

## Syllabus Module Environmental and Occupational Health Sciences (EOHS) (Module 109)

<b>N°109</b>	<b>Environmental and Occupational Health Sciences</b>
<b>Coordinator</b>	Ianis DELPLA, Pauline ROUSSEAU-GUEUTIN
<b>Dates</b>	March 18 <sup>th</sup> to April 12 <sup>th</sup> 2024
<b>Credits/ECTS</b>	9 ECTS
<b>Duration or Course Format</b>	84 hours (13 days of 6 hours, 2 half-days of 3 hours)
<b>Location</b>	EHESP 20 Avenue George Sand 93210 LA PLAINE ST DENIS
<b>Description</b>	<p>The impact of some environmental factors on public health is known since the Minamata disaster or Rachel Carlson's book on pesticides (<i>Silent spring</i>). From the early 1960s up to now, the interrelations between environmental or occupational problems, politics and the health status of populations have been increasingly scrutinized. Often complex and unforeseeable, these interrelations have become increasingly central to public health policies and interventions. Interdisciplinary in essence, this track provides a broad perspective on environmental and occupational health, by bridging scientific and policy dimensions and by exploring a wide variety of health related topics (emerging infectious diseases, water systems, urbanization...).</p> <p>The aim of this module is to analyse and understand:</p> <ol style="list-style-type: none"> <li>(1) the interdisciplinary context of public health challenges of environmental or occupational origin,</li> <li>(2) the main environmental or occupational risk factors for public health and the corresponding issues,</li> <li>(3) and the weight of related uncertainty in a changing context (climate change, globalization...)</li> <li>(4) Methodological challenges related to environmental and occupational health sciences</li> </ol> <p>Lead by researchers with a high degree of professional experience, lectures, case studies and group works will be proposed to students over a five-week period. Students will regularly present paper analyses during the course of the modules.</p>
<b>Prerequisites</b>	no
<b>Course learning objectives</b>	<p>Students who successfully complete this course will be able to:</p> <ol style="list-style-type: none"> <li>1- Identify the key public health problems related to environmental and professional exposures</li> <li>2- Describe the methods of measurement of the main environmental and occupational risk factors</li> <li>3- Apply the principles of study design in environmental epidemiology</li> <li>4- Analyse critically the findings of environmental health papers</li> </ol>
<b>Structure (details of sessions title/speaker/date /duration )</b>	<ol style="list-style-type: none"> <li>1- Introduction to Environmental and Occupation Health week 12 J. Berneron (ANSES), B. Jacquemin (INSERM),</li> <li>2- Planetary Health - week 14 A. Garchitorena (IRD)</li> <li>3- Occupational Health - week 13 F.G. Schaasma (Amsterdam UMC), E. Counil (INED)</li> <li>4- Healthy Urban Planning - week 12 - 15 A. Roué Le Gall, P. Rousseau Gueutin (EHESP)</li> <li>5- Water pollution and health - week 15 I. Delpla, P. Le Cann, M., P. Rousseau-Gueutin (EHESP)</li> <li>6- Tools and methods - week 12,13,14 T. Benmarhnia (UCSD, EHESP), B. Jacquemin (INSERM), A. Gely-Pernot (EHESP), M. Fuentes Vallejo</li> </ol> <p>Full details given hereafter</p>

<b>Resources</b>	Books
<b>Course requirement</b>	Students are expected to attend all lectures and seminars. Class attendance will be checked accordingly. Students are expected to read and analyse selected papers for the group work before the courses.
<b>Grading and assessment</b>	<p>25% on Healthy Urban Planning (week 15-18, group work, field work presentation and note)</p> <p>25% Reflection paper/journal (week 14 – 18, individual work, homework)</p> <p>Students record their personal reflections or reactions to materials covered in the track. During and after each week, student will write a brief (not more than one single-spaced page) journal entry in a Word document labelled with your name (e.g. EOHSY1_2021_Rousseau-Gueutin). Journal entries should be reflective and may address such points as what you learned that surprised you, what you agreed or disagreed with, how you might apply what you've learn to a work situation, how the information may have influenced your view on the topic, and so on. Journal entries should not simply summarize or repeat what the author or lecturer wrote or said.</p> <p>50% for a 2 Hour closed book final sitting exam. The sitting exam is scheduled on April 12<sup>th</sup>, 2023. It usually consists of short answer, brief essay questions and/or lengthier case questions. The exam covers material from required readings, lectures, guest speakers, and in-class discussions and activities.</p>
<b>Course policy</b>	<p><b>Attendance &amp; punctuality</b>  <b>Regular and punctual class attendance is a prerequisite for receiving credit in a course.</b> Students are expected to attend each class. Attendance will be taken at each class.  The obligations of attendance and punctuality cover every aspect of the course: - lectures, conferences, group projects, assessments, examinations, as described in EHESP Academic Regulations <a href="http://mph.ehesp.fr">http://mph.ehesp.fr</a> EHESP Academic Regulation Article. 3).  If students are not able to make it to class, they are required to send an email to the instructor and to the MPH program coordinating team explaining their absence prior to the scheduled class date. All supporting documents are provided to the end-of-year panel.  Students who miss class are responsible for content. Any student who misses a class has the responsibility for obtaining copies of notes, handouts and assignments. If additional assistance is still necessary, an appointment should be scheduled with the instructor. Class time is not to be used to go over material with students who have missed class.</p> <p><b>Lateness:</b> Students who are more than 10 minutes late may be denied access to a class. Repeated late arrivals may be counted as absences (See <a href="http://mph.ehesp.fr">http://mph.ehesp.fr</a> EHESP Academic Regulation Article. 3 Attendance &amp; Punctuality)</p> <p><b>Maximum absences authorized &amp; penalty otherwise</b>  Above 20% of absences will be designated a fail for a given class. The students will be entitled to be reassessed in any failed component(s). If they undertake a reassessment or they retake a module this means that they cannot normally obtain more than the minimum pass mark (i.e. 10 out of 20)</p> <p><b>Exceptional circumstances</b>  Absence from any examination or test, or late submission of assignments due to illness, psychological problems, or exceptional personal reasons must be justified; otherwise, students will be penalized, as above mentioned. Students must directly notify their professor or the MPH academic secretariat before the exam or before the assignment deadline. Before accepting the student's justification, the professor or the MPH academic secretariat has the right to request either a certificate from the attending physician or from a psychologist, or from any other relevant person (See <a href="http://mph.ehesp.fr">http://mph.ehesp.fr</a> EHESP Academic Regulation Article 4 Examinations).</p> <p><b>Courtesy:</b> <u>All cell phones/pages MUST be turned off during class time.</u>  Students are required to conduct themselves according to professional standards, eating during class time is not permitted during class time, such as course or group work.</p>
<b>Valuing diversity</b>	Diversity enriches learning. It requires an atmosphere of inclusion and tolerance, which oftentimes challenges our own closely-held ideas, as well as our personal comfort zones. The results, however, create a sense of community and promote excellence in the learning environment. This class will follow principles of inclusion, respect, tolerance, and acceptance that support the values of diversity. Diversity includes consideration of: (1) life experiences, including type, variety, uniqueness, duration, personal values, political viewpoints, and intensity; and (2) factors related to "diversity of presence," including, among others, age, economic circumstances, ethnic identification, family educational attainment, disability, gender, geographic origin, maturity, race, religion, sexual orientation and social position.
<b>Course evaluation</b>	EHESP requests that you complete a course evaluation at the end of the school year. Your responses will be anonymous, with feedback provided in the aggregate. Open-ended comments will be shared with instructors, but not identified with individual students. Your participation in course evaluation is an expectation, since providing constructive feedback is a professional obligation. Feedback is critical, moreover, to improving the quality of our courses, as well as for instructor assessment.

<b>Session 1</b>	<b>Introduction to Environmental and Occupation Health</b>
<b>Dates</b>	March 18 <sup>th</sup> , and 19 <sup>th</sup> 2024
<b>Session Description</b>	<p>Environmental health addresses all the physical, chemical, and biological factors external to a person. The natural environment presents a rich variety of hazards to human health (chemical, physical and biological) to which human activities have added more hazards (i.e. urbanization, pesticides, toxic waste...). Environmental and occupational health sciences aim at studying the health consequences of human-environment interaction and reducing human health risks.</p> <p>This session serves as a general introduction through which students can learn about the complex and multi-disciplinary field of environmental and occupational health sciences. Looking in particular at the case of hazardous chemicals and air pollution, the course will raise issues of science, regulation and policy and how they interact with one another. This session will introduce the process of climate change to the students.</p>
<b>Session Structure</b>	<ol style="list-style-type: none"> <li>1. Climate Fresk (several facilitators)</li> <li>2. Hazardous chemicals: Health risks and international regulation, Johanna Berneron, ANSES</li> <li>3. Air pollution: Ambient air and indoor air, Bénédicte Jacquemin, INSERM</li> </ol>
<b>Duration</b>	9 hours
<b>Training methods</b>	Lecture, workshop, case study, group work

<b>Session 1.1</b>	<b>Climate Fresk</b>
<b>Speakers</b>	Several facilitators
<b>Session Outline</b>	This workshop aim to raise awareness on the causes and the impacts of the climate change, and to identify solutions that could be put in place at different levels.
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Recognize the main causes and consequences of climate change</li> <li>- Identify solutions</li> </ul>
<b>Duration</b>	3 hours

<b>Session 1.2</b>	<b>Ambient and Indoor Air Quality and Health</b>
<b>Speakers</b>	Bénédicte Jacquemin (INSERM), <a href="mailto:benedicte.jacquemin@inserm.fr">benedicte.jacquemin@inserm.fr</a>
<b>Session Outline</b>	<p>Air pollution is a major environmental risk to health. In 2016, 91% of the world population was living in places where the WHO air quality guidelines levels were not met. Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or that damages the natural environment, into the atmosphere. Ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 4.2 million premature deaths worldwide in 2016. In addition to outdoor air pollution, indoor smoke is a serious health risk for some 3 billion people who cook and heat their homes with biomass, kerosene fuels and coal. This session will provide the students with key topics such as: air pollution history, air pollutants, some regulations related to air pollution, Impact on emissions, Ambient Air Monitoring, Health effects of Ambient and Indoor Air Pollution.</p>
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Describe how ambient &amp; indoor air pollution impact population health</li> <li>- Provide examples of each of the major impacts</li> <li>- Identify national and international regulation, recommendations</li> </ul>
<b>Duration</b>	3 Hours

<b>Session 1.3</b>	<b>Hazardous chemicals: Health risks and international regulation</b>
<b>Speakers</b>	Johanna BERNERON (ANSES), <a href="mailto:johanna.berneron@anses.fr">johanna.berneron@anses.fr</a>
<b>Session Outline</b>	Using REACH as a case study, this course is an introduction to health risks related to chemicals and how international regulations are designed to protect workers, populations and environment. REACH is a regulation of the European Union, enforced since 2007 to improve the protection of human health and the environment from the risks that can be posed by chemicals. REACH applies to all chemical substances; not only those used in industrial processes but also in our day-to-day lives (cleaning products, paints, clothes...). The course will give students an overview of the main interfaces between chemicals, health and human activities, and provide them with an understanding of the sometime difficult implementation of environmental health-related regulations and policies.
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Identify the main issues in environmental public health for industrial and agricultural use of chemicals</li> <li>- Identify the principles of international regulations for chemicals (from their authorization of production to their final destruction)</li> </ul>
<b>Duration</b>	3 hours

<b>Session 2</b>	<b>Occupational Health</b>
<b>Dates</b>	March 25 <sup>th</sup> , March 26 <sup>th</sup> , March 28 <sup>th</sup> 2024
<b>Session Description</b>	The purpose of this session is to present the history, concepts, principles and methods related to occupational health and occupational epidemiology. With workers representing half of the world's population, improving working conditions and limiting the exposure to occupational hazards and risks should be a priority for any public health authority. Despite effective interventions to assess and manage health risks at the workplace, major gaps exist between countries and sectors, with regards to the health status of workers and their exposure to occupational risks. The prevention of occupational hazards, the protection and the promotion of health at work, the management and the organization of occupational health services requires the involvement of workers, employers, medical professionals and public health specialists as it will be exposed through a case-based approach to the students. Epidemiology is also a key discipline once it comes to occupational health as there is a need to assess and measure the health status of workers against various occupational hazards and risks.
<b>Session Structure</b>	1- Occupational Health: an introduction, F.G. Schaafsma (Amsterdam UMC) 2- Introduction to occupational epidemiology, Emilie Council, INED
<b>Duration</b>	15 hours
<b>Training methods</b>	Lecture and case study

<b>Session 2.1</b>	<b>Occupational health: an introduction</b>
<b>Speakers</b>	F.G. Schaafsma (Amsterdam UMC), <a href="mailto:f.schaafsma@amsterdamumc.nl">f.schaafsma@amsterdamumc.nl</a>
<b>Session Outline</b>	This session will provide an overview of occupational health and its relevance to public health. It will explore the impact of work on health and of health on work, the professional disciplines involved, and further analysis of key topics: - Defining occupational health, Some history, OH service delivery - Functions of an OH service Occupational diseases (work-caused and work-related)  And of some key issues: Confidentiality, Disability at work, Fitness for work, Bloodborne viruses, Sickness absence, Overcoming obstacles to return to work, Cost-benefit of OH interventions
<b>Learning Objective</b>	<i>At the end of the session, the students should be able to:</i> - Discuss occupational health in relation to public health - Define occupational health, and some occupational diseases - Describe some current issues in occupational health - Interpret some Cost-benefit finding from occupational health interventions
<b>Duration</b>	9 hours

<b>Session 2.2</b>	<b>Introduction to occupational epidemiology</b>
<b>Speakers</b>	Emilie Council (INED), <a href="mailto:emilie.council@ined.fr">emilie.council@ined.fr</a>
<b>Session Outline</b>	Students will be introduced to the main concepts in occupational epidemiology along with appropriate designs and methods used to investigate occupational health issues.
<b>Learning Objectives</b>	<i>At the end of the session, the students should be able to:</i> - Identify key concepts in occupational epidemiology; - Discuss the appropriate design and methods for investigating an occupational health question; Critically read results of a study in terms of PH decision.
<b>Duration</b>	6 hours

<b>Session 3</b>	<b>Planetary Health</b>
<b>Dates</b>	April 2 <sup>nd</sup> , April 4 <sup>th</sup> 2024
<b>Session Description</b>	Global improvements in health and economic conditions over the past 2 centuries have been achieved alongside rapid degradation in most of the Earth's ecological and biophysical systems. This has brought along reductions in ecosystem services that threaten the health and wellbeing of human populations. The concept of planetary health is based on the premise that human health, development and environmental sustainability are connected. In this course we will show how the new scientific movement of Planetary Health can help build an evidence-base to achieve the UN Sustainable Development Goals. The course will be based on a mix of lectures, case studies and a situation game.
<b>Session Structure</b>	1- Planetary Health: a new discipline to inform the Sustainable Development Goals agenda 2- Interactions between ecological and socio-economic drivers of disease 3- Novel approaches for sustaining health & development 4- Situation game: planetary health in action
<b>Duration</b>	12 hours
<b>Training methods</b>	Lecture, case study, situation game

<b>Session 3.1</b>	<b>Planetary Health: a new discipline to inform the SDGs agenda</b>
<b>Speakers</b>	Andres Garchitorena (IRD), <a href="mailto:andres.garchitorena@ird.fr">andres.garchitorena@ird.fr</a>
<b>Session outline</b>	1. Global trends in economic development and health during the Millennium Development Goals 2. Global environmental trends to sustain human development: welcome to the Anthropocene Epoch 3. The United Nations' Sustainable Development Goals: opportunities and challenges 4. The need for new systems of governance and organization of human knowledge: the concept of Planetary Health
<b>Learning Objectives</b>	<i>At the end of the session, the students should be able to:</i> <ul style="list-style-type: none"> <li>- Identify important changes in economic, health and environmental indicators around the world in the past decades.</li> <li>- Understand key pieces of evidence that have driven international development assistance in the past and present</li> <li>- Recognize gaps in evidence and implementation that threaten the success of the SDGs, as well as current steps to fill these gaps</li> </ul>
<b>Duration</b>	3 hours

<b>Session 3.2</b>	<b>Interactions between ecological and socio-economic drivers of disease</b>
<b>Speakers</b>	Andres Garchitorena (IRD), <a href="mailto:andres.garchitorena@ird.fr">andres.garchitorena@ird.fr</a>
<b>Session outline</b>	<ol style="list-style-type: none"> <li>1. Feedback mechanisms between environment, poverty and disease in tropical regions</li> <li>2. Novel frameworks to simultaneously study multiple feedback mechanisms</li> <li>3. The group of Neglected Tropical Diseases as exemplary of these feedbacks</li> <li>4. Case studies: Buruli ulcer in Cameroon and Schistosomiasis in Senegal</li> </ol>
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Understand the connection between poverty, environmental degradation and infectious disease burdens, both at macro- and micro-scales.</li> <li>- Identify socio-economic factors that can increase vulnerability to disease among poor populations</li> <li>- Recognize different types of economic impacts that infectious diseases can have on human populations</li> <li>- Provide examples of disease systems where these multiple links can be observed</li> </ul>
<b>Duration</b>	3 hours

<b>Session 3.3</b>	<b>Novel approaches for sustaining health &amp; development</b>
<b>Speakers</b>	Andres Garchitorena (IRD), <a href="mailto:andres.garchitorena@ird.fr">andres.garchitorena@ird.fr</a>
<b>Session outline</b>	<ol style="list-style-type: none"> <li>1. International agreements on health, climate and development</li> <li>2. Vertical programs: from the big three to integrated action on NTD</li> <li>3. Ecological levers of health and the search for win-win solutions</li> <li>4. Integrated health system strengthening and horizontal programs</li> </ol>
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Assess different types of public health solutions to reduce disease burdens in developing countries: advantages and limitations</li> <li>- Recognize how ecological knowledge on disease transmission can be used to design complementary interventions for disease control</li> </ul>
<b>Duration</b>	3 hours

<b>Session 3.4</b>	<b>Real world situation game: planetary health in action</b>
<b>Speakers</b>	Andres Garchitorena (IRD), <a href="mailto:andres.garchitorena@ird.fr">andres.garchitorena@ird.fr</a>
<b>Session outline</b>	<ol style="list-style-type: none"> <li>1. Situation game introduction: environmental, health and socioeconomic challenges in Ifanadiana, rural Madagascar.</li> <li>2. Student group work: strategic planning of a planetary health intervention</li> <li>3. Group presentations</li> </ol>
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Understand the complexity of real world program implementation, where a multiplicity of challenges and actors interact</li> <li>- Critically use the knowledge learned to identify problems and propose adequate solutions</li> </ul>
<b>Duration</b>	3 hours

<b>Session 4</b>	<b>Healthy Urban Planning</b>
<b>Dates</b>	March 21 <sup>st</sup> , March 25 <sup>th</sup> , April 3 <sup>rd</sup> , April 10 <sup>th</sup> 2024
<b>Session Description</b>	<p>Nowadays, in poor and rich countries alike, obesity, asthma, health inequalities, mental health problems, social isolation and exposure to different types of pollution are strong public health challenges. They are conditioned by the quality of our living environments, themselves a product of the urban planning and development policies implemented by municipalities and local stakeholders. As the majority of the world's population lives presently in cities, there is a need to rethink urban planning principles and to reinforce the links between planning and health.</p> <p>In this session, students will be presented with concepts and principles of Healthy Urban Planning (HUP) and how they can positively impact urban dwellers health. Through field visits in Saint-Denis neighborhoods and group work, students will gain a better understanding of ways to reinforce healthy urban planning and how to put HUP concepts into practice.</p>
<b>Session Structure</b>	<ol style="list-style-type: none"> <li>1. Healthy Urban Planning: Concepts and principles, A. Roué-Le Gall, Ehesp</li> <li>2. Healthy Urban Planning: Case study, A. Roué-Le Gall</li> </ol>
<b>Duration</b>	12 hours
<b>Training methods</b>	Lecture, case study, group work
<b>Assignments</b>	Group work: each group will be assigned a case and a neighborhood and will analyze the impact of each individual's living environment on its health and well-being. On the final session students will share and discuss their results. A short written note will be submitted as well on the same day. 25% of final grade.

<b>Session 4.1</b>	<b>Healthy Urban Planning: Concepts and principles</b>
<b>Speakers</b>	Anne Roué Le Gall (Ehesp), <a href="mailto:anne.roue-legall@ehesp.fr">anne.roue-legall@ehesp.fr</a>
<b>Session Outline</b>	Cities are complex systems and a variety of characteristics affect urban dwellers health. Environmental issues can combine with social issues and lead to strong health inequalities in cities. At the same level of exposure, deprived population faces a higher health risk (differential of vulnerability) or they can be exposed to higher level or wider range of environmental risks (differential of exposure). Urban planning and design, because they transform dwellers' living space, are an important determinant of health and well-being in cities. Healthy Urban Planning (HUP) concepts and principles can therefore be a strong lever to improve population health and well-being and has been supported variously by international organizations (WHO, EU) and local stakeholders.
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Clarify the definition of determinants of health in cities</li> <li>- Appropriately the concept of Healthy Urban Planning (HUP)</li> <li>- Identify levers to promote HUP</li> </ul>
<b>Duration</b>	3 hours

<b>Session 4.2</b>	<b>Healthy Urban Planning: Case study</b>
<b>Speakers</b>	Anne Roué Le Gall (Ehesp), <a href="mailto:anne.roue-legall@ehesp.fr">anne.roue-legall@ehesp.fr</a>
<b>Session Outline</b>	In this session, students will work on case study and analyze the impact of living environment on the health and well-being of different sections of the population (elders, children, family...). Using HUP concepts and principles as reference framework, they will make proposals aimed at reducing health risks and maximizing health benefits. Groups will share and discuss their findings during a presentation session and in a short written note.
	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Become familiar with analytical reference tools for urban development projects</li> <li>- Gain a better understanding of a holistic approach to health determinants</li> </ul>
<b>Duration</b>	9 hours



<b>Session 5</b>	<b>Water Pollution and Health</b>
<b>Dates</b>	April 8 <sup>th</sup> , April 9 <sup>th</sup> , April 10 <sup>th</sup> 2024
<b>Session Description</b>	Water, whether used for drinking, domestic purposes, food production or recreational purposes has an important impact on health. 2 billion people use drinking-water source contaminated with feces. Water quality, safety and its management are fundamental to health and well-being. Providing access to safe water is one of the most effective instruments in promoting health and human development. This course will review the various aspects of water, wastewater and sources of water pollution, how they relate to human health, and how we can monitor and protect water resources for public health. The course will be based on a mix of lectures and case studies as well as some group work.
<b>Session Structure</b>	1- Water Pollution and Health, P. Rousseau-Gueutin, P. Le Cann, Ehesp 2- Assessing and monitoring water quality, I. Delpla, Ehesp 3- Microbial quality of drinking water, P. Le Cann, Ehesp
<b>Duration</b>	15 hours
<b>Training methods</b>	Lecture, case study, group work

<b>Session 5.1</b>	<b>Water Pollution and Health</b>
<b>Speakers</b>	Pauline Rousseau-Gueutin (Ehesp), <a href="mailto:pauline.rousseau-gueutin@ehesp.fr">pauline.rousseau-gueutin@ehesp.fr</a> Pierre Le Cann (Ehesp), <a href="mailto:pierre.lecann@ehesp.fr">pierre.lecann@ehesp.fr</a>
<b>Session Outlines</b>	This session will present: <ul style="list-style-type: none"> <li>- Key concepts about water pollution and health</li> <li>- Key concepts about groundwater and surface water</li> <li>- Assessment of the vulnerability of groundwater and surface water</li> <li>- Importance of groundwater and surface water in the hydrological cycle</li> <li>- Impact of groundwater and surface water on health</li> <li>- Importance of protecting groundwater and surface water to protect health</li> </ul> <p>Through study of different cases of groundwater and surface water degradation (landfill impacts, Arsenic, saline intrusion), the students will be introduced to the various uses of water and the protection and mitigation measures taken to preserve this resource.</p>
<b>Learning Objectives</b>	<i>At the end of the session, the students should be able to:</i> <ul style="list-style-type: none"> <li>- Use different concepts studied about groundwater</li> <li>- Discuss the vulnerability of groundwater</li> <li>- Identify the role of groundwater in the hydrological cycle</li> <li>- Assess the impact of ground water on health</li> </ul>
<b>Duration</b>	6 hours

<b>Session 5.2</b>	<b>Drinking water : treatment, monitoring, protection and management</b>
<b>Speakers</b>	Ianis Delpla (Ehesp), <a href="mailto:Ianis.Delpla@ehesp.fr">Ianis.Delpla@ehesp.fr</a>
<b>Session Outline</b>	<p>Metrology is the science of measurement. It includes units of measurement and their standards, measuring instruments and their field of application, and all theoretical and practical aspects relating to measurement. Looking at the environmental metrology applied to the pollution of surface water we will:</p> <ul style="list-style-type: none"> <li>- Present the water contamination (sources) and the main pollutants , their fate in the environment, and the human exposure</li> <li>- Present the monitoring objectives and the monitoring tools</li> </ul>
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Identify the main sources of water contamination, and especially the health risks related to chemical contaminants</li> <li>- Discuss the monitoring objectives</li> <li>- Use the monitoring tools,</li> <li>- Know the risk managements tools (WSP)</li> </ul>
<b>Duration</b>	3 hours

<b>Session 5.3</b>	<b>Microbial quality of drinking water</b>
<b>Speakers</b>	Pierre Le Cann (Ehesp), <a href="mailto:pierre.lecann@ehesp.fr">pierre.lecann@ehesp.fr</a>
<b>Session Outline</b>	<p>The most common and widespread health risk associated with drinking-water is microbial contamination, the consequences of which mean that its control must always be of paramount importance (WHO). The microbial and enteric microbial agents will be presented along with the methods to detect them in contaminated waters. Some country regulations will be analyzed. Last, disinfection processes for destroying and preventing microbe growth will be discussed.</p>
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Enumerate the classical agents that have been shown to contaminate waters</li> <li>- Identify the methods to detect agents in contaminated waters</li> <li>- Analyze the effectiveness of some national regulations</li> <li>- Implement some prevention interventions in given adverse environment</li> </ul>
<b>Duration</b>	3 hours

<b>Session 6</b>	<b>Measuring and assessing environmental exposure</b>
<b>Dates</b>	March 20 <sup>th</sup> , March 27 <sup>th</sup> , April 5 <sup>th</sup> , April 11 <sup>th</sup> , 2024
<b>Session Description</b>	The purpose of this session is to introduce students to important methodological aspects of environmental health looking at three disciplines (Toxicology, Geography and Epidemiology). Single or multiple environmental exposures throughout the lifespan can influence the prevalence and severity of diseases. Exposure to environmental factors remains a complex phenomenon those analyses and assessments raise several methodological issues. In the fast-evolving field of toxicology, High-throughput screening (HTS) assays that measure the <i>in vitro</i> toxicity of environmental compounds have generated large datasets (i.e. BPA, Dioxin), but more research is required to demonstrate their applicability for predicting <i>in vivo</i> hazard. While using GPS and Geographic Information System offers new opportunities in the measurement of environmental exposures, it also presents a series of potential biases in the assessment of causal environmental effects. Quantifying the impact of pollutant on health, demonstrating an association, improving the power of an epidemiological study are still major challenges in environmental epidemiology.
<b>Session Structure</b>	1- From the Basics concepts of Physiology to the basics concepts of Toxicology, A. Gely-Pernot, Ehesp 2- The Spatial Turn in Environmental Health, M. Fuentes Vallejo (Centre Léon Bérard) 3- Environmental Epidemiology, B. Jacquemin, INSERM
<b>Duration</b>	15 hours
<b>Training methods</b>	Lecture, case study, lab work

<b>Session 6.1</b>	<b>From the Basics concepts of Physiology to the basics concepts of Toxicology</b>
<b>Speakers</b>	Aurore Gely-Pernot (Ehesp), <a href="mailto:aurore.gely-pernot@ehesp.fr">aurore.gely-pernot@ehesp.fr</a>
<b>Session Outline</b>	The aims of this course are to give some basic concepts of biology systems, physiology and organ functions, both at a cellular level (cell biology) and at a molecular level (proteins functions, receptors, signaling pathways...) The first part will be necessary for students to understand the second part of the course about some basic knowledge in toxicology as it applies to environmental health ("Is Human fertility affected by environmental contaminants?"). The second part will be an example of the impact of environment on one physiological process, the biology of reproduction.
<b>Learning Objectives</b>	<i>At the end of the session, the students should be able to:</i> <ul style="list-style-type: none"> <li>- Mobilize basic concepts studied from biology, physiology and organ functions</li> <li>- Identify some key process from biology to toxicology associated to environmental contaminants</li> <li>- Describe the impact of environment on reproduction system and fertility</li> <li>- Assess some of these impacts</li> </ul>
<b>Duration</b>	6 hours

<b>Session 6.2</b>	<b>Introduction to environmental epidemiology</b>
<b>Speakers</b>	Bénédicte Jacquemin (INSERM), <a href="mailto:benedicte.jacquemin@inserm.fr">benedicte.jacquemin@inserm.fr</a>
<b>Session Outline</b>	In this course students will apply concepts taught in Environment (i.e. exposure), Epidemiology and Biostatistics. A first lecture will remind students of the importance of exposure in environmental epidemiology and review epidemiological concepts applied to the environmental field. Through a mix of readings and lab work on epidemiological data about lead in children and child psychomotor development, we will present different types of study design in environmental epidemiology and discuss issues related to exposure in environmental epidemiology and how to analyze results from an epidemiological and environmental point of view.
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Identify epidemiological concepts used in the environmental field</li> <li>- Identify the basic principles of exposure assessment in environmental epidemiology</li> <li>- Apply epidemiological and biostatistical methods to children lead exposures and their impact on neurodevelopment</li> <li>- Analyze main findings</li> <li>- Discuss major methodological issues related to environmental epidemiology</li> </ul>
<b>Duration</b>	6 hours

<b>Session 6.3</b>	<b>The Spatial Turn in Environmental Health</b>
<b>Speakers</b>	Mauricio Fuentes Vallejo (Centre Léon Bérard), <a href="mailto:fuentesv.mauricio@gmail.com">fuentesv.mauricio@gmail.com</a>
<b>Session Outline</b>	Geographic Information Systems have been absolutely fundamental in revealing patterns of inequalities in environmental exposures and mapping them. Many advances (GPS, remote sensing, open geographic data...) that have occurred in the past 20 years have helped us to better understand the spatial and temporal dimensions of exposures that are either harmful or beneficial for people's health. We will present state-of-the-art methods, assessing environmental exposure and analyzing data on population, health events, and risk factors. We will address several methodological issues related to the use of geographic information and spatial analysis and modelling in environmental health (privacy, MAUP, ecological fallacy, homogeneity/heterogeneity...). Finally, students will be introduced to webmapping tools (EPA, GoogleMaps) and how they can help to map the exposure to various environmental health risks.
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>- Describe the spatial and temporal dimensions of environmental exposures</li> <li>- Summarize the state of the art GIS methods assessing environmental exposures</li> <li>- Discuss major methodological issues while using GIS analysis for environmental health</li> </ul>
<b>Duration</b>	3 hours

<b>Session 6.4</b>	<b>Climate change and Environmental Justice</b>
<b>Speakers</b>	Tarik Benmarhnia (UCSD, EHESP), <a href="mailto:tbenmarhnia@health.ucsd.edu">tbenmarhnia@health.ucsd.edu</a>
<b>Session Outline</b>	In this course, we will focus on the critical intersections between climate change, environmental health, and social justice within the realm of public health. We will discuss the foundations of the environmental justice movement, and how we can conduct environmental justice studies applied to climate sensitive exposures.
<b>Learning Objectives</b>	<p><i>At the end of the session, the students should be able to:</i></p> <ul style="list-style-type: none"> <li>• Understand the definitions and conceptual frameworks related to environmental justice</li> <li>• Understand the history of the environmental justice movement and regulations in the US and other countries</li> <li>• Understand how to conduct environmental justice mapping</li> <li>• Understand how to conduct an epidemiological analysis to quantify differential susceptibility and exposure to various climate sensitive exposure.</li> </ul>
<b>Duration</b>	3 hours