

SIO 189/289: Pollution, Environment and Health

Syllabus v.1 - 29 Sep 2014

Fall 2014, TuTh 11:00-12:20, Cognitive Sciences Building 002

4 units credit, offered for letter grade

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Course description:

In less than 100 years, humans have produced nearly 85,000 synthetic chemicals and have dramatically increased the environmental concentrations of natural harmful compounds such as carbon dioxide and mercury. Is pollution a problem? Do environmental chemicals affect our health? How is science applied to solving our world's most pressing pollution problems?

This course has three major goals. The first is to study the scope and consequences of the pollution problem. The second is to understand the basic properties and fate of chemicals in the environment. The third is to study the biological mechanisms, particularly those operating at the cellular level, that determine accumulation and toxicity of chemicals. By the end of the course, students should have the basic toolkit necessary for evaluating complex information on the effects of pollutants on human and environmental health and an appreciation of the factors that shape our dependence on them.

Student discussion and participation are highly encouraged!

Prerequisites:

Introductory biology and chemistry are highly recommended. Having completed a basic course in toxicology will be helpful but is not required. If you are concerned about having sufficient background come talk to me – many students have done well without the pre-requisites as long as they cover the extra material on their own and meet regularly with the TAs.

Required reading:

Specific readings for each lecture will be announced in class. A required course reader (available from the bookstore) has relevant material from 4 textbooks on environmental science.

Online materials:

TED.ucsd.edu website. Original scientific papers will be posted to TED, and these are also required readings. **Please subscribe to the course twitter account @hamdounlab to receive updates with links to news articles relevant to the lectures.**

Recommended reading:

These two books on environmental science are recommended reading during the quarter, and some lecture material will be based on them.

1. *Merchants of Doubt* by Naomi Oreskes
2. *Plastic: A Toxic Love Story* by Susan Freinkel

You may submit a concise, well-written and original 2-page synopsis of one of these books for **3% extra credit**. Extra credit reports are due by **Nov 21**.

Grading:

30% Midterm Exam 1

30% Midterm Exam 2

30% Final

10% Op-ed Assignment (see attached)

The top op-eds will be shared in class in and their authors awarded the “**Green Pen**”.

Academic conduct:

Please see UCSD policy <http://students.ucsd.edu/academics/academic-integrity/defining.html>. **Please do not text, e-mail, surf the Internet, Facebook, tweet or otherwise be enslaved to your gadgets during class.** Phones are NOT allowed during exams. **All assignments must be your own independent work – plagiarism will be referred to campus authorities.**

Class Schedule:

UNIT I The behavior of chemicals in the environment.

- R Oct 2 Introduction to the class: Scope of the chemical problem.
T Oct 7 A brief history of toxicology. *Silent Spring*, DDT.
R Oct 9 Chemodynamics and physical properties of chemicals that govern accumulation in organisms.
T Oct 14 Environmental fate and transport of pollutants.
R Oct 16 Biotic and abiotic transformation of compounds in the environment.
T Oct 21 The mercury cycle – mind your sushi!
R Oct 23 Doubt: How and why we do not act.
T Oct 28 Midterm 1

Relevant reading in the course reader:

1. “Principles of Toxicology” by David Eaton and Steven Gilbert from *Casarett and Doull’s Toxicology*.
2. “Environmental Chemodynamics” and “Refractory pollutants” from *Environmental Toxicology and Chemistry* by Donald Crosby
3. “Fate and Transport of Contaminants” from Landis, Sofield and Yu.

UNIT II How chemicals interact with biological systems.

- R Oct 30 The intoxication: Introduction to the biological effects of chemicals.
Discussion of op-ed assignment.
T Nov 4 Biology as a solution to pollution: Bioremediation.
R Nov 6 Contaminants in the body: Absorption, Distribution, Metabolism and Excretion of Toxicants.
T Nov 11 Cellular defenses: Bouncers and policemen.
R Nov 13 Beautiful, unapologetic, polluting plastics.
T Nov 18 Phenotypic plasticity: How the environment shapes phenotypes.
T Nov 20 **Midterm 2**

Relevant reading in the course reader:

1. “Absorption distribution and excretion of toxicants” by Lehman-Mckeeman and “Developmental Toxicology” by John Rogers from *Casarett and Doull’s Toxicology*.
2. “The environment as a normal agent in producing phenotypes” and “Endocrine disruptors” From Gilbert and Epel *Ecological Developmental Biology*.

UNIT III Implications of pollution for the health of humans and the environment.

- T Nov 25 Endocrine disruption
R Nov 27 Thanksgiving
T Dec 2 Epigenetics and evolutionary consequences. Developmental origins of disease.
Op-ed Assignment due. Extra Credit Assignment due.
R Dec 4 Developmental origins of disease
T Dec 9 Emerging problems and solutions.
T Dec 11 Course summary.

Final Exam Wednesday, December 17, 11:30-2:30 pm.

Relevant reading in the course reader:

1. “The epigenetic origins of adult disease” From Gilbert and Epel *Ecological Developmental Biology*

Required Assignment: A Pollution, Environment and Health Op-ed.

The section of a newspaper **opposite** the **editorial** page is often reserved for guest opinion on current topics. Op-eds are usually written by people with no affiliation with the newspaper itself, but who may have some expertise in the topic of interest. Op-eds can have significant impact on public opinion by amplifying the discussion on a current topic and by providing alternative views. In many cases, op-eds are written by lobbyists who are paid to campaign on behalf of a specific position. However, in any democratic society, it is important for well-educated citizens to contribute to the discussion on topics of social or environmental importance. That is you.

The goal of this assignment is for each of you to write a long op-ed piece (750- 1000 words) from the perspective of a scientist on any topic related to the theme of this course – i.e. the interaction of pollutants, the environment and health. One suggestion is to read the recommended book on plastics (which can be purchased used for ~\$5 on Amazon) and to turn in both the Op-ed and Extra Credit Assignments. But you are free to choose any topic you like, as long as it clearly relates to the course. For example, you could write your op-ed on the need to reform the Toxic Substances Control Act.

Your position for or against a certain issue will have no impact on your grade. To do well on this assignment, you will need to write a highly focused op-ed that uses factual information from the course to make your arguments. Passionate pleas for action (eg. “we must act now”) are less important than logical sequences of argument (eg. “inaction will lead to accumulation of 400,000 tons of mercury in yellowfin tuna, reducing average IQ of children by 6 points and thereby reducing America’s literacy by 6% by the year 2020”). In other words, this should be more editorial than opinion. See the example on TED entitled “Warnings from a flabby mouse”.

In grading the op-eds, we will evaluate in equal parts:

1. Quality and quantity of the content: use of independent reading and course material to formulate quantitative arguments and factual accuracy.
2. Clarity of the writing: grammar, spelling, syntax, presentation and following these instructions.
3. Sophistication of logical argument: how many arguments/dots you connect in 75-1000 words and how reasonable those connections are.

Your op-ed should be submitted on **paper**, in class on or before **Nov 21** – sorry, but no late or e-mailed assignments will be scored. However do hang on to your e-versions for submission to newspapers.

We will select some of the op-eds to send off for submission to major newspapers. Again, you are free to choose any topic you like, as long as it clearly relates to the course. Ask us if you are in doubt. Keep in mind your chances of being published will increase if you choose a topic related to an issue currently in the news (i.e. plastic bag bans, oil extraction). You can check the twitter feed @hamdounlab for links to recent pollution-related news articles. Your grade will not be affected by whether or not your op-ed is published. If you really **DO NOT** wish to have your op-ed considered for submission to a newspaper, please indicate so in writing on your submitted assignment.