

PH. 180 (ENVIRONMENTAL HEALTH AND ENGINEERING)

Courses

Course location and modality is found on the BSPH website (<https://publichealth.jhu.edu/courses/>).

PH.180.600. Public Health Implications of Health as a Human Right. 2 Credits.

Explores the evolution and application of policy and legal remedies that promote respect for and protection of -internationally recognized- human rights in general and the protection & fulfillment offered through public health and health care access as a human right. Explores the creation of a culture of human rights and its application to health as a human right, focusing broadly on health as a human right using: a) human rights law & policy to enhance health programs, b. the impact of public health policies, programs and practices on human rights; and c. the health impacts of human rights violations. Discusses gross violations during conflict and insidious violations associated with the mistreatment of marginalized groups and individuals, including violence (broadly interpreted) may be included based on the stated interests of class participants.

PH.180.601. Environmental Health. 5 Credits.

Summarizes the concepts and principles underlying environmental health sciences, characterizes the major environmental agents and vectors affecting public health, and introduces major ecologic, scientific, and political issues from selected topical areas of environmental health. Presents the major concepts and principles that are environmentally mediated and that constitute a risk to humans —emphasizing the chemical, biological, and physical agents and factors. Considers sources, environmental pathways of transmission, exposure-dose relationships, adverse health effects, and particularly susceptible populations. Identifies the principles and methods of risk assessment and risk management, and uses these as a unifying theme.

PH.180.602. Environment and Health in Low and Middle income Countries. 2 Credits.

Introduces students to how environmental health hazards can affect human health in low and middle income settings. The core concepts are: exposure assessment, environmental epidemiology, and risk communication. Topics include: heavy metals, water sanitation and hygiene, waterborne and related diseases, tropical diseases, energy resources and health, and air pollution.

PH.180.603. Research Methods in Health Security. 3 Credits.

Provides tools for applying the Bayesian framework for decision analysis. Explores, through discussion and exercises, opportunities for its application in occupational and environmental hygiene data interpretation and exposure risk assessment. Emphasizes the use of a number of heuristics (rules of thumb) and mathematical exposure models to increase the accuracy and efficiency of exposure decision-making. Includes several exposure assessment exercises using videos of tasks and basic characterization of the environment.

PH.180.605. Food Systems Practicum: Service and Reflection to Enhance Policies and Programs. 4 Credits.

Students learn first-hand about food system sustainability issues by engaging with organizations working for positive change. They broaden their learning through classroom education, readings and assignments covering: food system sustainability, with emphasis on content areas relevant to student projects; skills and context relevant to working with these organizations; and reflection on service-learning experiences.

PH.180.606. Case Studies in Food Production and Public Health. 3 Credits.

Explores critical food system priorities including the dynamics between agriculture and the climate crisis, emerging threats from zoonotic diseases, agricultural land use, and the health of workers and rural populations. Invites insights from leading experts on alternative proteins, institutional food procurement, carbon sequestration, and other advances in food system change. Challenges students to reconcile competing priorities and conflicting recommendations. Applies an array of frameworks, including a One Health lens, to the public health and ecological impacts of food production. Draws lectures from the peer-reviewed literature and includes dynamic podcast-style interviews.

PH.180.607. Climate Change and Public Health. 3 Credits.

Explores the science of how and why the climate is changing, as well as the likely and potential impacts of climate change on public health in developed and developing regions of the world. Discusses how rising sea levels; fossil fuels; worsening air quality; frequency and severity of weather-related disasters; and scarcity of food and drinking water are all influenced by the changing climate. Examines policy, behavior, mental health, social determinants of health, economics, sustainable strategies for mitigation and adaptation, and the role public health professionals can play in these decisions. Synthesizes concepts and knowledge from multiple disciplines through a hands-on, translational project.

PH.180.609. Principles of Environmental Health. 4 Credits.

Presents concepts, principles, and applications underlying the field of environmental health. Topics include contaminant sources, fate and transport, exposure and dose, study design in toxicology, climate change, environmental justice, and the built environment. Emphasizes policy, practice, and systems-based approaches. Discussions and exercises focus on reviewing current environmental health issues in the media, evaluating peer-reviewed literature on these issues, and deliberating on potential opportunities for prevention and intervention.

PH.180.610. Applied Environmental Health Practice. 4 Credits.

Applies principles of environmental health to a real-world problem impacting a community in our own backyard. Investigates the driving forces that underlie these complex environmental health issues. Explores strategies for assessment and intervention. Integrates the lived experiences of community members and students wherever possible. Incorporates group work, so students are expected to coordinate schedules with each other and the community-based organization. Students practice skills in project management and data analysis —enacting theoretical principles of environmental health learned in previous classes—while working in a group setting. The combination of these practical skills and theoretical foundations are fundamental in today's professional practice.

PH.180.611. The Global Environment, Climate Change, and Public Health. 4 Credits.

Explores how global environmental issues such as global warming, urban sprawl, deforestation, mining, environmental refugees, biodiversity loss, and food security may cause increasing human harm. Provides an overview of the science and policy issues related to the changing environment, how environmental problems affect human health, and emphasizes potential solutions and sustainable development methods essential for resolving a myriad of environment-health problems.

PH.180.612. Advanced Environmental Health. 4 Credits.

Addresses environmental contaminants originating from four environmental vectors, Air, Water, Soil, and Food, impact human health. Focuses on the foundational knowledge and methods in environmental health needed by doctoral students to prepare for advanced careers in environmental health including integration of multi-disciplinary approaches.

PH.180.613. Teaching Environmental Health. 1 Credit.

Prepares students to excel in required teaching activities as part of their PhD program. Includes access to teaching resources, departmental best practices and faculty support. Reviews critical skills in teaching and communicating environmental health and engineering concepts.

PH.180.614. Urban Agriculture and Public Health. 2 Credits.

Explores the connections between urban agriculture and public health using case studies around the United States. Examines the people, practices, policies, and public health significance of urban agriculture. Lectures and background reading provide an evidence-based introduction to the connections among public health, agriculture, community development and food justice. Students are expected to listen to online lecture(s), do readings, and quizzes before the course begins. The course be based at the Center for a Livable Future's Food System Lab, an urban farm at Cylburn Arboretum featuring an aquaponics system. Field trips to local food system sites, such as a farm, farmers market and community garden, and hands-on activities help students blend theory and practice. For a final project, students will translate what they learn in the course by exploring and reporting on aspects of their own local food environment.

PH.180.615. Total Worker Health. 3 Credits.

Introduces the key health effects of environmental exposures and the epidemiologic methods used to identify and estimate those effects. Emphasizes the interplay of methodological issues, including the assessment of environmental exposures and the understanding of specific disease processes in identifying the health impact of environmental exposures in the population. Students learn about environmental exposures (including water and air pollution, food contamination, ionizing radiation, persistent environmental pollutants and emergent environmental exposures) and key methodological issues relevant for these exposures in population studies (including study design, exposure assessment and biomonitoring, disease clusters, dose-response relationships, susceptibility, geographic analysis, and evidence synthesis).

PH.180.616. DrPH Concentration Seminar in Environmental Health. 0.25 Credits.

Provides opportunities to discuss issues and concepts related to Environmental Health. Discusses evaluation of existing research, identification of gaps and topics, and design of research projects. Facilitates preparation for the comprehensive written exams, the design and conduct of practicum projects, preliminary oral exams, dissertation projects, and the final oral exam. Provides opportunities to present work-in-progress on overall projects and on specific research methodologies and to give and receive peer feedback. Emphasizes clear communication of ideas.

PH.180.618. Law and Laboratory Animals: Statutes, Regulations and Policies. 3 Credits.

Examines the laws, regulations and policies that govern the relationship between biomedical institutions, laboratory researchers and animals that have developed over the past half-century. Focuses on the systems of governmental and self-regulation that are at the heart of the U.S. (and international) efforts to address ethical and societally beneficial laboratory animal use. Explores the ethical foundations of these laws and discusses the relationship between scientists, animals and society. Includes both in-person and online lectures by research scientists, veterinarians, and professionals who are experts in humane science. Features class discussions and case studies.

PH.180.619. Drinking Water and Water Policy: Avoiding Another Flint. 1 Credit.

Provides an overview of the federal drinking water and clean water laws, as well as the resultant regulations from these laws. Considers the contaminants addressed by the regulations and the drinking water and wastewater treatment necessary to comply with the regulations. Explores the use of the Consumer Confidence Report (CCR) to understand what's in drinking water. Investigates current issues and problems facing the water sector, as well as some of the potential solutions.

PH.180.620. Introduction to Food Systems and Public Health. 4 Credits.

Introduces the complex and challenging public health issue of food security (sufficient, safe and nutritious food for all) in a world where approximately 850 million people are under-nourished while over 2 billion are overweight or obese. Explores the connections among diet, our food system, the environment and public health, considering factors such as equity, population pressure and the historical, economic and political forces that have helped shape food systems. Considers approaches to achieving both local and global food security. Explores the important role public health professionals can play. Guest lecturers include experts from a variety of disciplines and experiences.

PH.180.621. Protecting the Environment and Safeguarding Worker Health: A Problem-Based Approach. 3 Credits.

Examines environmental and worker health by introducing and analyzing four real world problems; Explores how evidence-based interventions are designed and implemented; Emphasizes the role that social justice and environmental equity play in establishing effective public health interventions; Reviews how science, communication, and policy interweave in environmental and occupational health decision-making; Shows how environmental and occupational health leaders act to address and solve problems and prepares students to tackle and design solutions for contemporary problems in environmental and occupational health.

PH.180.623. Infectious Disease Threats to Global Health Security. 3 Credits.

This course will introduce students to the major health security threats that face the US and other countries and the strategies, policies and organizations that are in place to defend against them. Throughout the course, we will make notes of areas where approaches to health security have evolved. We will also examine where important gains in health security preparedness have been made and identify areas in which progress is still needed. Given their particular challenges and frequency with which they occur, preparedness for and response to biological threats to health security will be a large focus of this class. Discussions of other health security threats and sharing of experiences from students are welcome.

PH.180.624. Biotechnology and Health Security. 3 Credits.

Prepares students to examine the complex issues surrounding the security of advances in the biological sciences, and their impact on public health. Acquaints students with medical and public health options that may be possible as a result biotechnology advances—for example, to rid areas of malaria-carrying mosquitoes. Will also acquaint students with the difficult history of past bioweapons programs in the 20th century, and the continuing effect that history has on current biodefense and health security efforts. Introduces the concept of the dual-use dilemma—that is, how biotechnologies may have applications for good and harm—and explores how current biotechnology advances may be applied towards security aims, or could be misused. Topical issues in science and security policy, including genetically modified organism (GMO) controversies, will be explored, researched, and debated. Encourages application of critical thinking skills through class discussions and written assignments.

PH.180.625. Community-Driven Epidemiology and Environmental Justice. 3 Credits.

Introduces principles, concepts, and methods in community-driven environmental justice research. Presents current environmental justice research and future research needs. Offers practice opportunities for active involvement in problem-solving in environmental justice research. Provides students an opportunity to develop facility with analytic methods needed to conduct research into community environmental justice concerns.

PH.180.626. Environmental Justice and Public Health Practice. 3 Credits.

Explores environmental justice through a historical, ethical and political lens with discussions on the impacts of environmental injustice on health disparities, particularly in low income and minority communities. Critical assessment of existing environmental justice approaches will be used to foster discussions and strategies for alleviating inequities in environmental exposure and disease at multiple levels and domains of public health. This course will highlight various approaches for public health officials, advocacy groups, health professionals, policymakers, and stakeholders to contribute to environmental justice, and guide students through integrating existing expertise into environmental justice solutions.

PH.180.627. Lessons Learned in 1918 Pandemic Flu. 1 Credit.

Prepares students to examine the complex history surrounding the 1918 influenza pandemic, the public health response at that time, and compare to preparedness, today. Acquaints students with the realities of mass vaccination and medical countermeasure development. Topical issues related to influenza preparedness will be discussed, including an examination of what happened in the 1977 reemergence of H1N1 influenza, gain of function influenza experiments and other controversial influenza research, and the effectiveness of non-pharmaceutical interventions. Encourages application of critical thinking skills through class discussions and written assignments.

PH.180.628. Introduction To Environmental and Occupational Health Law. 4 Credits.

Introduces the theory and practice of environmental and occupational health law. Examines the approaches and strategies that underlie federal (United States) and state environmental and occupational health laws and regulations. Focuses on the study of the most significant federal and state environmental and occupational health laws and regulations, such as the Clean Air Act, Occupational Safety and Health Act, Comprehensive Environmental Response, Compensation, and Liability Act, and workers' compensation laws, with a particular emphasis on how they can be utilized as public health tools. Introduces students to the institutions and agencies that administer worker and environmental protection programs, and acquaint students with international treaties and laws aimed at protecting the environment and workers.

PH.180.629. Infectious Disease and Fragile Settings. 2 Credits.

Focuses on the relationship amongst political instability, conflict, fragile settings and infectious disease, as well as the corresponding impacts on local and global populations. Reviews how a country's national and foreign policy positions impact health systems and assesses the risk of infectious disease threats when nations become unstable due to factors such as internal state actors, man-made sources of instability, terrorism, and/or natural disaster and climate change. Focuses on discussions on why particular infectious diseases are prone to emergence or re-emergence during conflict and instability, and the impacts of those diseases on national systems and broader global health security. Gains a general understanding of recent global political conflicts and environmental threats, and how pathogens that were previously considered controllable now take their toll on a population, health system and/or governance structure.

PH.180.630. Chemical and Biological Weapons Threats: Science, Public Health, Policy. 4 Credits.

Provides a broad understanding of the application of scientific concepts of biological and chemical warfare agents to inform evidence-based public health action and policy-making. Reviews the scientific principles and outcomes of threat agent use. Includes topics such as scientific and clinical aspects of threats agents, history of past use, and overarching policies to control their use. Examines the public health aspects of preparedness, including national development, use, and sharing of medical countermeasures. Explains principles of preparedness and response using case studies. Builds skills in crafting evidence-based public health policy options in preparing and responding to chemical and biological threats.

PH.180.631. Environmental and Occupational Health Policy Seminar. 3 Credits.**PH.180.632. Introduction to Molecular Toxicology. 3 Credits.**

'Introduction to Molecular Toxicology' is a 3-credit online course that introduces toxicology at a molecular level. It is designed for students with minimal background in biology and toxicology. The course will review the molecular mechanisms of diseases associated with environmental exposures. The course will introduce the cellular signaling pathways involved in protection from effects of chronic exposure to environmental toxicants, including responses to stress and oxidative damage. The course will also review both genetic and epigenetic changes that are associated with disease pathogenesis. In addition, the course will present the most recent technological advances in the molecular tools available to study effects of environmental toxicants, including next generation sequencing, mass spectrometry, gene editing models and emerging alternative animal models.

PH.180.633. The Sociocultural Dimensions of Disasters. 3 Credits.

Provides an anthropological viewpoint on extreme events including natural disasters, outbreaks, and technological accidents. Explores the human hand in, and experience of disasters - phenomena that influenced by the ways people imagine, build, organize, and value their communities. Critically examines the present trend of more frequent and more severe disasters, as well as chronic disparities in people's abilities to withstand and to recover from mass tragedy. Introduces theories of social vulnerability and community resilience to inform policies on how to reduce the chances for, as well as consequences of disasters.

PH.180.634. Public Health Emergencies: Risk Communication and Decision Science. 3 Credits.

Explores the science of risk communication and decision making. Discusses risk perception, communication guidance, and news media portrayal of risks. Reviews existing guidance on risk decision making. Presents previous and current public health emergencies as practice-based examples of risk communication and decision making. Examines public health emergency scenarios to prepare students for communication and decision making in their future work.

PH.180.635. Seafood and Public Health: Global Trade, Nutrition and the Environment. 3 Credits.

Explores the (sea)food system with a multi-disciplinary approach and real world examples. Examines the local-to-global connections in the most internationally traded food commodity, and why this matters for food and nutrition security, as well as environmental health. Discusses how the seafood sector can create sustainable aquatic food systems that work for businesses, fish workers, and consumers. Focuses on low- and middle-income countries where seafood is key for food and livelihoods.

PH.180.636. Human Rights and Health Seminar. 3 Credits.

Introduces students to human rights in general, health as a human right, impact of health policies, programs and practices on human rights, and collective impacts of human rights violations, whether gross violations in human conflict or insidious violations associated with mistreatment of individuals and marginalized groups.

PH.180.637. Refinement of Animal Experimentation: Essential to Reduce Animal Suffering and Enhance Scientific Rigor. 2 Credits.

Prepares students who work or plan to work with animal subjects in the laboratory. Explores how to comprehensively and adequately apply Refinement methods in practice. Focuses on current housing and husbandry standards and discusses the benefits of a 'culture of care' for animals. Examines current best approaches to the important experimental refinements, namely anesthesia, analgesia, pain assessment and management, health monitoring, and humane endpoints and killing methods. To further assess the quality of animal-based research, necessary refinements in planning, conduct, analysis and reporting practices of animal studies are reviewed. Presents potential barriers to the uptake and application of Refinement methods and how they are challenged.

PH.180.638. Animals in Research: Ethics. 1 Credit.

Introduces students to the principles of bioethics when using animals in biomedical research and testing. Discusses the most common ethical theories such as contractarianism, Kantianism and utilitarianism. Addresses ethical issues arising from the use of animals in biomedical research and emphasizes on the role the three Rs of animal experimentation (Replacement, Reduction and Refinement) play when conducting animal experiments. Explores the harms involved in animal studies and assesses these against the benefits (harm-benefit analysis, HBA). The HBA is considered to be a key ethical safeguard for animals and, thus, is discussed in detail. Prepares students for real-world problems they may face in the laboratory.

PH.180.639. Advanced Environmental Health II. 2 Credits.

Focuses on the foundational knowledge and methods and their application in environmental health and engineering needed by doctoral students to prepare for careers in environmental health. Frames how environmental contaminants originating from four environmental vectors, Air, Water, Soil and Food, impact human health.

PH.180.640. Molecular Epidemiology and Biomarkers in Public Health. 4 Credits.

Emphasizes the scientific basis of molecular epidemiology and provides examples of the application of molecular biology, analytical chemistry, and toxicology to the study of chronic disease etiology and its public health application, including examples in human cancer, cardiovascular, immunological, and neurological diseases. Also discusses methodological and study design problems.

PH.180.641. Climate Change and Public Health Problem Solving Seminar: Global Challenges and Solutions for Mitigation, Adaptation, and Sustainability. 3 Credits.

Equips students with the skills to understand how to evaluate, assess, and design adaptation and mitigation strategies for global climate change impacts on public health. Features "real world" scenarios and case studies that are used to demonstrate the likely impacts of climate change on public health. Analyzes case studies and discusses how evidence-based science is deployed to combat the environmental health aspects of climate change. Gains a better understanding of the role that social justice and environmental equity play in the challenges that climate change brings. Emphasizes a systems-based approach, recognizing that climate change problem-solving methodology is multi-dimensional and multi-sectorial.

PH.180.644. Food System Resilience. 2 Credits.

Provides an overview of how acute and chronic disasters affect food systems, describes actions to support food security, and discusses public health roles. Shares stories and insights from guest speakers at the cutting edge of policy, practice, and research, from community to global scale. Explores concepts of food systems, resilience, preparedness, and equity. Reviews strengths, limitations, and unintended consequences of responses. Discusses how systemic factors (e.g., poverty, racism, and unsustainable food systems) affect outcomes. Challenges students to explore diverse perspectives and constraints, build on assets, and envision responses for emergency needs and longer-term systemic change.

PH.180.647. The Health Effects of Indoor and Outdoor Air Pollution. 3 Credits.

Provides a broad understanding of air pollution, its sources, transport and exposure. Examines important atmospheric chemistry and measurement methods. Discusses the relationship between air pollution and health effects. Includes topics such as oxidant pollutants, sulfur dioxide and acid aerosols, particulates, bioaerosols, volatile organic compounds, and indoor air pollution. Also covers host susceptibility factors, the influence of global warming, and regulation and public policy.

PH.180.650. Fundamentals of Clinical Oncology for Public Health Practitioners. 3 Credits.

PH.180.651. Energy, Environment, and Public Health. 2 Credits.

Examines why energy policy choices are so important to human health and well-being. Explores how the impacts of energy exploration, generation, and usage patterns are tied directly to economic prosperity, the condition of the environment, the health of the population, and even aspects of national and international security, for developed as well as developing nations. Discusses and presents potential solutions to the three biggest energy challenges: (1) meeting the basic energy needs of the world's poorest people in a more healthful manner, (2) de-carbonizing electricity generation, and (3) reducing oil dependence. Emphasizes that energy is the core of the environment problem and environment is the core of the energy problem.

PH.180.653. Climate Change: Avoiding Conflict and Improving Public Health. 3 Credits.

This course explores the potential for a changing climate to cause food and water shortages, forced migration, and conflict. Through a series of case studies of climate change-relevant crisis events around the world, we will examine the factors that led to the communities in question mustering resilience to survive and recover from the crisis vs. the factors that led to conflict. Through this analysis, we will identify a suite of resilience factors and strategies, such as community cohesion, ecosystem restoration, agricultural and water capture and storage, that could be built into policies to assist high risk areas in avoiding conflict.

PH.180.655. Baltimore Food Systems: A Case Study of Urban Food Environments. 4 Credits.

Challenges students to look closely at the environment of Baltimore City's complex food systems, and to consider what it would take to improve these systems to assure access for all to nutritious, adequate, affordable food, ideally with reduced environmental harm. Students "go backstage" with tour guides at sites including a supermarket, a corner store, an emergency food distribution center, and a farm connected to the city school system. Students learn about the types of food available at these sites, who uses them, relevant aspects of their operations, and site-relevant key barriers to, and opportunities for, providing access to healthier and more sustainably produced food. Students also conduct oral history interviews about food with elderly city residents to understand how food access has changed over the years. Class sessions engage students to think critically, and provide background and frameworks for understanding the experiential sessions. Throughout, students consider the relative impacts of access, demand, and stakeholder interests, and consider the relative strengths and weaknesses of voluntary, regulatory (governmental), legal and other strategies. Lectures and discussions consider applicability of lessons gained from the study of Baltimore to other food systems. For their final papers, students identify a problem and its key determinants, and they propose/analyze an option to address it. Students think critically about selected aspects of the city's food systems and food environments, identifying challenges and opportunities for change and incorporating lessons learned from other food systems and programs. Students also discuss implications beyond Baltimore.

PH.180.661. Writing Scientific Papers I. 2 Credits.

Enables doctoral students to attain skills in writing successful scientific papers—that is, papers that are accepted by peer-reviewed journals. Confers skills in identifying and using online information sources. Informs participants on different publication options, including open source journals. Explains NIH requirements for notification and access. Through problem based learning and review of successful scientific papers, conveys the elements of successful scientific papers, including formats, data presentation, citations and acknowledgements. Demonstrates successful response to reviewer comments.

PH.180.662. Writing Scientific Papers II. 2 Credits.

Enables doctoral students to attain skills in writing successful scientific papers—that is, papers that are accepted by peer-reviewed journals. Confers skills in identifying and using online information sources. Informs participants on different publication options, including open source journals. Explains NIH requirements for notification and access. Through problem based learning and review of successful scientific papers, conveys the elements of successful scientific papers, including formats, data presentation, citations and acknowledgements. Demonstrates successful response to reviewer comments.

PH.180.663. Grant Writing I. 2 Credits.

Enables doctoral students to attain skills in writing successful funding proposals—that is, proposals that are likely to receive approval for funding. Introduces students to grant writing, funding sources, types of NIH grants, how to read an RFA, PA or other announcements, and develop a biosketch. Explores the requirements of a successful NIH style grant proposal.

PH.180.664. Grant Writing II. 2 Credits.

Enables doctoral students to attain skills in writing successful funding proposals—that is, proposals that are likely to receive approval for funding. Introduces students to grant writing, funding sources, types of NIH grants, how to read an RFA, PA or other announcements, and develop a biosketch. Explores the requirements of a successful NIH style grant proposal.

PH.180.665. Planetary Health Law: Global Health Security and a Changing Environment. 4 Credits.

Explores how humanity's health is dependent on the flourishing of the natural environment. Examines how international law, policy, and governance respond to environmental disruption and global health consequences. Discusses treaties and frameworks responding to global change events, including pandemics, biodiversity loss, and climate change. Interrogates colonialism's role in planetary ill-health and international law's development. Explores pathways to respond to the inequitable distribution of health, economic, and social impacts and benefits from planetary health disruption.

PH.180.670. Introduction to Public Health Emergency Preparedness. 3 Credits.**PH.180.676. Occupational Injury Prevention and Safety Policy and Practice. 2 Credits.**

Provides a link between the public health approach to injury prevention, the traditions of safety science and engineering, and their relationship with ergonomics and biomechanics. Covers topics including identifying the injury problem; using surveillance and record-keeping systems; preventing injuries by government, unions, health departments, and industry; and comparing safety sciences and a public health approach to injury prevention.

PH.180.820. EHE Doctoral Thesis Research. 1 - 22 Credits.

Provides an opportunity to actively conduct research in environmental health

PH.180.828. Teaching in Environmental Health and Engineering. 1 - 22 Credits.

Teaching Assistant (TA) for PhD students in Environmental Health and Engineering

PH.180.829. Summer Thesis Research. 12 Credits.

PH.180.840. EHE Doctoral Special Studies and Research. 1 - 22 Credits.

Provides a forum for students to receive feedback on their research ideas and projects. Acquaints students with research of leading environmental health experts.

PH.180.841. SS/R: INTRODUCTION TO ENVIRONMENTAL HEALTH. 3 Credits.

Examines health issues, scientific understanding of causes, and possible future approaches to control of the major environmental health problems in industrialized and developing countries. Topics include physical, chemical, and biological agents of environmental contamination; solid and hazardous waste; susceptible populations; biomarkers and risk analysis; the scientific basis for policy decisions; and emerging global environmental health problems

PH.180.860. EHE Student Seminar & Grand Rounds. 1 Credit.

Provides a forum for students to present their current research project and receive feedback from faculty and students. Introduces students to research of leading environmental health experts.

PH.181.845. MHS Special Studies & Research. 1 - 22 Credits.

Provides a forum for students to receive feedback on essay topics and outlines.

PH.181.850. MHS Essay. 1 Credit.

Provides the opportunity for the student to work with their adviser to formulate, research, finalize, and gain approval of the required essay.

PH.182.613. Exposure Assessment Techniques for Health Risk Management. 3 Credits.

Prepares the students to use techniques of exposure assessment to quantitatively estimate exposures in occupational and non-occupational settings. Students will be introduced to concepts of exposure variability and its implications for interpreting small exposure data sets. Students will apply advanced techniques such as mathematical modeling of exposures using exposure determinant information, analysis of variance for between- and within-subject variability, Monte Carlo analysis of uncertainty, Bayesian decision analysis using small data sets, exposure assessment strategies in occupational settings. Students will analyze case studies to assess exposures in real-life scenarios using multiple methods. Students will critically evaluate key scientific papers on exposure assessment strategies.

PH.182.614. Laboratory Techniques to Measure Environmental and Occupational Contaminants. 5 Credits.

Provides the knowledge and skill to perform air sampling for occupational and environmental air pollutants. Focuses on how to analyze and present results. Discusses calibration, passive and active sampling, gases and vapors, particulate matter (PM), size-selective sampling; special methods for PM sampling (i.e. fibers, bioaerosols), and direct reading instruments. Addresses concepts of limit of detection, exposure assessment, standards and guidelines, and significant figures.

PH.182.615. Airborne Particles. 4 Credits.

Describes the basics of airborne particles. Explores properties of gases, particle motion, size statistics, Brownian motion and diffusion, curvilinear motion of particles, particle deposition and clearance in the human respiratory system, filtration, aerosol samplers, and sampling methodology, optical properties and electrical properties of aerosols.

PH.182.617. Exposure Sciences for Health Risk Assessment. 4 Credits.

Prepares students to use techniques of exposure assessment in aid of epidemiological studies. Introduces students to core concepts including exposure variability and its implications for reconstructing historical exposures; sparse data and measurement errors; the exposure data matrix; methods for imputation of missing values; the relationship between exposure and tissue concentrations; the choice of exposure metric; and exposure-response relationships. Examines advanced techniques for imputing missing data while reconstructing exposures. Demonstrates the application of mathematical models of exposure using exposure determinant information and Bayesian methods. Considers exposure windows and exposure lagging. Focuses on using biologic models of how disease develops in response to exposure. Students critically evaluate exposure assessment strategies in selected epidemiological studies from the peer-reviewed literature.

PH.182.621. Introduction to Ergonomics. 4 Credits.

Introduces the fundamental principles of ergonomics, including terminology, concepts, and applications of physiology, anthropometry, biomechanics, psychology, and engineering to work place and work methods design. Emphasizes the complex relationships among workers, job demands, work place designs, and work methods. Prepares students for advanced study in safety science, industrial hygiene, injury prevention, industrial engineering, and safety and health management.

PH.182.622. Ventilation and Hazard Control. 4 Credits.

Covers the principles of industrial ventilation and engineering controls for airborne hazards. Provides competency in general ventilation and industrial ventilation design.

PH.182.623. Occupational Health Management. 3 Credits.

Examines modern Lean management methodology and how it can be leveraged to design and implement an effective health, safety, and environmental (HSE) management system in an organization. Dresses Lean management methods and tools and how they impact organizational structure, SHE planning, risk assessment, training, and continuous HSE improvement.

PH.182.625. Principles of Occupational and Environmental Hygiene. 4 Credits.**PH.182.626. Water and Sanitation in Low-Income Communities. 2 Credits.**

Introduces major environmental health problems in the tropical areas of the world and discusses some solutions in detail. Covers engineering, human behavior, and public health approaches to providing potable water and sanitation including simple water supplies, sanitary latrines, the relationship of water supply and sanitation to diarrheal diseases, disaster sanitation, and techniques for disinfection. Demonstrates field treatment of water supplies and water microbiology. Each student develops a case study drawn from current events and designs a field project for an environmental control measure to reduce disease in a community. In addition, students develop a short (4-6 page) mock grant proposal designed to implement an integrated water and sanitation hygiene intervention of their choosing drawing on the lessons learned during this course.

PH.182.631. Principles of Occupational Safety. 2 Credits.

Introduces the organizational framework in which safety sciences are practiced in the U.S. Illustrates professional and scientific methodologies by focusing on selected, substantive areas of practice (systems safety, nature of accidents, electrical hazards, fire and fire suppression, explosions and explosives, and falls and walking and working surfaces).

PH.182.637. Noise and Other Physical Agents in the Environment. 4 Credits.

PH.182.638. Environmental and Health Concerns in Water Use and Reuse. 4 Credits.

PH.182.640. Food- and Water- Borne Diseases. 3 Credits.

PH.182.641. AIR, WATER AND FOOD TOXINS. 3 Credits.

PH.182.810. MS Field Placement. 1 - 22 Credits.

Focuses on a mentored, hands-on practical public health experience, which involves meaningful participation and interaction with public health professionals.

PH.182.845. EHE MS Special Studies and Research. 1 - 22 Credits.

Prepares students to identify and research the central issues in environmental health.

PH.182.850. EHE MS Essay. 1 - 16 Credits.

Students work with their adviser to formulate, research, finalize, and gain approval of their master's essay, which is based on a required Independent Professional Project (IPP). Students write the essay as a professional report summarizing the findings of the IPP. This represents a substantive application of professional technical skills through the process of collecting and summarizing data and reviewing appropriate literature.

PH.182.860. Special Studies Seminar in Occupational and Environmental Hygiene. 1 Credit.

Presents seminars by faculty, students and invited speakers dealing with occupational and environmental hygiene professional practice and research. Provides examples of various occupational/environmental settings and associated worker hazards. Serves to integrate various courses taken as part of the online master's in OEH program and to familiarize students with state-of-the art professional practice procedures and guidelines. Provides a venue for master's students to present their final essays.

PH.183.631. Fundamentals of Human Physiology. 4 Credits.

Encompasses the integration of a variety of organ systems. Invites leading scientists from different fields of physiology to offer exceptional and up-to-date lectures that quickly move through the basic mechanistic principles. Applies basic mechanistic principles of each organ system to current public health issues and environmentally relevant topics.

PH.183.638. Mechanisms of Cardiopulmonary Control. 2 Credits.

PH.183.642. The Cardiopulmonary System Under Stress. 2 Credits.

PH.183.643. Essentials of Pulmonary Function Measurements. 3 Credits.

PH.183.825. EHE ScM Thesis Research. 1 - 22 Credits.

Provides an opportunity to actively conduct research in environmental health

PH.183.840. EHE Scm Special Studies and Research. 1 - 22 Credits.

Provides a forum for students to receive feedback on research ideas and projects. ScM students enroll in this course prior to passing the written comprehensive exam.

PH.184.830. Postdoctoral Research Environmental Health and Engineering. 1 - 22 Credits.

Offers an opportunity for postdoctoral students to conduct research and write papers for publication.

PH.185.600. One Health Tools to Promote and Evaluate Healthy and Sustainable Communities. 3 Credits.

Students will learn and apply tools and principles of One Health, which is the interface of human health, animal health and environmental health, to promote and evaluate healthy and sustainable communities. Classes will cover methods central to the conduct of One Health research or programs, which includes study design, stakeholder participation, community engagement and program evaluation, and will cover topics of high relevance to One Health in a way that uses systems approaches and synthesis to join perspectives from the multiple disciplines. These topics include drivers—such as the food system and antimicrobial resistance—that can contribute to or detract from the health and sustainability of communities. Methods will be presented in the context of applications such as policy, regulation, and economics and will connect One Health techniques for knowledge integration and other approaches to the design of healthy communities.

PH.185.601. One Health Seminar. 1 Credit.

Addresses global and domestic health challenges through a One Health lens, including practice-based approaches increasingly adopted by government agencies, non-governmental organizations and the tripartite (WHO, OIE, FAO). Engages experts in the field to discuss emerging topics and application of One Health approaches. Explores wide-ranging topics that include zoonotic infectious diseases, health security, preparedness, disaster response, climate change, planetary health, food systems, sustainability, chemical exposures, occupational health, health communication, and policy.

PH.185.801. Exposure Sciences & Environmental Epi Journal Club. 1 Credit.

Provides a forum for students and multiple faculty to keep up-to-date on the latest environmental health research and get feedback on their research ideas and projects. Emphasizes active participation in discussions of the peer-reviewed literature, the most up-to-date research, and the process of research development.

PH.185.803. Health Security Journal Club. 1 Credit.

Provides a forum for students to engage with multiple faculty to discuss current topics in health security and global catastrophic biological risks. Emphasizes active participation in discussions related to peer-reviewed publications, as well as trends in research and policy, and offers an environment to contemplate and receive feedback on research development.

PH.185.804. Environmental Sustainability, Resilience, and Health Journal Club. 1 Credit.

Provides a forum for students and faculty to keep up to date on the latest ESRH research, with a particular emphasis on research designs and methods. Emphasizes active participation in discussions of peer-reviewed literature, the most up-to-date research, and the process of research development.

PH.185.805. Toxicology, Physiology & Molecular Mechanisms Journal Club & Seminar. 1 Credit.

Provides an opportunity for students and postdoctoral fellows to present scientific papers from the current literature dealing with mechanisms underlying environmental diseases and the methodologies used to study them. Papers are organized around specific themes selected by the course instructors.

PH.185.806. Advanced Concepts in Toxicology, Physiology & Molecular Mechanisms. 2 Credits.

Provides a platform for students, postdoctoral fellows and faculty to present and discuss impactful scientific papers from the current literature that deal with mechanisms underlying environmental disease along with accompanying methods. Explores additional aspects that are relevant to conducting and conveying laboratory research, including study design and statistical analysis, manuscript and grant review, policy and practice, and risk assessment. Outside speakers will also be invited to present on a topic relevant to advanced concepts.

PH.185.810. Field Placement Esee. 1 - 22 Credits.**PH.186.800. MPH Capstone: Environmental Health & Engineering. 2 Credits.**

Provides students with the opportunity to work on a public health practice project on a chosen public health problem that simulates a professional practice experience.

PH.186.895. MPH Practicum: EHE. 1 - 4 Credits.

The MPH Practicum is a mentored, hands-on practical public health experience, which involves meaningful participation and interaction with public health professionals.

PH.187.610. Public Health Toxicology. 4 Credits.

Examines basic concepts of toxicology as they apply to the effects of environmental agents present in air, water and food (e.g. chemicals, metals) on public health. Discusses the distribution, cellular uptake, metabolism, and elimination of toxic agents, as well as the fundamental principles governing the interaction of foreign chemicals with biological systems. Considers how population data on disease incidence (various cancers, lung, kidney, heart, etc.) can suggest possible etiologies and how genetic and epigenetic factors can influence risk for adverse health effects. Focuses on the application of how these concepts provide evidence relevant to the understanding and prevention of morbidity and mortality resulting from environmental exposures to toxic substances through presentation of case studies.

PH.187.625. Animals in Research: Law, Policy, and Humane Sciences. 3 Credits.

Imparts fundamental knowledge about basic and applied (bio)medical research. Explores the main shortcomings of animal use in science. Discusses how to fully apply the 3R principles, and how to properly conduct experiments. Prepares students to critically appraise the validity of animal and non-animal models and methods in order to choose the best means for particular research interests.

PH.187.632. Molecular Toxicology. 4 Credits.

Reviews the mechanisms by which environmental toxicants cause chronic diseases such as cancer, COPD, asthma and heart diseases that impact public health. Topics include cell signaling pathways involved in oxidative and nitrosative stress, the microbiome, cell growth, cell death, DNA repair, inflammation and carcinogenesis in response to exposure to air pollutants, metals and other environmental toxicants. Presents most recent technological advances in the molecular and genetic tools available to study how environmental toxicants cause diseases, which includes omics technologies (genomics, proteomics and metabolomics), next-generation sequencing for gene expression and genetic variations, transgenic animals and emerging alternative animal models.

PH.187.633. Introduction to Environmental Genomics and Epigenomics. 3 Credits.

Presents the concept of the genetic and epigenetic data analysis in environmental health studies. Introduces not only single gene analysis but also genome-wide data searching. Also introduces cutting-edge analytical tools for 'omic' data not limited to genomics, but also for epigenomics, proteomics and metabolomics. Provides an introduction to the pathway analysis for 'omic' data.

PH.187.634. Analysis for Environmental Genomics and Epigenomics. 1 Credit.

Emphasizes the analytical methods for genomic and epigenomic data analysis. Presents step-by-step instructions for searching and extracting databases and performing pathway analyses on existing genomic and/or epigenomic data. Acquaints students with 'omic' data analysis by participating group project that aims for proving the principle or generating new hypothesis for a selected research topic.

PH.187.640. Toxicology 21: Scientific Foundations. 1 Credit.

Provides students with fundamental knowledge of the emerging science driving new strategies for human risk assessment. Includes topics: toxicokinetics, xenobiotic activation and inactivation, systems biology, and databases for toxicity testing. Presents case studies that have used different data bases for toxicity testing. Offers hands-on experiences using the databases and other Web-based applications.

PH.187.645. Toxicology 21: Scientific Applications. 3 Credits.

Familiarizes students with the novel concepts being used to revamp regulatory toxicology in response to a breakthrough National Research Council Report "Toxicity Testing in the 21st Century: A Vision and a Strategy." Presents the latest developments in the toxicology field: moving away from animal testing toward human relevant, high content, high throughput integrative testing strategies. Active programs from EPA, NIH and the scientific community work-wide illustrate the dynamics of safety sciences.

PH.187.650. Alternative Methods in Animal Testing. 3 Credits.

Discusses and evaluates strategies for reducing the number of animals utilized in basic and applied research. Addresses traditional in vitro methods, including cell culture and analytical chemistry as well as newer and evolving techniques such as informatics, genomics, proteomics, and metabolomics. Also discusses governmental regulatory processes for approving new testing methods, especially in vitro methods.

PH.187.655. Evidence-Based Toxicology. 3 Credits.

Provides students with fundamental knowledge about EBT approaches currently in use (or in development) that integrate and utilize diverse sources of data. These approaches include meta-analysis and systematic reviews, as used in evidence-based medicine. Introduces, explains and expands upon techniques such as risk of bias, QA/QC, good laboratory practice and validation, and the role that these tools and techniques play in assuring maximum confidence in evidence-based approaches

PH.187.661. Environmental Health in Neurological and Mental Disorders. 3 Credits.

PH.188.680. Fundamentals of Occupational Health. 3 Credits.

Introduces selected important topics in occupational health through lectures, readings, and class discussion. Provides an overview of the field, providing a survey of the history of occupational health; analysis of case studies in the history of asbestos, coal workers pneumoconiosis, and uranium mining; identification of the burden of occupational injuries and diseases; application of the toxicologic paradigm to activities in occupational health; analysis of occupational health hazards; identify the association between social, behavioral, and organizational factors and health outcomes in the workplace; identification of legal, regulatory, and ethical issues; analysis and research in clinical and non-clinical emerging issues in occupational health; and an introduction to the concepts of occupational health in developing countries.

PH.188.681. Onsite Evaluation of Workplace and Occupational Health Programs. 5 Credits.

Lectures, discussions, and visits to various industrial sites present approaches to evaluating the industrial environment, including industrial process, hazards, organization, and management structure. Stresses the importance of interdisciplinary cooperation in the development of occupational health programs, with reference to the U.S. workplace in the next decade.

PH.188.682. A Built Environment for A Healthy and Sustainable Future. 3 Credits.

Addresses the role that the built environment plays in public health. Examines how building design, community planning and design, land use, and transportation networks contribute to energy use, water supply degradation, climate change, ecosystem degradation, and public health. Explores the contributions of suburban sprawl to adverse environmental and public health outcomes. Examines how the built environment could and must change if we are to stabilize the climate and move into a sustainable future.

PH.188.686. Clinical Environmental and Occupational Toxicology. 3 Credits.

Explores adverse impacts on human health from a wide range of environmental and occupational toxicants, using a variety of methods. Covers toxicant-related health effects by organ system and by selected chemical categories, including metals, pesticides, solvents, and asphyxiants. Discusses the use of biomarkers in clinical evaluations of exposed individuals and populations. Addresses prevention of adverse health effects in exposed populations and assessment of causal relations. Presents a wide range of information resources which are then utilized in course work. Utilizes case-based examples throughout the course.

PH.188.688. Global Sustainability & Health Seminar. 1 Credit.

Discusses the causes, consequences, and implications of key global environmental challenges that we are facing and that are likely to become more challenging over time. Addresses how land use (e.g., patterns of urban growth and suburban sprawl), energy use, food production and distribution, water use, and population growth are causing climate change, ecosystem degradation, biodiversity losses, species extinctions, and other resource depletion, and how all this is in turn is a threat to human health as individuals, in communities, and globally. Focuses on discussion and not lectures and will utilize a mix of movies, guest discussants, and student-directed discussions.

PH.188.694. Health of Vulnerable Worker Populations. 3 Credits.

Discusses occupational safety and health program considerations for vulnerable populations, including all levels of prevention and using examples such as the health needs of women workers, shift workers, aging workers, workers' families, and workers with chronic diseases or impairments. Focuses on strategies for identifying and removing barriers that affect health and work performance, program development and management responsibilities, and cost issues related to selected preventive and rehabilitative programs. Presents relevant research findings on the ability of vulnerable populations to benefit from safe and healthy working lives.

PH.188.840. Special Studies and Research Environmental Health & Engineering. 1 - 22 Credits.

Prepares students to identify and research the central issues in environmental health

PH.188.861. Advanced Topics in Toxicology and Physiology. 1 Credit.

Reviews the unique and advanced topics in toxicology and physiology. Presents students with guidelines for understanding the basic knowledge as well as the advanced methodology in toxicology and physiology. Prepares students to be able to identify the environmental health problems and present the critical reviews on the original peer-review papers in selected topics.