In this course, students will be introduced to the concepts of exposure science. Students will learn how contaminants are transported from sources to receptors and how human receptors are affected by such contact. Varying exposure science approaches, across a range of environmental media, including air, water, soil, and internal biological matrices, will be considered. Methods of assessment including direct monitoring of environmental media, modeling, as well as biomarkers of exposure will be presented and discussed in detail. Students will examine the literature of exposure science through readings, in-class article discussions, and by conducting a collaborative exposure assessment.
MPH/MSPH FOUNDATIONAL COMPETENCIES:

- Apply the principles of exposure science to characterize and quantify environmental exposures
- Select quantitative and qualitative data collection methods appropriate for a given public health context
- Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate

COURSE LEARNING OBJECTIVES:

- To familiarize students with the basic analytical methods of environmental exposure science

EVALUATION

Evaluation will be based on your scores on an in-class midterm exam, weekly discussions and presentation of selected journal articles, and group exposure assessment and presentation. These exercises are designed to assess your understanding of lecture materials and readings. The midterm will be in the form of multiple choice questions and short answer questions.

<table>
<thead>
<tr>
<th>Final Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm</td>
<td>30</td>
</tr>
<tr>
<td>Article Discussion</td>
<td>20</td>
</tr>
<tr>
<td>Group Exposure Project</td>
<td>50</td>
</tr>
<tr>
<td>≥ 95 points</td>
<td>A</td>
</tr>
<tr>
<td>90 – 94 points</td>
<td>A-</td>
</tr>
<tr>
<td>86 – 89 points</td>
<td>B+</td>
</tr>
<tr>
<td>82 – 85 points</td>
<td>B</td>
</tr>
<tr>
<td>79 – 81 points</td>
<td>B-</td>
</tr>
<tr>
<td>74 – 78 points</td>
<td>C</td>
</tr>
<tr>
<td>&lt; 74 points</td>
<td>C-</td>
</tr>
</tbody>
</table>

COURSE STRUCTURE

EH 510 is a course designed to introduce public health students to basic concepts of environmental exposure science used to quantify exposure to a range of stressors across different environmental media. The course is structured into four modules covering environmental monitoring, modelling, biomonitoring, and exposomics. The second half of the course will consist primarily of conducting an exposure assessment within a group setting. Students will continue to meet weekly to provide progress reports to the instructor and teaching assistants and discuss challenges or opportunities in ongoing research. The final sessions of the semester will be dedicated to presenting the results from the assessment to your EH 510 peers.
Dr. Sarnat will serve as primary course coordinator throughout the semester. Guest instructors will supplement instruction throughout the semester by presenting material and leading discussion within their respective fields of expertise.

*Midterm exam:* The midterm, worth 30 points, will be given in class on March 22nd and will be 50 minutes long. If, for some very extenuating reason, you cannot take the exam that day, a make-up exam must be arranged with Dr. Sarnat and be taken prior to the scheduled exam date. The midterm exam will be closed book and closed note.

**Foundational Competencies and Knowledge Addressed:**

- Apply the principles of exposure science to characterize and quantify environmental exposures

**Article Discussions:** During each session of the first half of the EH 510 (sessions 2 – 8), a peer-reviewed article will be assigned to the class. There will be 8 articles assigned throughout the semester, as specified in the course schedule below. The articles will provide examples of an application and/or a systematic review of the concepts covered during the respective session on that given day.

Your responsibility will be to read and discuss assigned articles on the weekly topic and prepare relevant questions related to the reading. A link to each paper can be found in the Assignment tab on the EH 510 Canvas site. In addition, each week, 6 students will serve as Discussants for the selected article, with the responsibility of providing a synopsis of the article and leading an interactive discussion with their peers. Discussants during a given week will work together to read, understand, and work towards formulating coherent and engaging discussion.

**Foundational Competencies and Knowledge Addressed:**

- Communicate audience-appropriate public health content, both in writing and through oral presentation

**Group Exposure Assessments:** Exposure scientists are often called upon to perform field investigations in which a design will be proposed, samples collected and analyzed and data interpreted and presented. As part of EH 510, every students will work with peers to conduct a multi-week environmental exposure assessment. The purpose of the Group Exposure Assessment (GEA) is to give students an opportunity to participate in all aspects of the exposure science process, including data collection (where appropriate), data processing, analysis, and interpretation. Students will work in small groups of 4-5 to design and implement their assessment.
Working in groups will provide for equitable division of labor among group members, which is likely to be substantial, and development of team approaches common to exposure science field work. Groups will be permitted to propose exposure assessments utilizing the spectrum of approaches covered in class (e.g., monitoring vs. modeling). Although the projects will be designed by students, topics and methods used for assessment will be curated by Dr. Sarnat to ensure that the projects can be feasibly conducted within the allotted timeframe for this assignment. Proposals must be presented and approved by Dr. Sarnat and the TA’s prior to commencing work on the project.

At the end of the semester (sessions 13-14), each group will present their collective findings to the class. A detailed grading rubric for assessing the GEA’s will be distributed in class.

Examples of GEA projects that may be conducted:

- Secondary, spatiotemporal analysis of publicly-available or previously collected environmental or microenvironmental measurements
- Biochemical monitoring of local tap water or groundwater sources
- Secondary analysis of environmental epigenetic influences on disease prevalence
- Dispersion modeling of a proposed local pollutant source

Foundational Competencies and Knowledge Addressed:

- Apply the principles of exposure science to characterize and quantify environmental exposures
- Communicate audience-appropriate public health content, both in writing and through oral presentation
- Perform effectively on inter-professional teams

COURSE POLICIES

As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and the Office for Equity and Inclusion, 404-727-9877.

ATTENDANCE. One of the worst aspects of the spring EH 500 session is the 8 AM start time. I hate it, you hate it. When teaching graduate students, though, we are uncomfortable with making attendance mandatory or taking weekly roll. That said, I promise you at least two things regarding attendance and EH 500. First, this is a course that you get out what you put in - you will enjoy and benefit much more from EH 500 if you come to class. Second, you will find that the exams will be much easier to prepare
for and successfully complete if you attend class. Exam material is taken from the in-class content, exclusively, and I frequently stress overarching concepts, themes, and interpretations in class to help you prepare for the exams.

*COURSE CANVAS SITE: https://canvas.emory.edu/courses/54162; course title is EH500: Foundations in Exposure Science – Spring 2019;

**RSPH POLICIES**

**Accessibility and Accommodations**

Accessibility Services works with students who have disabilities to provide reasonable accommodations. In order to receive consideration for reasonable accommodations, you must contact the Office of Accessibility Services (OAS). It is the responsibility of the student to register with OAS. Please note that accommodations are not retroactive and that disability accommodations are not provided until an accommodation letter has been processed.

Students who registered with OAS and have a letter outlining their academic accommodations are strongly encouraged to coordinate a meeting time with me to discuss a protocol to implement the accommodations as needed throughout the semester. This meeting should occur as early in the semester as possible.

Contact Accessibility Services for more information at (404) 727-9877 or accessibility@emory.edu. Additional information is available at the OAS website at http://equityandinclusion.emory.edu/access/students/index.html

**Honor Code**

You are bound by Emory University’s Student Honor and Conduct Code. RSPH requires that all material submitted by a student fulfilling his or her academic course of study must be the original work of the student. Violations of academic honor include any action by a student indicating dishonesty or a lack of integrity in academic ethics. Academic dishonesty refers to cheating, plagiarizing, assisting other students without authorization, lying, tampering, or stealing in performing any academic work, and will not be tolerated under any circumstances.

The RSPH Honor Code states: “Plagiarism is the act of presenting as one’s own work the expression, words, or ideas of another person whether published or unpublished (including the work of another student). A writer’s work should be regarded as his/her own property.” (http://www.sph.emory.edu/cms/current_students/enrollment_services/honor_code.html)
# Course Calendar and Outline

<table>
<thead>
<tr>
<th>Session</th>
<th>Date</th>
<th>Topic</th>
<th>Presenter</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18-Jan</td>
<td>Course Overview</td>
<td>Jeremy Sarnat, ScD Environmental Health</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>25-Jan</td>
<td><strong>Module A.1</strong>: Environmental Monitoring (Water)</td>
<td>Amy Kirby, PhD Global Health</td>
<td>Article Discussion #1: Devane et al., 2009</td>
</tr>
<tr>
<td>3</td>
<td>1-Feb</td>
<td><strong>Module A.2</strong>: Environmental Monitoring (Air)</td>
<td>Jeremy Sarnat, ScD Environmental Health</td>
<td>Article Discussion #2: Sarnat et al., 2000</td>
</tr>
<tr>
<td>4</td>
<td>8-Feb</td>
<td><strong>Module B.1</strong>: Modeling (Remote Sensing)</td>
<td>Yang Liu, PhD Environmental Health</td>
<td>Article Discussion #3: Xiao et al., 2015</td>
</tr>
<tr>
<td>5</td>
<td>15-Feb</td>
<td><strong>Module B.2</strong>: Modeling (Box, Dispersion Models)</td>
<td>P. Barry Ryan, PhD Environmental Health</td>
<td>Article Discussion #4: Ryan et al., 1983</td>
</tr>
<tr>
<td>6</td>
<td>22-Feb</td>
<td><strong>Module C.1</strong>: Internal monitoring (PBPK modeling)</td>
<td>Qiang Zhang, PhD Environmental Health</td>
<td>Article Discussion #5: Price et al., 2011</td>
</tr>
<tr>
<td>7</td>
<td>1-Mar</td>
<td><strong>Module C.2</strong>: Internal monitoring (Targeted Approaches)</td>
<td>Dana Barr, PhD Environmental Health</td>
<td>Article Discussion #6: Bouchard et al., 2011</td>
</tr>
<tr>
<td>8</td>
<td>8-Mar</td>
<td><strong>Module C.3</strong>: Internal monitoring (Untargeted Approaches)</td>
<td>Todd Everson, PhD Donghai Liang, PhD Environmental Health</td>
<td>Article Discussion #7/8: Liang et al., 2018; Everson and Marsit, 2018</td>
</tr>
</tbody>
</table>
| Session 9 | 22-Mar | Midterm  
**GEA:** Introduction | Jeremy Sarnat, ScD  
Environmental Health | None |
| Session 10 | 29-Mar | **GEA:** In-class Progress Meetings | Jeremy Sarnat, ScD  
Environmental Health | GEA proposal ideas due in-class |
| Session 11 | 5-Apr | **GEA:** In-class Progress Meetings | Jeremy Sarnat, ScD  
Environmental Health | GEA Progress Report |
| Session 12 | 12-Apr | **GEA:** In-class Progress Meetings | Jeremy Sarnat, ScD  
Environmental Health | GEA Progress Report |
| Session 13 | 19-Apr | **GEA:** Group Presentations | Jeremy Sarnat, ScD  
Environmental Health | Final GEA presentations in-class |
| Session 14 | 26-Apr | **GEA:** Group Presentations | Jeremy Sarnat, ScD  
Environmental Health | Final GEA presentations in-class |