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**SIO 189/289:  
Pollution, Environment and Health**

Syllabus v.1 - 19 Aug 2019  
Fall 2019, TuTh 11:00-12:20, Vaughn 100  
*4 units credit, offered for letter grade*

**This syllabus will change during the quarter- be sure check for the latest version online**

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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 foundation of knowledge necessary for evaluating information on the effects of pollutants on human and environmental health.

**Student discussion and participation are highly encouraged!**

Prerequisites:

Introductory biology and chemistry are prerequisite and a basic course in toxicology is very helpful for any student in the course. That said, many students have been able to keep up without these requirements as long as they are diligent about the required reading and meet regularly with the TA.

Required reading:

Specific readings for each lecture will be announced in class and posted online. The course reader is available as a course reserve through the Geisel Library or it can be purchased at the UCSD Bookstore. Please let us know on the first day of class if you plan to buy one so we can give the bookstore an idea of how many readers to print. We will provide physical handouts for some material and post material at TritonED/Blackboard.

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Online materials:

TED.ucsd.edu website. Original scientific papers will be posted to TED, and these are also required readings. **I often use my lab twitter account @hamdounlab to post links to news articles that are relevant to the lectures and I will use these linked articles to find extra credit questions.**

Recommended reading:

This course will present a broad perspective on the impacts of environment on health and aims to expose students to the popular press perspective of the topic. Lay audience books on environmental science are recommended reading during the quarter, and some lecture material will be based on them. Examples of books which are used as inspiration for lecture material are:

1. *Merchants of Doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming.* Naomi Oreskes and Erik Conway.
2. *Plastic: A Toxic Love Story.* Susan Freinkel.
3. *Chemicals without harm. Policies for a sustainable world.* Ken Geiser.
4. *Limits to Growth.* Donella Meadows et al.
5. *Our stolen future.* Theo Colburn et al.
6. *Origins. How the nine months before birth shape our lives.* Annie Paul.
7. *Slow death by rubber duck.* Robert Smith and Bruce Lourie.
8. *Cadillac Desert: The American west and its disappearing water.* Marc Reisner.
9. *Silent Spring.* Rachel Carson.
10. *Children and environmental toxins.* Mary Landrigan and Philip Landrigan.

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 12**.

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 be nice and do not text, e-mail, surf the Internet, Facebook, tweet or otherwise be enslaved to your gadgets during class. Please try to attend all lectures and participate in discussion as this dramatically improves outcomes. Please see UCSD policy on academic integrity <http://students.ucsd.edu/academics/academic-integrity/defining.html>. **Phones are NOT allowed during exams. All assignments must be your own independent work – plagiarism is referred to campus immediately. It's not worth it.**

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## **Class Schedule:**

### **UNIT I The behavior of chemicals in the environment.**

- R Sep 26 Introduction to the class: Scope of the chemical problem.  
T Oct 1 A brief history of toxicology. *Silent Spring*, DDT.  
R Oct 3 Chemodynamics and physical properties of chemicals that govern accumulation in organisms.  
T Oct 8 Environmental fate and transport of pollutants.  
R Oct 10 Mercury  
T Oct 15 Guest lecture – Dr. Amina Schartup. “*Methylmercury accumulation in marine food webs.*”  
**R Oct 17 Midterm 1**

#### 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.**

- T Oct 22 The intoxication: Introduction to the biological effects of chemicals.  
**Discussion of op-ed assignment.**  
R Oct 24 Biology as a solution to pollution: Bioremediation.  
T Oct 29 Contaminants in the body: Absorption, Distribution, Metabolism and Excretion of Toxicants.  
R Oct 31 Cellular defenses: Bouncers and policemen.  
T Nov 5 Guest Lecture Dr. Catherine Schrankel. “*Ecological Developmental biology: How the embryo protects itself.*”  
**R Nov 7 Midterm 2**

#### 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 12 Dr. Bill Fenical - Guest Lecture “*Molecular Modulation of Survival and Communication in the Marine Environment*”.  
**Op-ed Assignment due. Extra Credit Assignment due.**  
R Nov 14 Endocrine disruption, epigenetics and evolutionary consequences.  
T Nov 19 Developmental origins of disease  
T Nov 21 Dr. Dimitri Deheyn “*Plastic microfibers in the marine environment.*”  
T Nov 26 Plastics  
**R Nov 28 Thanksgiving**  
T Dec 3 Doubt: How and why we do not act.  
R Dec 5 Course summary.

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

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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. You are free to choose any topic you like, as long as it clearly relates to the course

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 12** – 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.