PARTNERING FOR GREEN CHEMISTRY EDUCATION

South Dakota State University
Department of Chemistry and Biochemistry

Douglas E. Raynie and Matthew L. Miller
Department of Chemistry and Biochemistry
South Dakota State University
Brookings, SD
Thank you to Kate Anderson & Amy Cannon
Green Chemistry Commitment SIGNER
GREEN CHEMISTRY COMMITMENT

As a signer of the Green Chemistry Commitment, your department agrees to work towards adopting the Student Learning Objectives in your own unique way. Each institution will adopt the objectives differently, and through different timelines.

Upon graduation, we believe all chemistry majors should have proficiency in the following essential green chemistry competencies:

**Theory:** Have a working knowledge of the Twelve Principles of Green Chemistry.

**Toxicology:** Have an understanding of the principles of toxicology, the molecular mechanisms of how chemicals affect human health and the environment, and the resources to identify and assess molecular hazards.

**Laboratory Skills:** Possess the ability to assess chemical products and processes and design greener alternatives when appropriate.

**Application:** Be prepared to serve society in their professional capacity as scientists and professionals through the articulation, evaluation, and employment of methods and chemicals that are benign for human health and the environment.
whining there's no Uber in SD. The fact there is electricity/running H2O was sufficient for me
ChemEd17 bloodynewyorkers
“A teacher’s presence, in and out of the classroom has the greatest consequence, the noblest of professions.”

"We have a noble obligation to close the gap between the science-rich sector and the science-poor sector; it's widening at an alarming rate."

"Science is the driving force of our society, not just our economy."
A Special 2-Day Green Chemistry Training Program
FOR HIGH SCHOOL SCIENCE TEACHERS

When: July 22 and 23, 2017
Where: South Dakota State University
Avera Health & Science Center, Brookings, SD
FREE OF CHARGE: ChemEd, SDSU and Flinn Scientific.
Register: by June 23, 2017
1 Graduate Credit is available for participants from SDSU for $40
To register contact Matt Miller, SDSU, Chemistry Associate Professor at matt.miller@sdstate.edu

About South Dakota State University and Beyond Benign

SDSU, with an enrollment of 12,500, is the state’s land-grant institution. The Department of Chemistry and Biochemistry offers B.S., M.S., and Ph.D. degrees in chemistry, chemical education, and biochemistry certified by ACS.

BEYOND BENIGN Since 2007, Beyond Benign has disseminated sustainable science and green chemistry curriculum, case studies in innovation, lab experiments and outreach activities in K-12 and higher education throughout the world. More at beyondbenign.org.

INSTRUCTION TEAM:
Kate Anderson, Beyond Benign Director of Education, who earned her Master’s in Education: Curriculum and Instruction with an emphasis in Environmental Education from Florida Atlantic University in 2006.
Amy Cannon, Ph.D., Beyond Benign Executive Director, Amy holds a Ph.D. in Green Chemistry from the University of Massachusetts. Amy co-founded Beyond Benign in 2007 in order to bring the science of green chemistry to K-12 classrooms and higher education.
Beyond Benign Lead Teachers (peer teachers with green chemistry classroom experience)

About the Workshop
This one-day training will feature an introduction to green chemistry, industry examples of green technologies and green chemistry replacement labs. Participants will learn how to incorporate green chemistry principles and practices into the classroom in alignment with NGSS.

Following the training, teachers will be eligible to earn 1 graduate credit from SDSU and have access to Beyond Benign’s extensive repository of green chemistry curriculum and will be connected to a national network of sustainable science educators.

By teaching green chemistry concepts with support from Beyond Benign, science educators are providing the next generation of scientists and citizens with the skills and knowledge required to design and make informed decisions regarding green sustainable technologies that support human health and the environment.
Green Chemistry Workshop Agenda 7/22-7/23/17
South Dakota State University

7/22/17
8:00 a.m. – 8:30 a.m. Registration/Breakfast
8:30 a.m. – 8:45 a.m. Welcome and introductions
8:45 a.m. –10:15 a.m. Intro to Biomimicry and Green Chemistry
   Kate Anderson, Director of K-12 Education, Beyond Benign
   Mollie Enright, K-12 Program Manager, Beyond Benign
   Kathe Blue Hetter, BB Lead Teacher, Skyline High School, Ann Arbor, MI
   Richard Cooper, BB Lead Teacher, Science Tech High School, Ontario, CA
10:15 a.m. – 10:30 a.m. Replacement Lab Spotlight- Hazard Awareness
10:30 a.m. – 12:00 p.m. Lab Station Rotation
   1. Reactions
   2. Recycling PLA
   3. Wood Ash Titration
12:00 p.m. –1:00 p.m. Lunch
1:00 p.m. – 1:30 p.m. Resource Review
1:30 p.m. – 3:00 p.m. Lab Station Rotation
   1. Sublimation
   2. Vitamin C Clock
   3. Freezing Point Depression
   4. Endothermic and Exothermic Reactions
   5. Le Chatelier’s Principle
   6. Empirical Formula
3:00 p.m. – 4:45 p.m. Group work: Chemicals of concern replacements
4:45 p.m. – 5:00 p.m. Wrap-up
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South Dakota State University

7/23/17
8:00 a.m. – 8:15 a.m.  Review & Goals
8:15 a.m. – 9:30 a.m.  Advanced Green Chemistry Modules Rotation:
  •  Ecovative-Material science project using mushroom mycelium as a replacement to polystyrene for packaging, insulation etc.
  •  Sharklet- Microbiology and surface chemistry simulation using a material that prevents bacteria from growing
  •  Cogent- Natural dye chemistry
9:30 a.m. – 10:30 a.m.  Higher Education Panel: How Green Chemistry Prepares Students for the Future (Irv Levy, Doug Raynie)
10:30 a.m. – 11:45 a.m.  Group work: Chemicals of concern replacements presentations
11:45 a.m. – 12:00 p.m.  Wrap-up: Closing Remarks and Workshop Evaluations
GRADUATE CERTIFICATE IN GREEN CHEMISTRY EDUCATION (PROPOSED)

Intend to have approved and operational in AY 20/21

Completely online

Aligns with M.S. in Chemistry (Teaching Specialization)

12 credits, approx. $465 per credit:
- Introduction to Green Chemistry for High School Teachers (Beyond Benign), 3 cr.
- Advanced Green Chemistry: Connections to Our World (Beyond Benign), 3 cr.
- Chemistry Teaching Strategies, 3 cr.
- Chemical Safety, 3 x 1 cr.
Introduction to Green Chemistry for High School Teachers

Looking for a course that will support NGSS integration in your high school science & engineering class for remote learning? Are you looking to infuse how science and technology are creating solutions to environmental challenges? This 48-hour course load will equip you with the knowledge, skills, and resources to integrate green chemistry principles and practices into your teaching through real-world sustainable innovations. Develop safer labs and lessons aligned to your local standards in an interactive online environment designed for asynchronous learning. Course features forum discussions and lesson plan development. Discussions will focus on how to prepare for effective remote learning in this time of an ever-changing educational landscape.

Advanced Green Chemistry: Connections to Our World

Ready to take green chemistry to the next level in your classroom? Have you already started replacing your labs with safer materials? Are you looking to expand your students’ horizons and support their project-based learning and invention in the classroom? In this course you will expand your knowledge of green chemistry principles and practices by analyzing Presidential Green Chemistry Challenge Award technologies. In addition, you will investigate the pedagogy for effective guidance of student-based research projects and inquiry-based projects.
“Never before in an education course have I been required to make a specific plan to implement what I learned, and I think it will be extremely helpful in improving my practice. I feel a lot less stressed out about integrating green chemistry into my curriculum after completing the activities in this course.”
TEACHER REACTIONS

“I found it very interesting to note the dates on the videos and articles presented - mostly in the early 2010s. In other words, it's been at least 10 years since industry started focusing on trying to use green chemistry. Why do I point this out? Well, it really makes sense that we should be teaching our students in a way that prepares them to enter into modern chemistry. Let's face it, even newly trained science teachers are coming from educational philosophies and practices that are from an earlier era.”
"By using "green" thinking and analysis towards what I teach my students, I'm actually better preparing them for the modern world of chemistry/science into which they are entering. Another benefit of thinking (and acting) in a green manner in the high school chemistry lab is the reduction of wastes (i.e. less costly!) and safer (yay!) procedures. These are attributes that I'm sure students, parents, administrators, and community members would be all for having."
CHEM 778: CHEMISTRY TEACHING STRATEGIES

This course will focus on pedagogical and curricular strategies and the educational research which supports using these methods. The incorporation of pedagogical methods into science classrooms as modifications for or enhancement of traditional instruction will be the goal for participants. Additionally, the development of integrated curricula which use multiple content areas will be discussed. Pedagogical and curricular strategies developed during the course will be peer-evaluated and tested in individual classrooms.

SAFETY COURSES
• Laboratory Safety
• Chemical Storage and Waste Disposal
• Chemical Hygiene Plans and Safety Assessments
TENTATIVE SCHEDULE

- Intro to Green Chemistry: Spring and Summer
- Advanced Green Chemistry: Fall and Summer
- Teaching Strategies: Spring
- Lab Safety: Spring
- Chemical Storage and Waste Disposal: Summer
- Chemical Hygiene Plans & Safety Assessments: Fall
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