

# Foundations of Environmental Health Sciences

## EHS C200A/C185A

Fall 2017

Time: MWF 3-4:50 pm  
Location: 41-235 CHS  
Office hours by appointment

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Every day the front page of every newspaper in the world has an article that touches on Environmental Health. The threats can be global climate change, heat waves or floods, air and water pollution, oil spills or water contamination from hydraulic fracturing (“fracking”), effects on vulnerable populations, radiation threats, and many more. (A good source for appropriate news is the Above the Fold daily email, which you can sign up for at <http://www.environmentalhealthnews.org/>.)

The purpose of this course is to develop the content knowledge and thought processes to be a successful environmental health researcher. The lectures on Mondays and Wednesdays present the fundamental science behind critical environmental health issues and their application to human health. Friday sessions are devoted to developing critical thinking and research skills.

### Course Description

Introduction to field of environmental health sciences designed for students pursuing M.S. and Ph.D. degrees (C200A) and for IoES undergraduate majors who are pursuing a concentration in Environmental Health or Public Health Minors (C185A). Examination of a series of topics relevant to science of environmental health (e.g., population, agriculture/food, microbiology, energy, climate change, water, waste, air) by introducing scientific basis from ecological perspective and describing how topics relate to health on biochemical and molecular basis. Emphasis on scientific aspects of the field, with focus on critique of primary literature and quantitative approaches for examination of topics to provide skills that are critical to perform research. Letter grading. Preparation required: one year of undergraduate biology and chemistry. *Please note that this course is designed for students pursuing the **MS degree** in Environmental Health Sciences. EHS students pursuing the **MPH degree** should enroll in EHS 200B.*

### Course Website

The course website is <https://ccle.ucla.edu/course/view/17F-ENVHLTC200A-2>. The assigned readings, links to videos, and other course materials will be on the website. If you are unable to access the course website, please contact Rich Ambrose ([rambrose@ucla.edu](mailto:rambrose@ucla.edu)).

## Course Learning Objectives

Upon completion of this course, you should be able to demonstrate the skills listed as “Course Learning Objectives” below.

<b>COURSE LEARNING OBJECTIVES</b>
1. Describe the fundamental science behind critical environmental health issues and its application to human health
2. Present information about a complex topic in an organized formal presentation (written and oral).
3. Critically evaluate and discuss scientific literature about environmental health science issues.

These learning objectives were selected to help you build competencies required for the EHS MS and PhD programs (see <http://ph.ucla.edu/current-students/programmatic-competencies>). (Note: these competencies are relevant for EHS students, although of course they are useful for students in other degree programs.)

<b>HOW THESE LEARNING OBJECTIVES ALIGN WITH COMPETENCIES FOR SPECIFIC DEGREE PROGRAMS</b>	
<i>EHS MS Competencies</i>	<i>EHS PhD Competencies</i>
A1. Retrieve and organize literature; synthesize and critically evaluate scientific literature in environmental health, public health and other relevant fields.	A1. Judge, critique and interpret reports of individual environmental health studies; evaluate strengths and limitations of environmental health reports.
A2. Use existing databases to provide background information or data to address research questions and draw appropriate inferences/estimates from environmental health data.	C1. Apply advanced informatics techniques in the description of public health characteristics and in public health research and evaluation.
B2. Evaluate the scientific merit and feasibility of study designs.	D1. Apply scientific and statistical reasoning and methods to address, analyze, and solve problems in public health.
B3. Identify an appropriate target population or organism for investigating the research question.	D2. Deduce environmental and public health implications of research results and propose subsequent studies.
B4. Identify potential sources of systematic error (bias) as well as random error.	E1. Gauge the cultural background, knowledge base and skills of an audience to appropriately customize communications for the target audience.

<b>HOW THESE LEARNING OBJECTIVES ALIGN WITH COMPETENCIES FOR SPECIFIC DEGREE PROGRAMS</b>	
<b><i>EHS MS Competencies</i></b>	<b><i>EHS PhD Competencies</i></b>
B5. Be able to articulate interdisciplinary approaches to solving public health problems.	E2. Organize and make oral presentations to professionals ranging from brief scientific presentations of research findings to longer presentations.
B6. Identify potential sources of systematic error (bias) as well as random error.	F1. Understand the norms and principles of research ethics and demonstrate an ability to incorporate those principles into study designs, programs of data management and quality assurance.
C2. Produce working tables, statistical summaries, and effective figures to summarize data.	G1. Identify environmental health problems requiring additional investigation and research.
D1. Make reasonable inferences from results of analysis of observational and analytic studies.	G2. Identify existing knowledge gaps amenable to clarification through environmental health research.
E1. Prepare presentation materials including outlines, posters, and Powerpoint presentations.	
E2. Deliver effective oral presentations individually and as part of a team.	
E3. Explain and interpret research findings for students, professionals, the public, and media.	
F2. Recognize ethical issues that arise in research.	

## Reading

Required readings will be available on the course CCLE site (available through My UCLA or <https://ccle.ucla.edu/course/view/17F-ENVHLTC200A-2>). Class discussions depend on the assigned reading, so all of the readings for each class session **must** be completed **before** class.

## Grading

	<u>EHS 185A</u>	<u>EHS 200A</u>
Written assignments		
Literature review	200	200
Research proposal questions	50	50
Research proposal	300	300
Presentations		
Critical evaluations of papers: presentation	-	100
Presentation of research proposal questions	50	50
Research proposal presentation	100	100
Class participation	50	50
TOTAL	750	850

### *Written assignments*

There will be two written assignments: (1) a literature review, and (2) a research proposal. Both of these papers will cover the same topic but from different perspectives. The literature review focuses on a succinct summary and synthesis of previous research on a topic, while the research proposal provides an opportunity to focus on more scientific aspects of environmental health sciences by developing a research question and the methods to answer it.

Each student will choose a topic for the literature review and research proposal in consultation with the instructor. Any topic in environmental health sciences is acceptable, but the topic should be chosen that would make a good research proposal; that is, an important environmental health issue with significant uncertainties and ideally a clear connection to management, policy or legislative action. Examination of current environmental health news can help identify good topics for the literature review and proposal; a good source for news compilations is Above the Fold from Environmental Health News (<http://www.environmentalhealthnews.org>). Important current topics can also be identified by examining recent issues of relevant journals, including specialist journals such as *Environmental Health* or *Environmental Health Perspectives*, as well as general journals such as *Nature*, *Science* and *Environmental Science and Technology*.

Written assignments must be uploaded to the course CCLE site by the due date; late assignments will be penalized 10% of the assignment's points per day.

### *Literature Review (200 pts)*

A literature review will be required on an environmental health issue. The topic will be related to the research grant proposal (see below). Topics must be submitted by email to the instructors for approval before the paper is written. The paper will be a brief review of the scientific information about the topic. Information about the topic should come mainly from the peer-reviewed literature. In addition to a review of information in the papers referenced, an emphasis should be placed on critical assessments of the information presented, synthesizing the results from different studies, and identifying “data gaps” that can serve as motivation for the grant proposal. This paper will provide a broader context for the research grant proposal, and will help refine the research question for the data analysis project.

The literature review is due October 27. It can be up to five pages long (12 pt font, 1” margins, double-spaced).

### *Research Proposal*

Developing compelling research proposals is an important skill for researchers from all disciplines. An effective proposal relies on a thorough understanding of the relevant literature, a clear conception of the research question, and careful development of appropriate study design and methodology. For this class, each student will write a research proposal on the same topic as the literature review paper.

There are two assignments for the research grant proposal: (1) the research questions (50 pts), and (2) the proposal itself (300 pts).

A successful research proposal depends on a clear articulation of research question, which in turn depends on a good understanding of relevant literature on the topic and especially the “data gaps,” or research needs that have not yet been filled. The questions for the research proposal, along with the general proposed methodology for answering these questions, is due Monday November 20.

In addition to clear research questions, an effective research proposal must contain a clear, well thought-out study plan. The study plan must include a description of appropriate methodology and a study design that can answer the research questions posed. The research proposal is due Friday December 8. The proposal can be up to ten pages long (12 pt font, 1” margins, double-spaced).

Guidelines for writing an effective proposal are available on the course CCLE site.

### *Presentations*

Three types of presentations will be graded: (1) critical evaluation of a paper, (2) a presentation of the research questions to be addressed in the research proposal, and (3) a presentation on the research proposal.

*Critical evaluation of a paper (100 pts)*

During some of the Friday sessions, all students will read one or more papers for critical evaluation. Guidelines for critical thinking and evaluation are available on the CCLE site. Each student should read and evaluate the assigned papers using these guidelines. In particular, it will be useful to create a list of three substantive scientific questions about each paper, considering why these are interesting questions and might indicate a flaw or shortcoming in the paper. These questions could relate to methods (e.g., “Was the sample size adequate for the question asked?”), conclusions (e.g., “Did the author recognize the potential impacts of unusual climatic conditions during the study?”), or any other aspect of the paper (note: the questions should be more specific to the study than the examples here). These questions should reflect a critical evaluation of the paper and focus on areas where you feel the paper may be lacking. The primary goal of this assignment is to sharpen your critical evaluation skills, so you should think carefully about the paper when developing your questions.

The critical evaluation of the papers, including the questions about each paper, will prepare students for in-class exercises. Students should come to class prepared to discuss their questions and their implications for the paper. Students should also be prepared to discuss the questions raised by other students in the class, and critically evaluate their implications.

In addition to the readings and in-class exercises all students will do, each student enrolled in EHS 200A will make an oral presentation about an environmental health paper; the paper will be chosen in consultation with the instructors. The presentation should provide a brief overview of the study and a critical evaluation of the paper. The presentation should demonstrate deep insight into the study. Each student’s presentation should be no longer than 5 minutes.

Students enrolled in EHS 185A do not need to make a presentation on a critical evaluation paper.

*Presentation of research questions for proposal (50 pts)*

Each student will make a brief presentation about the questions they propose addressing in their research proposal, as well as ideas about how the questions will be answered.

Each student’s presentation should be no longer than 3 minutes, with 2 minutes for class discussion after each presentation. The presentations will take place on November 17.

*Presentation of research proposal (100 pts)*

At the end of the course, each student will present the highlights of their research proposal. This presentation should include background to the problem, the research question, and proposed methods for answering the question.

Each student’s presentation should be no longer than 5 minutes. There will be a brief class discussion after each presentation. The presentations will take place on December 4 and 6.

### *Class participation (50 pts)*

Every student is expected to be an active and well-informed participant in all class discussions. Class participation is particularly important during the discussion about paper critiques, but students are also expected to participate during lectures and student presentations.

For the paper critiques, students should come to class prepared to discuss the questions they have prepared and their implications for the paper. Students should also be prepared to discuss the questions raised by other students in the class, and critically evaluate their implications.

Completing the assigned reading before class is essential for you to be a well-informed participant.

### *Statement on Disability*

Students needing academic accommodations based on a disability should contact the Center for Accessible Education (CAE) at [\(310\) 825-1501](tel:3108251501) or in person at Murphy Hall A255. When possible, students should contact the CAE within the first two weeks of the term as reasonable notice is needed to coordinate accommodations. For more information visit [www.cae.ucla.edu](http://www.cae.ucla.edu).

### *Statement on Academic Integrity*

All policies in the UCLA Student Code of Conduct regarding academic integrity apply to this course, including policies regarding cheating and plagiarism. When warranted, infractions will be reported to the Dean of Students and may result in disciplinary action. UCLA's complete policy regarding academic dishonesty can be found on the website for the Office of the Dean of Students: <http://www.studentgroups.ucla.edu/dos/>.

### *Technology in the Classroom*

The use of technology in the classroom for educational purposes is encouraged. Feel free to use laptops or other devices, but please be mindful of your classmates and do not allow technology to become a distraction. Please silence all devices, especially cell phones, and do not take calls or text during class. If we determine your electronic devices are repeatedly distracting you or others, your participation grade may suffer and you will be asked to refrain from using your devices during class.

**Note about file names:** Do not name your files with a generic name such as "assignment 1.docx". There may be files with the same name from ten different students! Your file names should include your last name, a descriptive title, and often the date (to keep track of versions, such as "Doe briefing paper 2-14-15"). This is good practice for naming all of your files, not just for this class.

	Topic	Lecturer	Reading	Assignment Due
Week 0	Introduction			
Session 1 Fri Sept 29	Introduction to the course.  What is Environmental Health Sciences? Key concepts: Defining the environment, Environmental insults and contribution to diseases, Key examples of environmental disasters/issues and related diseases.	R. Ambrose  M. Collins	Gross 2013; Burnside et al. 2012	
Week 1	Environment and Disease			
Session 2 Mon Oct 2	Environmental influences on diseases. Zoonotic diseases (e.g., Zika), linkage between ecosystem health and human health.	R. Ambrose	WHO 2006	
Session 3 Wed Oct 4	Gene-environment interactions. Key concepts: What is a gene, going beyond gene vs environment, epigenome as an environmental sensor, concepts in pathophysiology.	M. Collins	McLachlan 2016	
Session 4 Fri Oct 6	Critical evaluation of scientific papers. Key concepts: Features of a scientific paper, Design of scientific studies, Critically evaluating a scientific article. Reproducibility of research results.	R. Ambrose M. Collins	Critical evaluation papers	



Week 2	Population and consumption pressures			
Session 5 Mon Oct 9	Ecological concepts: population dynamics, ecosystem services, sustainability, resilience, habitat alteration, biodiversity, extinction, ecological footprint	R. Ambrose	MEA 2005 (pp. 1-16)	
Session 6 Wed Oct 11	Human population, consumption, Earth's carrying capacity, urbanization, urban design, rule of 15, zoobiquity	M. Collins	Gross 2012; Bradshaw and Brook 2014	
Session 7 Fri Oct 13	Discussion of journal article and student presentations	R. Ambrose M. Collins	Critical evaluation paper	• Student critical evaluation presentations
Week 3	Energy			
Session 8 Mon Oct 16	Ecological concepts: energy flow and cycling, ecological efficiencies, bioenergetics	R. Ambrose	Covich 2000	
Session 9 Wed Oct 18	Energy utilization by humanity, energy alternatives, sustainability, health impacts, Chernobyl, Fukushima	M. Collins	Chu and Majumdar 2012; Smith et al. 2013	
Session 10 Fri Oct 20	Developing research questions Sampling design	R. Ambrose M. Collins		

Week 4	Land			
Session 11 Mon Oct 23	Ecological concepts: land transformation, nutrient cycling (e.g. C, O <sub>2</sub> , N, P), food webs	R. Ambrose	Gruber and Galloway 2008; Ellis et al. 2011	
Session 12 Wed Oct 25	Agriculture: loss of biodiversity from agriculture, use of resources/energy, nutrition, food safety, genetically-modified organisms, mycotoxins, fertilizer, water utilization, pesticides, occupational health issues	M. Collins	“King Corn” (DVD); Casida and Durkin 2013	
Session 13 Fri Oct 27	Writing research proposals	R. Ambrose M. Collins		• Literature review due
Week 5	Water			
Session 14 Mon Oct 30	Water as a critical environmental parameter. Ocean and freshwater ecology: water cycle, fisheries depletion, coastal habitat destruction	R. Ambrose	Halpern et al. 2012	
Session 15 Wed Nov 1	Water, its contaminants and health. Key concepts: Toxic Organisms, Toxic compounds, Water borne pathogens and diseases.	M. Collins	Larsen et al. 2016 Shannon et al. 2008	
Session 16 Fri Nov 3	Discussion of journal article	R. Ambrose M. Collins	Critical evaluation papers	• Student critical evaluation presentations

Week 6	Microbes Air			
Session 17 Mon Nov 6	Ecological concepts: microbial ecology, role of microbes in the ecosphere, descriptions of bacteria, archaea, viruses, fungi, protozoa, algae, prions, environmentally protected forms of microorganisms (spores, conidia, cysts), ecology of Lyme disease	M. Collins	Holt et al. 2015; Gilbert et al. 2016	
Session 18 Wed Nov 8	Microbial pathology. Key concepts: Genetic basis of antibiotic resistance, persistent organisms, microbiome, zoonoses, vectors, immune-microbe interactions, immunizations	M. Collins	Lessler et al. 2016	
Session 19 Fri Nov 10	Veteran's Day Holiday			
Week 7	Climate change			
Session 20 Mon Nov 13	Physical and Chemical factors, ecological effects, ocean acidification	R. Ambrose	Scheffers et al. 2016	
Session 21 Wed Nov 15	Health consequences of climate change: heat, air quality, infectious diseases	R. Ambrose	USGCRP 2016	
Session 22 Friday Nov 17	Student presentations of research questions and approach	R. Ambrose M. Collins		• Research questions presentations

Week 8	Waste			
Session 23 Mon Nov 20	Ecological view of waste, wastewater, wastewater treatment, radiological waste, solid waste, hazardous waste, plastic, green chemistry, leachate, organic versus inorganic compounds, Love Canal, TCDD (Seveso, Times Beach, Vietnam)	M. Collins	Castaldi 2014; Sheldon 2012	• Research questions due
Session 24 Wed Nov 22	No class meeting			
Session 25 Fri Nov 24	Thanksgiving Holiday			
Week 9	Air			
Session 26 Mon Nov 27	Atmospheric chemistry, reductive versus oxidative pollution, primary and secondary air pollutants, inversions	Y. Zhu	Ravindra et al. 2008 ; Lin et al. 2016	
Session 27 Wed Nov 29	London fog, health effects of air pollution, gases and vapors, particulate matter, compensatory physiology, occupational respiratory diseases, diacetyl, volatile pesticides, radon	J. Araujo	Pope and Dockery 2006; Araujo et al. 2008	
Session 28 Fri Dec 1	Discussion about proposed research and methods for research proposals	R. Ambrose M. Collins		

Week 10	Student presentations and Conclusion			
Session 29 Mon Dec 4	Student research Proposal presentations	R. Ambrose M. Collins		• Research proposal presentations
Session 30 Wed Dec 6	Student research Proposal presentations (continued)	R. Ambrose M. Collins		• Research proposal presentations
Session 31 Fri Dec 8	It's not all bleak: Innovative research solutions to tackle current environmental and ecological challenges. Ocean cleanup, bioremediation, Montreal Protocol, etc.	R. Ambrose M. Collins	Atlas and Hazen, EST, 2011.	• Research proposals due Dec 11