Winona State University (2014). Currently, Sarah teaches **CHE 220: Quantitative Chemical Analysis**, which is typically taken by sophomores, as well as the physical chemistry sequence consisting of **CHE 305: Thermodynamics & Kinetics** and **CHE 306: Quantum Chemistry & Spectroscopy**, which are both taken by juniors and seniors. She also teaches **CHE 392: Chemistry Junior Seminar,** in rotation with the other departmental faculty, and **CHE 394: Special Topics in Computational Chemistry.** Her research consists of using computer simulations to predict chemical and physical properties of molecular systems that contain non-covalent or long-range interactions. These non-covalent interactions can change a system's structure, energy, and other associated properties. Utilizing simulations can provide accurate property predictions for these challenging molecular systems.



Dr. Arradondo guiding her research student with a **Senior Capstone Experience** issue,

Sarah N. Arradondo, Ph.D.

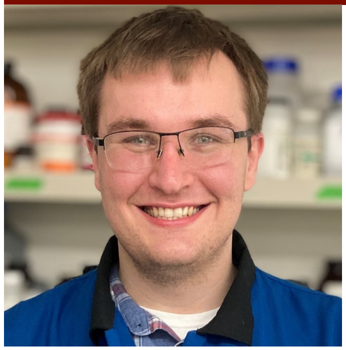
Dr. Arrodondo serves as Faculty Advisor for the **Gamma Eta Chapter** of the ***Gamma Sigma Epsilon Chemistry Honor Society.***

Read more about Sarah, her teaching focus, her research program in Computational Chemistry, and her publications at
https://www.washcoll.edu/people_departments/faculty/arradondo-sarah.php

2021 Induction of New Members into **Gamma Eta Chapter** of ***Gamma Sigma Epsilon***

The Clarence C. White Chair in Chemistry was established in 1997 through an endowment provided by Mary Jammer White, in memory of her late husband Clarence. Clarence C. White, a native of Cumberland, MD, was a 1916 graduate of Washington College, with a combined major in Science and Mathematics, and Valedictorian of his class. Following graduation, he was employed by E.I. DuPont Company in Wilmington, DE. Following military service in WWI, he was employed as a chemist with by N&G Taylor Company in Cumberland, MD, from where he was recruited to be principal metallurgist with U.S. Steel in Birmingham, AL. He died March 16, 1964.

FACULTY NEWS: *Jeremy P. Bard*



EDUCATION:
2016–2021: Ph.D. in Chemistry, *University of Oregon*
Thesis Title: *“Systematic Synthesis and Characterization of the 2-λ5-Phosphaquinolin-2-one Scaffold Towards Their Optimization and Application”*

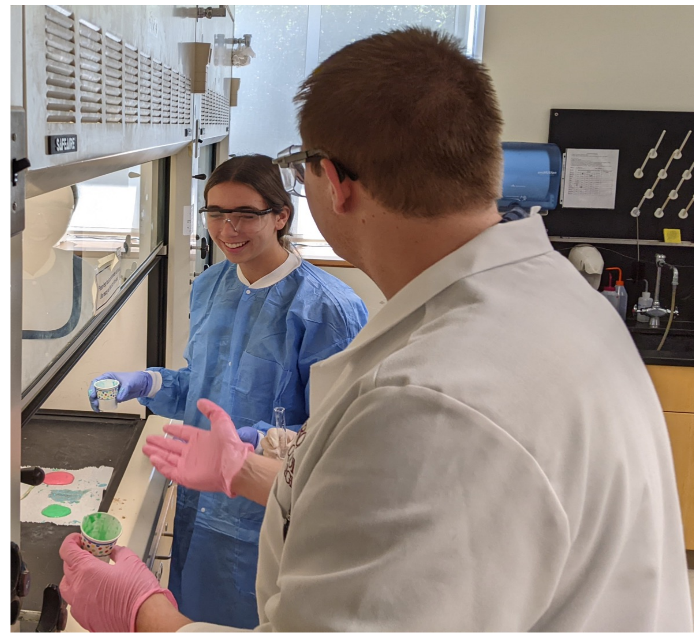
2012–2016: B.S. in Chemistry, ***Summa cum Laude;*** Minor in Mathematics, *Eastern Oregon University*

Jeremy arrived at Washington College in July 2022, having served as Visiting Assistant Professor of Chemistry at Roanoke College (2021-2022), which followed his receiving his Ph.D. in 2021 from University of Oregon. He credits his undergraduate experiences at Eastern Oregon University, inside and outside the classroom, as crucial in his choosing of a career in teaching at the undergraduate level.

“Taking general and organic chemistry courses at Eastern Oregon University showed me how interesting and pivotal chemistry is to the world around us. To get the most out of these courses, I would frequently work in study groups and talk with several people about the topics. After finishing the courses, I became a tutor for the organic chemistry course, which is where I realized that I found great fulfillment in the teaching of chemistry. Since then, I have strived to shape my career around the teaching of chemistry, specifically at an undergraduate level, as I aspire to create the same experience for my students that I had when I was an undergraduate.”

FACULTY NEWS: *Jeremy Bard*

Professor Bard and student shown engaged in a discussion about Hückel's Rule and Aromaticity.



Professor Bard in a Q&A about lab work.
"What did you see & what does it mean?"

FACULTY NEWS: *Jeremy Bard*

His research focuses on the development of new and interesting types of Fluorescence Resonance Energy Transfer (FRET) dyes that seek to achieve high separations between the colors of light emitted and the colors of light absorbed. Additionally, he is working to develop a family of related ion-pair host molecules capable of selective sensing of certain ion pairs.

Jeremy is a member of the American Chemical Society and the Division of Organic Chemistry and the Division of Chemical Education.

More about Jeremy, his teaching and research, and his list of publications can be found at https://www.washcoll.edu/people_departments/faculty/jbard2.php

FACULTY NEWS: *Daniel S. May*

EDUCATION

2013 – 2018: Ph.D. in Pharmacognosy, *University of Illinois at Chicago (UIC), Chicago, IL*

Thesis Title: Phenotypic Screening and Genome Mining for the Discovery of Natural Products from the Genus *Nostoc*

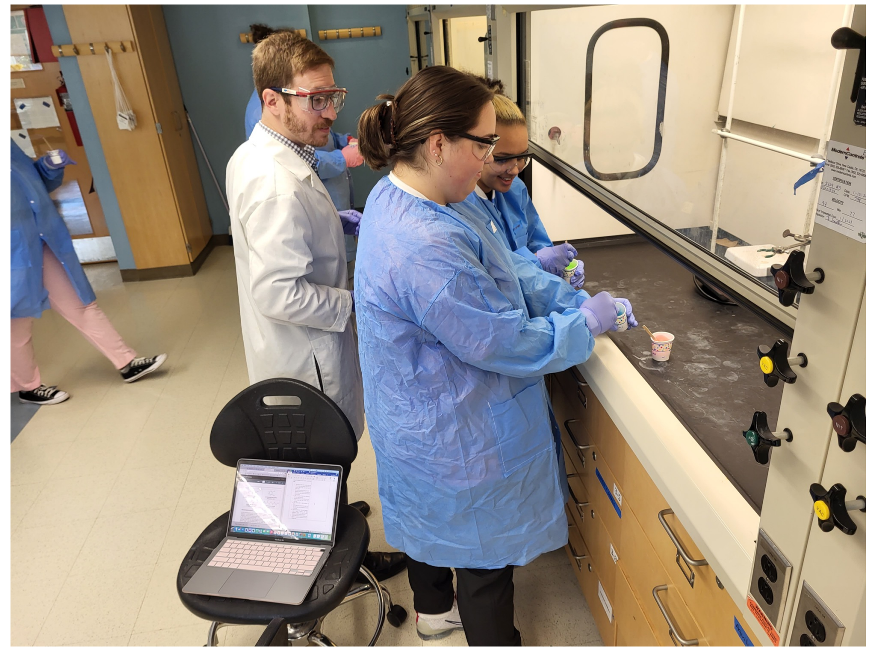
2009 – 2013: B.S. in Biology (Honors), ***Magna Cum Laude;*** Minor in Chemistry, *Alma College, Alma, MI*

Dan arrived at Washington College during the summer of 2022 having served as Postdoctoral Research Fellow (2018-2022) in the Department of Bacteriology at the University of Wisconsin in Madison, Wisconsin, which followed his receiving his Ph.D. in 2018 from the University of Illinois at Chicago.

Dan's interest in a career in teaching at the undergraduate level stems from his experiences at Alma College, a small College of the Liberal Arts and Sciences not unlike Washington College. He writes. *"It wasn't until I took a **Chemistry of Medicinal Plants** course that I began to fully appreciate the importance of basic chemistry concepts and how they applied to the topics I was most interested in. I love teaching because I can help undergraduate students make similar connections and discover a passion for chemistry in the topics they find most interesting."*

FACULTY NEWS: *Daniel May*

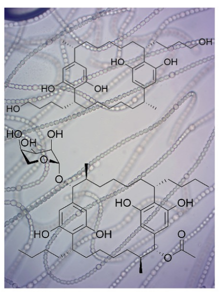
Professor May discusses repulsions between non-bonding electron pair with N-H sigma bonds.



Professor May monitors a team during work on an experiment: ***Polymer Synthesis and Properties*.**

FACULTY NEWS: *Daniel May*

Dan's research focuses on the natural products (small molecules) produced by bacteria associated with honeybee hives and native bee nests. Student researchers in the May Lab use chemical and biological techniques such as NMR, mass spectrometry, chromatography, bacterial culture, DNA extraction, PCR, and bioinformatics to discover and study natural products that could be used to treat brood diseases in honeybees.



Dan is a member of the American Society of Pharmacognosy (ASP); Rho Chi , an international honor society for pharmaceutical sciences; and Beta Beta Beta, a collegiate honor society and academic fraternity for students of the biological sciences.

More about Dan, his teaching and research, and his list of publications can be found at

https://www.washcoll.edu/people_departments/faculty/dmay2.php

STUDENT AWARDS

Gamma Sigma Epsilon Chemistry Honor Society

The April 7, 2022, Inductees into **Gamma Eta Chapter** of
Gamma Sigma Epsilon Chemistry Honor Society

Megan A. Blaine	Alison E. Buckwalter (*graduated in May 2022)*	Emilee C. Cramer	Shaniece D. Fraser (*graduated in May 2022*);	Elena A. Hilario (*Fall 2022 graduate*)	
Robert E. Hoot	Lauren T. Maynor	Savanna N. Pollard	Jackson J. Sopa	Julia E. Totis	Max R. Tucker

Max Tucker presented a poster on the Gamma Eta activities at the 49th Biennial Convention in Florida Gulf Coast University in Fort Myers, FL on November 11-13th, 2022. Max is a double major in Chemistry and Mathematics with minors in German and Physics.

Joseph H. McLain '37 Prize

Awarded to the graduating senior who, in the opinion of the Department of Chemistry, shows the greatest promise for making a future contribution to human understanding of chemistry. Endowed in 1982 by members of the American Pyrotechnics Association.

2022 Recipient: Hanna Leight Flayhart

STUDENT AWARDS

The James R. Miller ‘51 Award for Excellence in Chemistry

Awarded annually to an outstanding senior majoring in chemistry or a premedical student who has demonstrated special interest and high academic achievement in chemistry.

2022 Recipient: Brody W. Mann

The Eleanor and Francis Taylor Prize for in Chemistry

Awarded annually to a rising senior majoring in chemistry who has demonstrated special interest and high academic achievement in chemistry.

AY 2022-2023 Recipient: Max Tucker

PUMPKIN "POOF!"

The **Washington College Student Chapter of the American Chemical Society** and the ***Gamma Eta Chapter of the Gamma Sigma Epsilon Honor Society*** co-hosted their **Ninth Annual Explosive Pumpkin Event** on Friday, October 28, 2022, in the McLain Atrium of the John S. Toll Science Center.

Students and community members joined in on pumpkin painting, inside the Atrium, while waiting for the outdoor explosive demonstrations to start.



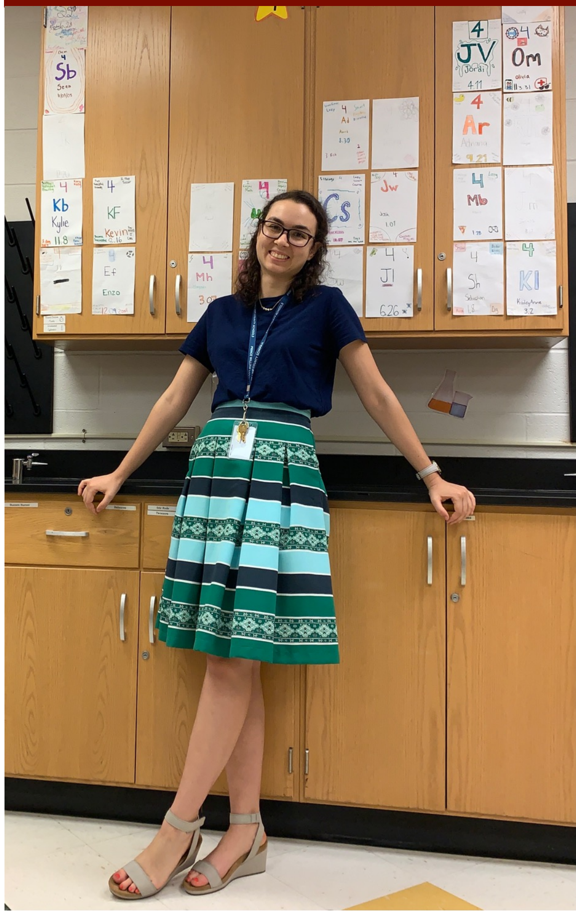

And then there were snacks to chew on while watching the outdoor explosions.

PUMPKIN "POOF!"

The explosive procedure itself relies on two separate reactions taking place in the closed atmosphere of the hollowed-out pumpkin—one that makes acetylene gas (C_2H_2) and a second that makes oxygen gas (O_2). A flame from a long-armed lighter ignites a combustion reaction that wipes the signature marking right off the pumpkin's face.




ALUMNI SPOTLIGHT: *Eleanor Byers ‘20*

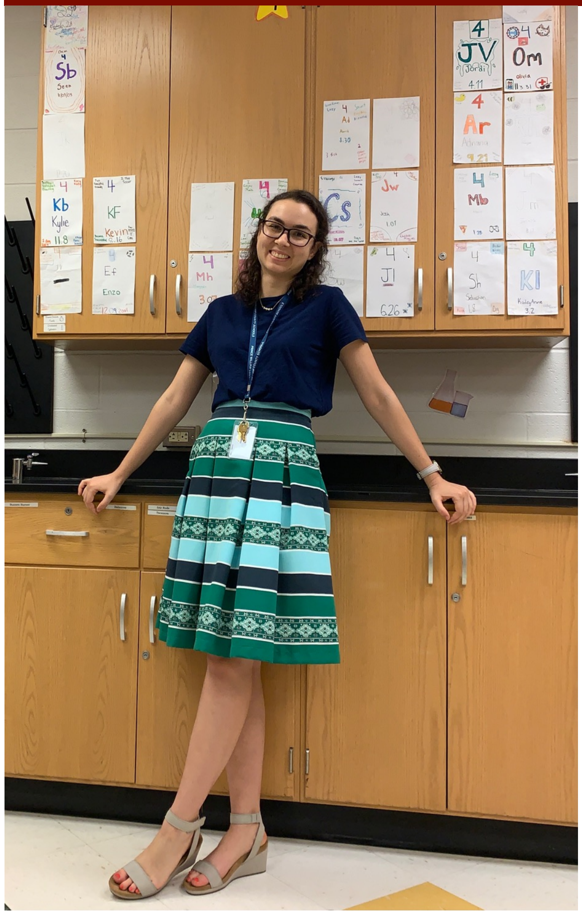


Eleanor Byers ‘20, who holds an M.Ed. from the University of Maryland, currently teaches Chemistry at Woodbridge Senior High School in Woodbridge, VA.

Eleanor graduated from Washington College, ***Summa cum Laude****,* in 2020, and was inducted into ***Phi Beta Kappa*** in February 2020. In 2019 she was inducted into the ***Gamma Eta Chapter of Gamma Sigma Epsilon,*** a national chemistry society and served as its President in 2019-2020. She was awarded the 2020 Joseph H. McLain ‘37 Prize in Chemistry and the 2020 American Chemical Society Award in Inorganic Chemistry.

Ellie is a member of **AACT (*****The American Association of Chemistry Teachers).*** Every month **AACT** spotlights a passionate member who is dedicated to enhancing chemistry inside and outside the classroom. **AACT** chose to **SPOTLIGHT** Ellie in their May 2022 issue, which can be found at https://teachchemistry.org/news/aact-member-spotlight-eleanor-byers

ALUMNI SPOTLIGHT: *Eleanor Byers '20*



Ellie conducted her Senior Capstone Experience (SCE) under the guidance and mentorship of Professor Anne Marteel-Parrish. Their research focused on the development of a **Guided-Inquiry, Green Chemistry** experiment in which students design, execute, and analyze a process aimed at synthesizing their own biomimetic product, specifically songbird preen oil.

The entire experiment is fully described in a publication, ***A Green Chemistry Guided-Inquiry Lab Designing Biomimetic Songbird Preen Oil from Waste Cooking Oil,*** by Eleanor Byers and Anne Marteel-Parrish, which can be found in the following pages.

NOTE: The biomimicry-focused guided-inquiry lab described in the following pages was implemented in three high schools (two public and one private) in four introductory 10th grade chemistry classrooms. Students who completed the lab provided feedback on its effectiveness and quality. These experiments were run under Washington College Institutional Review Board for Research on Human Subjects experimental number FA19-060.

Chemistry Solutions

November 2020 | Resource Feature

A Green Chemistry Guided-Inquiry Lab Designing Biomimetic Songbird Preen Oil from Waste Cooking Oil

By Eleanor Byers and Anne Marteel-Parrish

Chemistry Solutions

November 2020 | Resource Feature

A Green Chemistry Guided-Inquiry Lab Designing Biomimetic Songbird Preen Oil from Waste Cooking Oil

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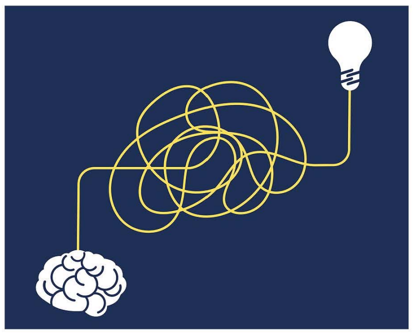
Advanced Chemistry, Demos & Labs, Inquiry

Chemistry as a (Green) Creative Discipline



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Chemistry is more than a subject to be learned or practiced by rote. How can we expect students to act like curious scientists, especially when they are mostly immersed in a verification laboratory setting?

Even at the high school level, I approach teaching chemistry as a creative discipline, and instill this value in my students through guided-inquiry labs where students play active roles in procedure development and data analysis. Students have greater engagement with the material when they are invested in the outcome. Guided-inquiry laboratories emphasize interpersonal skills in addition to the scientific content, which I encourage by having students consult within their group of three to four, or with another group, before asking me.

Like guided-inquiry laboratories, green chemistry also focuses on innovation and original research; students are encouraged to make choices, find alternatives, and innovate. The 12 Green Chemistry Principles, developed by Anastas and Warner, outline parameters to improve chemical products and processes in order to make them more sustainable.[1] Green chemistry and its principles are finding their way into more high school classrooms, but have not become universal by any means. The earlier and more often we expose students to green chemistry, the more likely it will become second nature.

Both biomimicry (literally, *the imitation of life)* and the use of nature as an inspiration in new products or processes are natural partners of green chemistry. Green chemistry looks to biomimicry, as nature has found ways to function effectively even with reduced resources or changes in the environment. We humans have industrialized many processes for our own convenience and commercial development; biomimetics is about reducing this damaging pattern and increasing the sustainability of industrial processes and chemical syntheses.[2] Biomimicry is an example of how students can be engaged in developing their own research methods and evaluating data. One size does not fit all — neither in guided-inquiry experiments, nor in biomimetic chemical syntheses.

Biomimetic preen oil

In this lab, students design, execute, and analyze a process aimed at synthesizing their own biomimetic product: songbird preen oil. Birds coat and protect their feathers with this waterproof and antibacterial substance, which is produced in their uropygial gland. Preen oil is composed of a wide array of organic compounds that vary by species, season, and region.[3] In order to produce a biomimetic preen oil that maintains both hydrophobic and antibacterial properties, the key components of an unsaturated oil base as well as methyl ketones must be present in the final product.

Methyl ketones are responsible for the characteristic flavor and scent associated with blue cheese. Methyl ketones can be synthesized from fatty acids in milk using a mold found in blue cheese known as *Penicillium roqueforti* through enzymatic and oxidative processes.[4,5] Inspired by the cheese-making process, I developed a process in which *P. roqueforti* from blue cheese slurries facilitates the reaction of fatty acids from waste cooking oil. A blue cheese slurry is composed of about 40% pre-ripened cheese solids, 55% water, and 5% salt, and must possess the characteristic flavor of the cheese.[4] Fatty acids added to the slurry incubate with the *P. roqueforti* to produce methyl ketones.

In this lab, waste cooking oil is used as the fatty acid feedstock to apply the green chemistry principle of using renewable feedstocks. Waste cooking oil is a huge environmental pollutant, especially in developed countries, such as the United States.

Designing a biomimetic preen oil synthesis

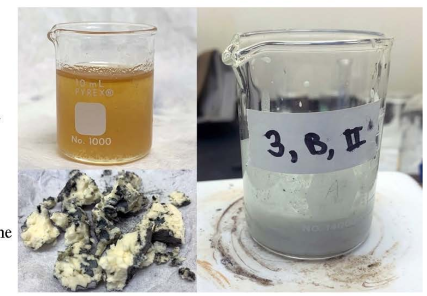

Figure 1. *Waste cooking oil and blue cheese slurry.*

One of the main aims of the lab is to simulate a research environment for students, where they are not told what to do, and instead have the freedom to test what is most effective. From the background materials to the post-lab questions, the lab activity is presented to students in an open-ended way. Background information, experimental goals, instructions about how to design, create, and test the preen oil, as well as pre- and post-lab questions are all provided in the student handouts.

The pre-lab questions prepare students for the hands-on portion of the activity and allow them to show understanding of the principles guiding the activity, including green chemistry, biomimicry, and methyl ketones. Students use the background information provided to complete the pre-lab; additional resources are not necessary. Before the activity, students should also work with their group to outline the steps they will use when designing their biomimetic oil. In my experience, allowing students to review the background material, and even begin to write an outlined procedure before the laboratory period, is more beneficial for students than simply introducing them to the experiment and instructing them to conduct it in an allotted period of time.

Students are given an outline of the experimental goals involved in creating and mixing a slurry, and filtering and testing their oil — and then are instructed to design their own procedure in order to meet these goals. They are constrained by the materials provided, and challenged to make the procedure as environmentally friendly as possible by incorporating the principles of green chemistry. Waste cooking oil, the feedstock, is the limiting reactant. The processes and techniques used in the lab, such as slurry-making and manual filtration, may be new to high school students, but should help in improving their current level of scientific inquiry.

During the activity, the slurry creation is the basis of the biomimetic oil design. In order to adapt a research-style experiment at the high school level, the optimal slurry ranges are provided to students as a guide. This strategy is mainly due to the time constraint as well as resource limitations. Students can choose the ratios of blue cheese, water, and salt to react with a designated volume (5 mL) of waste cooking oil to make whatever slurries they would like. If values within the given range of reactants are used, students are guaranteed to produce a successful biomimetic preen oil with methyl ketones present.

Figure 2. *Methylene blue test results from Day 0 (top) and Day 5 (bottom).*

Next, the students choose a length of time for the slurry to mix and incubate with the waste cooking oil in order for the *P. roqueforti* to produce methyl ketones from the oil fatty acids. Finally, students filter the oil from the slurry; two distinct layers form, one made of oil and the other one water-based. The oil layer can then be filtered manually using a coffee filter. Goggles and gloves should be worn by all students for the duration of the lab; proper use of PPE should mitigate any possible allergies to reactants.

Once the biomimetic oil has been filtered, students test their product for important chemical properties such as the presence of methyl ketones, hydrophobicity, and antibacterial ability. Step-by-step procedures are given to students for the iodoform and methylene blue tests that check for the presence of methyl ketones and antibacterial properties, respectively; however, students develop their own simple test for hydrophobicity. It would be prudent for students to wear gloves in addition to their goggles during the testing process, due to the 3M NaOH and iodine chemicals used. Students complete a data sheet, meant to mimic a research notebook, as they work to create and test their biomimetic oil.

After the lab, students are not asked to verify that they achieved an expected result. Instead, they are asked to evaluate and think about how to improve their design processes in a post-lab assignment in which the questions focus on self-reflection and forward thinking.

Student response to lab

The biomimicry-focused guided-inquiry lab described above was implemented in three high schools (two public and one private) in four introductory 10th-grade chemistry classrooms. Students who completed the lab provided feedback on its effectiveness and quality. These experiments were run under Washington College Institutional Review Board for Research on Human Subjects experimental number FA19-060. Students in the private school chemistry class had worked with guided-inquiry labs in their classroom earlier in the year. None of the students in either of the two public schools had ever been exposed to a guided-inquiry chemistry lab.

I implemented the lab as supplemental instruction to expose students to the topics of green chemistry and biomimicry, topics not commonly covered in high school chemistry curricula. The lab gives them real-world practice with units and significant figures, use of laboratory equipment, and the inclusion of mathematical concepts in science by calculating percentages. If this lab were to be implemented as an integral part of the curriculum, I would incorporate it into a chemical bonding or molecular structure unit to develop the connection between chemical form and macroscale function.

Students are told that the synthesized material needs to be hydrophobic, so one question that may follow is, *What type of molecules does it need to be comprised of?* Also, students will quickly think of oils that repel water, so another question could be, *If we need the product to exhibit antibacterial properties on a macroscale, what would that look like on a microscale?* Students are provided answers to these questions through their introduction to *P. roqueforti* and its role in creating antibacterial methyl ketones.

When asked to identify their favorite part of the activity, students mentioned either:

- the lab experience (including the equipment, procedure, reactants, etc.),
- testing their biomimetic oil,
- being afforded independence, or
- the novel ideas/concepts behind the activity.

Students especially enjoyed the testing of the product, as they felt this was extremely applicable to a real-life situation. It was gratifying for them to have chemically created a new product, and then determine if it had the desired properties. Students reported loving the new lab pattern, having fun, feeling less stressed than during normal labs, and valuing the environmental connection.

Students were similarly united in which parts they enjoyed *least*, which included:

- the independence expected of them,
- the blue cheese reactant (specifically the smell, and not being used to working with something like it in chemistry class),
- their group's time management relating to completing the experimental goals according to a schedule of their own making, or
- difficulty with various steps of the procedure.

Students who were familiar with verification labs were extremely uncomfortable with the freedom being afforded to them. They would often check in with me to make sure they were on the right track. During implementation, it was stressed to all students that there is not just one correct answer. The important pieces of the activity and biomimetic design are about the process and applying divergent thinking.

Students who had not worked in a guided-inquiry lab before also reported struggling with time management, since they were not used to such freedom and tended to want to tackle all steps at once. To remedy this, I notified the students in advance of the recommended time dedicated to each step so they could divide the tasks ahead of time. To add more structure to the in-class time for students new to guided-inquiry, I found it useful to set timers for each experimental goal. This ensured that students were progressing through the activity by being responsible for a specific task. Overall, this approach helps ensure students can complete each step without feeling rushed toward the end.

Technique-wise, during the activity, students struggled most with the gravity filtration to recover the biomimetic oil, the most manually "finicky" step of the experiment. However, this is the only type of filtration that can be universally done in high school chemistry classrooms that leads to clear, recovered biomimetic oil that is completely separated from any remaining slurry contaminants.

Even though many students were unsure at first, after reflecting on the lab, many liked the novel concept of a guided-inquiry laboratory activity integrating green chemistry and biomimicry. Most were also positively surprised how much the activity differed from their before-lab expectations: 76% of students felt the new approach was the most significant and positive difference, 17% of students appreciated the new knowledge/topic of the laboratory activity, and only 3% of students thought there was no difference from their expectations.

Why biomimicry and green chemistry through guided-inquiry?

Research-based labs that focus on guided-inquiry, when introduced and continually implemented in all types of secondary classrooms, allow students to develop valuable skills such as problem-solving, independence, resilience, and collaboration.

The real-world applications in this lab span multiple disciplines, such as environmental science, engineering processes, and of course, green chemistry. Overall, both the green chemical synthesis and preen oil biomimicry, as well as the application of these topics in high school chemistry classrooms through guided-inquiry, are effective for both student and teacher, and should be expanded upon. After completing this lab, students displayed continued interest in green chemistry and biomimicry — vital topics for them as future scientists, engineers, and citizens.

References

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5. King, R. D.; Clegg, G. H. The metabolism of fatty acids, methyl ketones and secondary alcohols by *penicillium roqueforti* in blue cheese slurries. *Journal of the Science of Food and Agriculture*. 1979, 30, No. 2 (February), 197–202. https://doi.org/10.1002/jsfa.2740300215.

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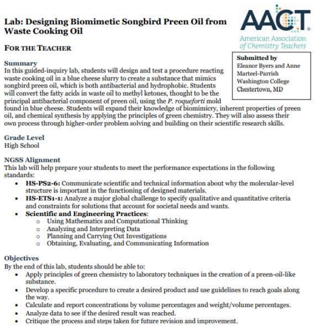

Lab: Designing Biomimetic Songbird Preen Oil from Waste Cooking Oil

For the Teacher

Submitted by
Eleanor Byers and Anne Marteel-Parrish
Washington College
Chestertown, MD

Summary
In this guided-inquiry lab, students will design and test a procedure reacting waste cooking oil in a blue cheese slurry to create a substance that mimics songbird preen oil, which is both antibacterial and hydrophobic. Students will convert the fatty acids in waste oil to methyl ketones, thought to be the principal antibacterial component of preen oil, using the *P. roqueforti* mold found in blue cheese. Students will expand their knowledge of biomimicry, inherent properties of preen oil, and chemical synthesis by applying the principles of green chemistry. They will also assess their own process through higher-order problem solving and building on their scientific research skills.

Grade Level
High School

NGSS Alignment
This lab will help prepare your students to meet the performance expectations in the following standards:

- **HS-PS2-6:** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- **HS-ETS1-1:** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- **Scientific and Engineering Practices**:
  - Using Mathematics and Computational Thinking
  - Analyzing and Interpreting Data
  - Planning and Carrying Out Investigations
  - Obtaining, Evaluating, and Communicating Information

Objectives
By the end of this lab, students should be able to:

- Apply principles of green chemistry to laboratory techniques in the creation of a preen-oil-like substance.
- Develop a specific procedure to create a desired product and use guidelines to reach goals along the way.
- Calculate and report concentrations by volume percentages and weight/volume percentages.
- Analyze data to see if the desired result was reached.
- Critique the process and steps taken for future revision and improvement.

Download the lab mentioned in this article from the AACT resource library:

- Designing Biomimetic Songbird Preen Oil from Waste Cooking Oil

Related Articles

- Getting the Facts Out About Secondary Chemistry Teaching
- Remote Technology Resources in a COVID-19 World
- Designing a Greener Le Châtelier's Principle Lab

More from the November 2020 issue »

About the Authors

Eleanor Byers is a pre-service chemistry teacher who is passionate about incorporating creativity into the high school chemistry classroom. This lab activity was developed as part of her undergraduate senior thesis. She graduated with a B.S. in Chemistry from Washington College in May 2020. Currently, she is a graduate student earning her Master of Education and teaching certificate in the University of Maryland's MCERT program.

Dr. Anne Marteel-Parrish is a professor of chemistry who defines herself as a green materials scientist. She teaches chemistry courses ranging from an introductory course for first-year students to multi-disciplinary courses such as "Greener and Sustainable Chemistry" and "Art in the Anthropocene." She has published many peer-reviewed publications with students on the topic of green chemistry, as well as a textbook titled, *Green Chemistry and Engineering: A Pathway to Sustainability*. She has been the advisor of the Honor Society in Chemistry (Gamma Eta chapter) since its inception and is actively involved in community service activities with local schools and organizations.

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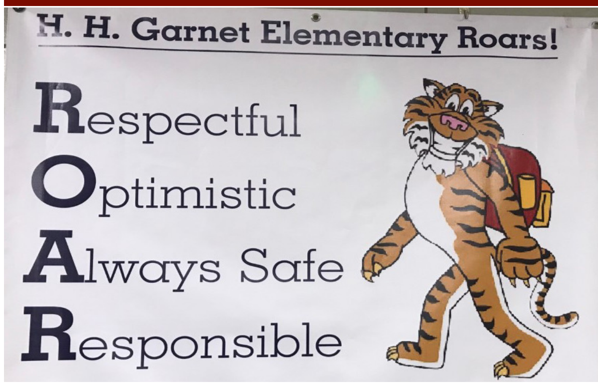
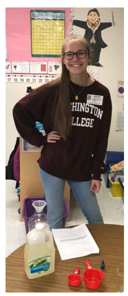
DEPARTMENT OUTREACH



On Friday, November 11, 2022, thirteen members of the ***Washington College Student Chapter of the American Chemical Society*** and the **Gamma Eta Chapter** of ***Gamma Sigma Epsilon Chemistry Honor Society,*** *[Jocelyn Aquilino, Erin Helgerman, Tiana Edwards, Mackenzie Stelyn, Regina Del Pilar, Lili Elgayar, Halina Saydam, Vani Chauhan, Leilani Roper, Julia Totis, Jackson Sopa, Emma Macturk , Kyaran Balin-Brooks]* accompanied by **Professor Anne Marteel-Parrish,** *Frank J. Creegan Professor of Green Chemistry,* brought hands-on experiences in chemistry to three classes *(16 students in each*) of first graders at **Henry Highland Garnet Elementary School** in Chestertown, MD.

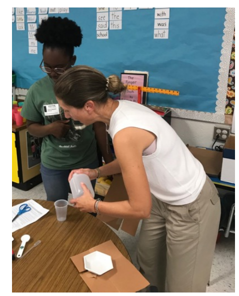

Erin Helgerman '26

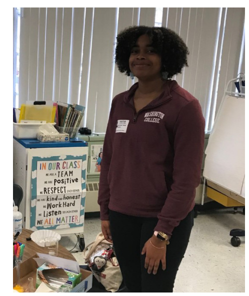

Jackson Sopa '23 & Emma Macturk '23


Jocelyn Aquilino '26


Leilani Roper '24

Mackenzie Stelyn '25


Tiana Edwards '25, with Professor Marteel-Parrish


Kyaran Balin-Brooks '26


Vani Chauhan '25 & Halina Saydam '25

WAC students getting ready to introduce Garnet Elementary School First-Graders to a few chemical principles.

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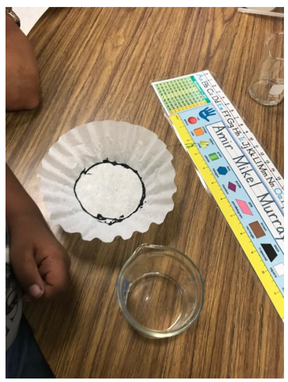
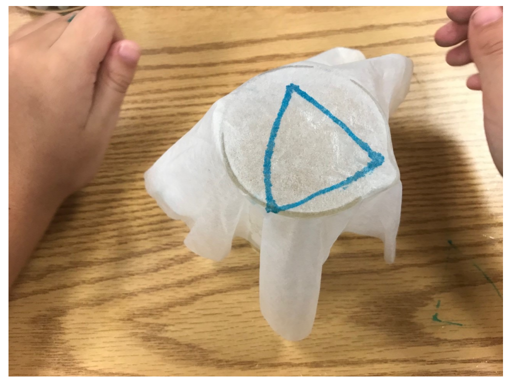
Three stations were set up in each of the three classrooms and teams of 5-6 first-graders, in a round-robin fashion, spent 20 minutes at each station to conduct activities on paper chromatography, crystal growing, and chemical "eruptions." WAC students were fully engaged as instructors at each station while Professor Marteel-Parrish served as a wondering "guide on the side."

Paper Chromatography Of Permanent Vs Non-permanent Markers

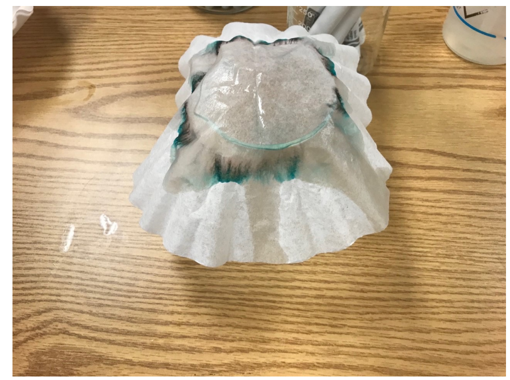
Regina Del Pilar '23 and Kyaran Balin-Brooks '26 review lesson plans for paper chromatography of inks in permanent and erasable markers.



Coffee filter marked and ready to be placed into water in beaker.



Student chose a blue permanent marker to test ink "composition." Looks like only one component. Hmm!



Student chose an erasable marker to test ink "composition." Looks like several components. Hmm!

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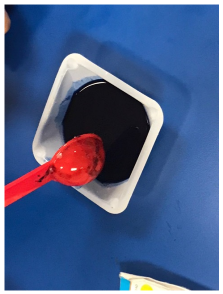
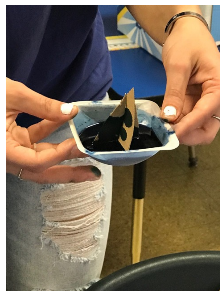
Growing Salt Crystals On A Crystal Tree

A first grader dissolves white NaCl in water.



Another adds blue dye to the solution.



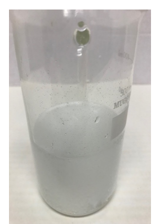
A carboard tree is placed into the solution.

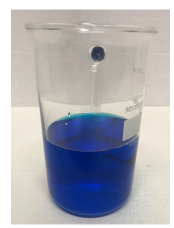
Assemblies are set aside for 3-days for wicking to occur.

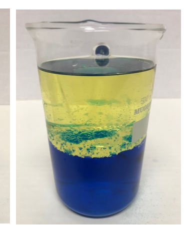
Students are surprised to see white, and not blue, crystals.

Study of Chemical "Eruptions"

When 2 tablets are added to 200 mL water, the resulting bubbles of CO_2 are released immediately (right image) to provide effervescence or fizzing.







Vegetable oil covered water, now blue for effect. Fizzing now coalesced due to insoluble oil to give LARGE bubbles.

In this activity students examine the best conditions to use Alka Seltzer to mimic a volcanic eruption.