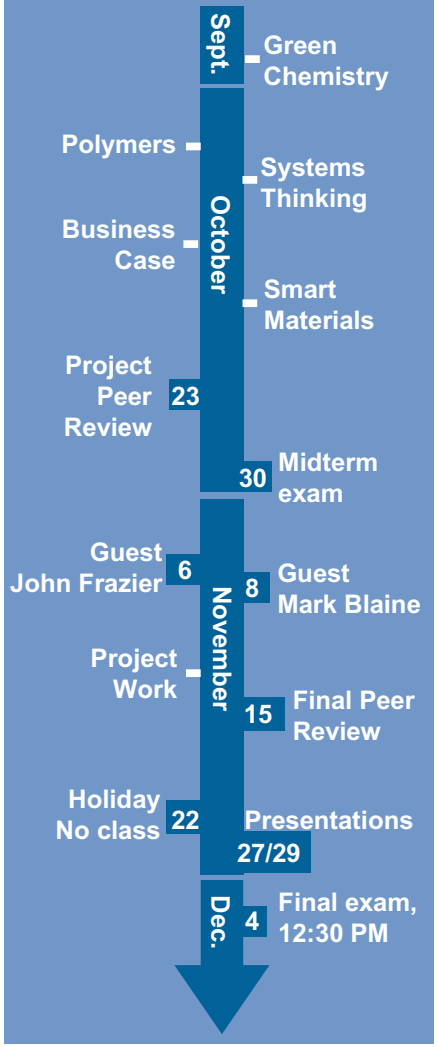
Course Timeline



CH 114: Green Product Design

Integrating green chemistry and life cycle thinking with design, communications, and sustainable business practices to create and accelerate the adoption of greener consumer products.

Class Location: 220 HEDCO
Class Time: Tues./Thurs. 1600 - 1750

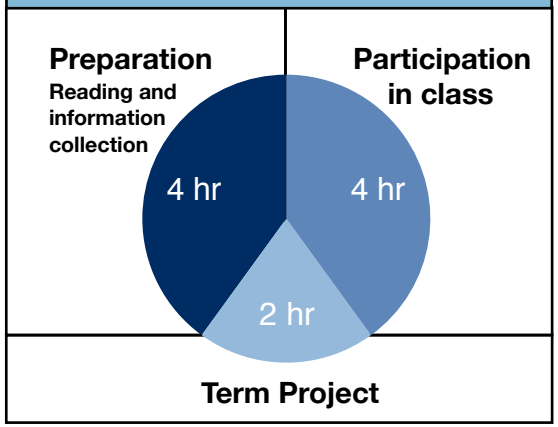
All course materials and resources are available on CANVAS.

Instructor:
Dr. Julie Haack
UO Dept Chem/Biochem
Email: jhaack@uoregon.edu
Phone: 541-346-4604
Office: Room 91 Klamath Hall

Science Literacy Fellow
Kiana Kawamura
Chemistry PhD Candidate
Email: kkawamu2@uoregon.edu

Chemistry GE
Checkers Marshall
Chemistry PhD Candidate
Email: checkers@uoregon.edu

Work load expectation: 10 hours/week



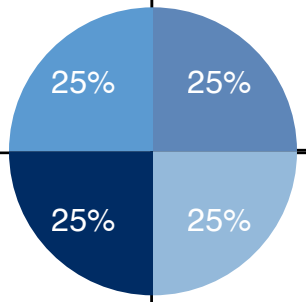
Grading breakdown

Term Project
Work in interdisciplinary teams using green chemistry and life cycle thinking to design and advocate for a greener consumer product. Grades will be based ability to craft and present a data-driven strategy for design & market adoption.

Midterm Exam Topics
Molecular Design (composition, structure, function, impacts on human health and the environment)

Green Chemistry/Life cycle thinking

Materials
Polymers
Nanoscale Materials
Wearable Devices



In class activities & assignments
Homework and hands on chemistry demonstrations

Data Analysis
Design Challenges
Interdisciplinary brain storming
Collaborative problem solving

Final Exam
Demonstrate ability to use a molecular perspective to assess the opportunities and challenges of greener wearables and use green chemistry and life cycle thinking to design more sustainable alternatives.

At the end of this course you will be able to use green chemistry and life cycle thinking to

1. Design a greener consumer product.
2. Advocate for greener than what, greener how and greener why.
3. Develop a strategy to accelerate the adoption of your greener product into the market.
4. Describe the opportunities and challenges of using polymers and nanoscale materials in greener consumer products.

RETAINING COPIES OF ALL COURSEWORK:
Please retain copies of all work submitted and the original copy of all work returned to you during the term until the final course grade has been posted. In the event of any question concerning whether grades have been accurately recorded, it is your responsibility to provide these copies as documentation.

ACCESSIBLE EDUCATION
The University of Oregon is working to create inclusive learning environments. If there are aspects of the instruction or design of this course that result in barriers to your participation, please notify me as soon as possible. The Accessible Education Center is located on the 1st Floor of Oregon Hall (541) 346-1155, uoaec@uoregon.edu. If you are not a student with a documented disability, but you would like me to know about class issues that will impact your ability to learn, I encourage you to come visit during office hours so that I can strategize how you can get the most out of this course.

ADDITIONAL ASSISTANCE
Tutoring and Learning Center (TLC) - Drop-in math and writing support in addition to tutoring, study skills support, and Class Encore. Located in the 4th Floor Knight Library (541) 346-3226, tlc@uoregon.edu.

Counseling Center - Call anytime to speak with a therapist who can provide support and connect you with resources. Located on the 2nd Floor of the Health Center(541)346-3227

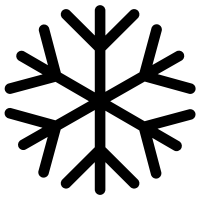
Center for Multicultural Academic Excellence (CMAE) - Their mission is to promote student retention and persistence for historically underrepresented and underserved populations. They develop and implement programs and services that support retention, academic excellence, and success at the UO and beyond. They reaffirm our commitment to all students, including undocumented and tuition equity students. Located on the 1st Floor of Oregon Hall (541) 346-3479, cmae@uoregon.edu

ACADEMIC INTEGRITY:
Academic dishonesty in any guise, including plagiarism, fabrication, and cheating, will not be tolerated. All work submitted in this course must be your own and produced exclusively for this course. The use of sources (ideas, quotations, paraphrases) must be properly acknowledged and documented. Consequences of academic dishonesty range from receipt of a failing grade on the assignment to an F in the course. All violations will be taken seriously and are noted on student disciplinary records. Please contact me with any questions you have about academic conduct.

INCLUSIVENESS: Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities.

Please notify me if you feel aspects of the course undermine these principles in any way. You may also notify the Department of Chemistry and Biochemistry at (541) 346-4601.

INCLEMENT WEATHER: In the event of inclement weather, the UO home webpage (www.uoregon.edu) will include a banner at the top of the page displaying information about delay or closure decisions for the Eugene campus. In the event of a class cancellation, for any reason, I will notify you by email, using Canvas, and post the cancellation on the course website.



Fine Print

GRADING: This course is interactive and your ability to excel will depend your in-class participation.

Grades will be awarded based on the following scale and you must complete all assigned work and exams to pass the course.

90 to 100% of the total points = A
80 to 89% of the total points = B
65 to 79% of the total points = C
50 to 64% of the total points = D
<50% of the total points = F

If you have chosen the P/N option, a total score of at least 65% is required to receive a P (pass) grade. A course grade of incomplete (I) will be considered on a case-by-case basis.

Final grades are based on the total amount of points obtained for all elements of the course. Please note that you must complete all assignments (including in-class activities) in order to pass the class. Late assignments must be turned in via email to jhaack@uoregon.edu.

EXAMS: Make-up exams or early exams are not provided. If you have to miss an exam for any reason, please notify Julie Haack ASAP to request an accommodation. The in-class and final exams are closed book. All cell phones, watches and other wireless communication devices must be turned OFF and placed under your seat with your backpack and other belongings. Headphones and unauthorized earpieces must be removed during exams. Due to the sophisticated nature of the material covered in this course, I do not allow dictionaries or translation devices to be used during exams.

Assignments

Developing the ability to evaluate and design greener products requires a robust collection of integrated skills in research, communication, and problem solving. Class activities and assignments are designed to help you develop, practice and refine these skills throughout the term.

You will participate in a variety of in-class activities that enable you to practice working with general concepts presented in lecture. These in-class activities promote communication and collaborative problem solving during class. These will be turned in during class.

Reading and Information Collection: Due to the rapidly evolving nature of wearable devices, I will provide a limited number of additional reading and homework assignments during the term. We will be utilizing a variety of source materials for this course. Some of the reading materials will be available via Canvas and some information will be accessible via the Internet.

SCIENCE LITERACY PROGRAM

As part of the Science Literacy Program, we will pay special attention to uncovering the ways that science is connected to larger societal issues and big ideas across and within the discipline. SLP courses include General Education courses for non-science majors and courses for science majors taught by teams of faculty, graduate fellows, and undergraduate scholars, who will include opportunities, during class time, for you to engage with the class topics through a variety of activities. For more information about the program, contact scilit.uoregon.edu.

Duty to Report: UO is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment, including sexual assault, domestic and dating violence and gender-based stalking. As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. As a member of the university community, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals here https://safe.uoregon.edu/services

Office Hours: I am here to help guide your learning and help you succeed during the course. I am available during office hours to answer questions about this course or provide additional resources. I invite you to come visit me, so I can meet you and learn more about your interests in the course.

I will be available for questions just before and just after class in the area just outside of our classroom 220 HEDCO. I am also available for general drop in office hours from 3-5 pm on Mondays and Wednesdays in room 91 Klamath Hall (inside the Chemistry Department office).
I am also available by appointment.

Course Description: These are interesting and exciting times – over the past few years we've seen a unique convergence between student interest and employer needs around sustainability. Students on campuses around the world are expressing a strong interest in sustainability yet they are often frustrated by the lack of knowledge and intellectual tools available to facilitate decision making and innovation in this area. Green product design (CH 114) examines the emerging partnerships between chemists, journalists, product designers, architects and business innovators to connect design and innovation to the science of sustainability.

This course illustrates how chemists play a central role in developing the knowledge and tools for society, not only to meet our basic needs for new materials, energy, clean water and food but also to address the important challenges of protecting human health and the environment.

This course focuses on integrating green chemistry with product design, journalism and communications and sustainable business practices and takes a systems approach to designing greener consumer products. Course content will focus on the use of green chemistry and life cycle thinking to design greener wearable devices (e.g., devices that have minimal impacts on human health and the environment). Throughout the term you will examine several case studies focusing on two classes of materials (1) polymers/plastics and (2) nanoscale materials and their use in wearable devices.

If you are majoring in liberal arts, product design, journalism and communications, business, education, finance, pre-law, or any other non-science area this course will help you to become a more informed citizen, consumer, and policy maker. You will gain the knowledge and critical thinking skills necessary to analyze technical challenged facing you today and in the future.

Learning Outcomes: At the end of this course students will be able to

1. Identify the different types of materials used to make wearable devices and understand the chemistry needed to create and modify the form and function of these devices to reduce their impacts on human health and the environment.
2. Use green chemistry and life cycle thinking as tools to (a) document and understand the impacts of wearable devices on human health and the environment, (b) create new or modify existing wearable devices with reduced impacts, and (c) develop a communication strategy that incentivizes change for businesses, consumers and society.
3. Create and use a research roadmap to explore a new field, align search strategies to information needs, and be able to access a variety of information systems.

CH 114
Green Product Design

SCHEDULE OF CLASSES
FALL 2018

Class meets in 220 HEDCO 1600-1750 T/R
CRN #11328 4 Credits

I'll do my best to keep this schedule, but shift happens sometimes.
I will try to communicate clearly any schedule changes

Please submit all assignments via CANVAS before the start of class.

	DATE	CLASS TOPIC		CLASS	READINGS (Read before class)	Assignments (Due in CANVAS)
1	9/25	Welcome/Introductions Course Overview Chemistry/Materials/Impacts	Wearables - Form/Function and Performance	1	R1 - *Sustainable Wearables for Enhancing the Quality of Life*	A1 - *Sustainable Wearables* (due in class)
	9/27	Transformation of Matter Green Chemistry	Life Cycle Thinking Research Roadmap	2	R2 - *General Chemistry - Introduction* R3 - *General Chemistry - Properties of Matter*	A2 - *Three Questions*
2	10/2	Chemistry of Polymers Greener than what?	Wearables Research	3	R4 - *Green Chemistry Theory and Practice*	A3 - *Wearables and Green Chemistry*
	10/4	Materials Design Intro to Systems Thinking		4	R5 - *Introduction: The System Lens* R6 - *Polymers*	A4 - *Chemistry Problem Set*
3	10/9	Green Chemistry Case Study Alternatives Assessment Green Design Strategies	Wearables - Opportunities/ Challenges	5	R7 - Life Cycle Assessment: Principles and Practice R8 - Report in Brief - Safer Chemical Alternatives	A5 - *Green Chemistry and Systems Thinking*
	10/11	Smart Materials Wearables	Introduce Term Project Research Roadmap	6	*None*	A6 - *Life Cycle Thinking*
4	10/16	Business Case for green chemistry	Review Core Materials	7	R9 - *Green to Gold*	A7 - *Project Ideas*
	10/18	Introduction to Nanomaterials Greener Wearables	Share project ideas and form teams	8	R10 - *ACS Nanotechnology*	A8 - *The Business Case for Greener Wearables*
5	10/23	Greener Nanoscience Lighting	Emerging Technologies Peer review project ideas	9	R11 - *Green Nanoscience*	A9 - *Practice problems*
	10/25	Emerging Technologies Exam Review	Finalize Project Teams	10	*R12 - Read Exam Review Sheet*	A10 - Greener Nano
6	10/30	**Midterm Exam - In Class**		11		No assignment
	11/1	Barriers to the implementation of green chemistry Research Roadmap		12	R13 - *Barriers to the Implementation of Green Chemistry in the United States*	A10 - *Barriers*
7	11/6	Guest Lecture John Frazier, Hohenstein Institute	*Closing the Loop*	13	R14 - *Circular Economy Overview*	Project #1 - Framing the Problem
	11/8	Guest Lecture Mark Blaine (UO Journalism)	*Telling the green story*	14	R15 - *The AND, BUT, THEREFORE of storytelling*	Project #2 - Refining the Problem Project #3 - Finding a Solution
8	11/13	Incentivizing Change Group Work		15		Project #4 - Product Design Project #5 - Business Case
	11/15	Peer review final project		16		Project #6 - Marketing/Communication
9	11/20	Final exam preparation Group Work - final presentation preparation		17		No assignment
	11/22	THANKSGIVING HOLIDAY! NO CLASS!		18		No assignment
10	11/27	**Team Presentations - Group A**		19		Student presentations and evaluation.
	11/29	**Team Presentations - Group B**		20		Student presentations and evaluation.
	12/4	**Final Exam Written (Tuesday)**			Start Time 12:30 pm	Room 220 HEDCO

Reading Assignments: All reading materials will be provided on CANVAS.

R1 - Lee, J.; Kim, D.; Ryoo, H-Y.; Shin, B-S. Sustainable Wearables: Wearable Technology for Enhancing the Quality of Human Life. Sustainability. **2016**, *8*, 466.

R2 - Wikibooks contributors, "General Chemistry/Introduction," *Wikibooks, The Free Textbook Project,* https://en.wikibooks.org/w/index.php?title=General_Chemistry/Introduction&oldid=3440931 (acce ssed September 24, 2018).

R3 - Wikibooks contributors, "General Chemistry/Properties of Matter/Basic Properties of Matter," *Wikibooks, The Free Textbook Project,* https://en.wikibooks.org/w/index.php?title=General_Chemistry/Properties_of_Matter/Basic_Properties_of_Matter&oldid=3470332 (accessed September 24, 2018).

R4 - Anasts, P.T.; Warner, J.C. *Green Chemistry Theory and Practice*;Oxford University Press: Oxford, 1998; pp 1-19.

R5 - Meadows, Donella H. “Introduction: The Systems Lens.” *Thinking in Systems*. Ed. Diana Wright. White River Junction, Vermont: Chelsea Green Publishing, 2008. 1-7. Print.

R6 - Hill, John W. “Polymers.” *Chemistry for Changing Times*, 14th edition. Boston, MA: Pearson Education, 2016. 185-207.

R7 - Scientific Applications International Corporation (US). Life Cycle Assessment. *Life Cycle Assessment: Principles and Practice*; EPA/600/R-06/060; Environmental Protection Agency (US); [Internet]. US [cited 2015 Sept. 27], **2006** May.

R8 - Committee on the Design and Evaluation of Safer Chemical Substitutions: A Framework to Inform Government and Industry Decision; Board on Chemical Sciences and Technology; Board on Environmental Studies and Toxicology; Division on Earth and Life Studies; National Research Council. *A Framework to Guide Selection of Chemical Alternatives-Report in Brief*. Washington (DC): National Academies Press (US); **2014** Oct 29.

R9 - Esty, D.C; Winston, A.S. *Green to Gold*; John Wiley & Sons: New Jersey, 2009; pp 1-30.

R10 - American Chemical Society. Nanotechnology. https://www.acs.org/content/acs/en/policy/nanotechnology.html (accessed September 23, 2018).

R11 - McKenzie LC. Hutchison JE. Green Nanoscience.pdf *Chimica oggi (Chemistry Today).* 2004; 22: 30-33.

R12 - Haack, Julie A. Exam Review Sheet (CANVAS).

R13 - Matus, K.J.M.; Clark, W.C.; Anastas, P.T.; Zimmerman, J. B. Barriers to the Implementation of Green Chemistry in the United States. *Environ. Sci. Technol*. **2012**, *46*, 10892-10899.

R14 - Ellen MacArthur Foundation. Circular Economy Overview, https://www.ellenmacarthurfoundation.org/circular-economy/overview/concept (accessed September 23, 2018).

R15 - Olson, Randy. "The And, But, Therefore of Storytelling" TEDMED 2013**,** https://www.youtube.com/watch?time_continue=91&v=ERB7ITvabA4 (accessed September 23, 2018).