EPIDEMILOGY OF MICROBIAL DISEASES

EMD 512a, Immunology for Epidemiologists  Nancy Ruddle
This course is designed to introduce students to the fundamentals of immunology including antigens, antibodies, methods for detecting antibodies, cells of the immune system, products of such cells, and immune mechanisms. Experience is gained in the analysis of primary research papers with relevance to immunologic aspects of epidemiologic studies. Prerequisite: two terms of college biology.

EMD 517a, Principles of Infectious Diseases I  Melinda Pettigrew
This course explores the epidemiology and biology of infectious agents and the diseases they cause. Through a theme-based, integrated approach, students learn about the epidemiology, pathogenesis, prevention, and control of bacteria, viruses, and eukaryotic parasites of public health importance. Emphasis is placed on epidemiological methods, routes of transmission, host-pathogen interactions, and mechanisms of virulence. The course also teaches skills for understanding and evaluating the published literature, specifically through class discussions and oral presentations of assigned readings by students. Topics covered include gastrointestinal, respiratory, and sexually transmitted pathogens.

EMD 518b, Principles of Infectious Diseases II  Amy Bei
This course explores the epidemiology and biology of infectious agents and the diseases they cause. Through a theme-based, integrated approach, students learn about the epidemiology, pathogenesis, prevention, and control of bacteria, viruses, and eukaryotic parasites of public health importance. Emphasis is placed on epidemiological methods, routes of transmission, host-pathogen interactions, and mechanisms of virulence. The course also teaches skills for understanding and evaluating the published literature, specifically through class discussions and oral presentations of assigned readings by students. The course builds upon concepts covered in EMD 517 and introduces new topics such as infectious causes of chronic diseases; and vector-borne, zoonotic, and emerging pathogens.

EMD 525a and EMD 526b, Seminar in Epidemiology of Microbial Diseases  Nathan Grubaugh
This is a weekly seminar series offered by EMD faculty. The presentations describe the ongoing research activities in faculty laboratories as well as in EMD-affiliated centers. The talks introduce the department's research activities as well as associated resources in the area. Although no credit or grade is awarded, satisfactory performance will be noted on the student's transcript. 0 Course cr per term

EMD 530b, Health Care Epidemiology: Improving Health Care Quality through Infection Prevention  Louise-Marie Dembry and David Banach
The history, descriptive epidemiology, surveillance methods, risk analysis methods, and economics of nosocomial infections are outlined in this introductory course. In-depth explorations of host, agent, and environmental factors influencing typical nosocomial illnesses in pediatric and adult services are reviewed by clinical faculty. Descriptive and analytical epidemiological methods are emphasized.

EMD 531b, Genomic Epidemiology of Infectious Diseases  Nathan Grubaugh
This course provides an overview of how we can harness microbial evolution to study epidemiology. During the first part of the course, students learn the basic skills to implement next-generation sequencing and phylogenetic approaches to investigate different stages of infectious disease outbreaks. During the second part, students critically evaluate genomic epidemiology case studies to understand the applications and limitations of genomic data, what aspects can be used to inform outbreak responses, and how the information can be communicated to the public. The course consists of lectures, group discussions, computer exercises, and student presentations.

EMD 533a, Implementation Science  J. Lucian (Luke) Davis
Implementation science can be defined as the study of facilitators and barriers to the adoption and integration of evidence-based practices into health care policy and delivery. Examples include comparisons of multiple evidence-based interventions; adaptation of interventions according to population and setting; approaches to scale-up of effective interventions; and development of innovative approaches to improve health care delivery and health. This course explores implementation science using a seminar format; each session begins with a brief presentation of focal topic content followed by critical thinking and dialogue. Students apply the content each week in the development of a potential research project using implementation science in their area of interest and expertise. Throughout the course, faculty and students bring case studies and illustrations from the literature to illustrate key concepts and challenges in the conceptualization and implementation of studies using these methods.

EMD 535, Urban Sanitation: The United States and Peru
This interdisciplinary course examines the challenges posed by the growing volumes of human waste (urine, feces, menstrual blood) that are generated daily in cities around the world. Topics to be covered include environmental, engineering, and public health aspects of sanitation; the history of sanitation; innovation in sanitation; sewage reuse; cultural and social considerations; and case studies of different centralized and decentralized solutions. The course is organized around two final projects: (1) a spring-break trip to Lima, Peru, where students will observe firsthand some of the components of this complex sanitation system, and will meet with stakeholders ranging from government officials to slum-dwellers to nonprofits pursuing innovative sanitation solutions; and (2) a U.S.-based analysis of a comparable sanitation system. Enrollment limited to twelve students each from the School of the Environment, the School of Public Health, and the Department of Chemical & Environmental Engineering. Prerequisite: EHS 537/EMD 537. 1 Course cr

EMD 536, Investigation of Disease Outbreaks
This is a course about the investigation of acute disease outbreaks by public health departments in the United States. The focus is on public health practice, not public health research. We expect students to have a basic understanding of epidemiology. Topics include
roles and responsibilities of local, state, and national public health agencies; legal framework for conducting outbreak investigations; public health practice vs. research; confidentiality laws and the need to release identifiable health information to prevent new cases of an infectious disease; crisis and emergency risk communication; incident command; and joint investigations with law enforcement. A theme throughout the course: can epidemiology provide information in real time to guide the implementation of control and prevention measures? Offered every other year. Prerequisite: EPH 508. 1 Course cr

EMD 537a / EHS 537a, Water, Sanitation, and Global Health  Ying Chen and Elsio Wunder
Water is essential for life, and yet unsafe water poses threats to human health globally, from the poorest to the wealthiest countries. More than two billion people around the world lack access to clean, safe drinking water, hygiene, and sanitation (WASH). This course focuses on the role of water in human health from a public health perspective. The course provides a broad overview of the important relationships between water quality, human health, and the global burden of waterborne diseases. It discusses the basics of water compartments and the health effects from exposures to pathogenic microbes and toxic chemicals in drinking water. It also covers different sanitation solutions to improve water quality and disease prevention and discusses future challenges and the need for intervention strategies in the new millennium.

EMD 538a, Quantitative Methods for Infectious Disease Epidemiology  Virginia Pitzer
This course provides an overview of statistical and analytical methods that apply specifically to infectious diseases. The assumption of independent outcomes among individuals that underlies most traditional statistical methods often does not apply to infections that can be transmitted from person to person. Therefore, novel methods are often needed to address the unique challenges posed by infectious disease data. Topics include analysis of outbreak data, estimation of vaccine efficacy, time series methods, and Markov models. The course consists of lectures and computer labs in which students gain experience analyzing example problems using a flexible computer programming language (MATLAB).

[ EMD 539, Introduction to Public Health Surveillance ]
Surveillance is one of the fundamental activities of public health organizations and is critical for understanding disease burden, impacts of interventions, and the detection of unusual events. The first part of the course provides an overview of the types of surveillance systems and their strengths and weaknesses, sources of data for surveillance, and controversies resulting from surveillance activities. The second part focuses on methods used to analyze surveillance data, with a particular focus on practical application. There is a focus throughout on the critical evaluation of surveillance data from different sources. 1 Course cr

[ EMD 540, Responding to Violent Conflict: Epidemiologic Methods and Public Health Interventions ]
In this course we discuss how epidemiological methods are applied to understand specific health consequences of violent conflicts, including infectious diseases, mental health, maternal/child health, and chronic health problems. In addition, we critically examine interventions employed to mitigate these negative consequences and assess the evidentiary basis for their efficacy with the goal of understanding what makes some interventions more successful than others. Throughout the course, we consider inevitable ethical challenges of conducting research in fragile settings and with vulnerable populations who often lack basic services and are suffering human rights violations. 1 Course cr

EMD 548b, Observing Earth from Space  Staff
A practical introduction to satellite image analysis of Earth’s surface. Topics include the spectrum of electromagnetic radiation, satellite-borne radiometers, data transmission and storage, computer image analysis, the merging of satellite imagery with GIS and applications to weather and climate, oceanography, surficial geology, ecology and epidemiology, forestry, agriculture, archaeology, and watershed management. Prerequisites: college-level physics or chemistry, two courses in geology and natural science of the environment or equivalents, and computer literacy.

[ EMD 550, Biology of Insect Disease Vectors ]
Insects transmit pathogens that cause many emerging and reemerging human and agriculture-related diseases. Many of these diseases, which are referred to as neglected tropical diseases (NTDs), have a dramatically negative impact on human health in the developing world. Furthermore, they cause indirect devastation by significantly reducing agricultural productivity and nutrient availability, exacerbating poverty and deepening disparities. This course introduces students to the biological interactions that occur between major groups of important disease vectors and the pathogens they transmit. Lectures cover current research trends that relate to the ecology and physiology of insect vectors. Course content focuses on how these aspects of vector biology relate to the development and implementation of innovative and effective disease-control strategies. Offered every other year. Prerequisite: full year of college/university-level biology, or permission of the instructor(s). 1 Course cr

EMD 553b, Transmission Dynamic Models for Understanding Infectious Diseases  Theodore Cohen
This course is an introduction to the use of transmission dynamic models as tools for studying the complex patterns that arise from the interaction between pathogens and hosts. Topics covered include the structure, parameterization, and analysis of simple mathematical models. Questions addressed include: Why do some pathogens fail to spread effectively in a host community while others increase in prevalence before eventual elimination? Why do some infections oscillate in frequency while others occur at relatively constant levels over long periods of time? How is it possible that an intervention could perversely increase the burden of disease in the community, even as it reduces the overall prevalence of infection? The course consists of lectures and practical exercises in which students gain experience designing and manipulating mathematical models of infectious diseases by hand and with the open-source programming language R. Knowledge of algebra is assumed, and familiarity with basic calculus concepts is helpful. There are no formal prerequisites, but students
without any familiarity with infectious diseases are encouraged to contact the instructor before registering. This course is required of students in the Public Health Modeling Concentration.

**EMD 563a or b, Laboratory and Field Studies in Infectious Diseases**  Christian Tschudi
The student gains hands-on training in laboratory or epidemiologic research techniques. The term is spent working with EMD faculty in a single laboratory or epidemiology research group. Students choosing to work in the laboratory gain experience in molecular biology, basic immunology, parasitology, virology, bacteriology, or vector biology. Students may also choose to work on a non-laboratory-based epidemiology research project. These students gain experience in epidemiologic methods including study design; field data collection including human cases, vectors, and environmental parameters; data analysis; and epidemiological modeling. Permission of the instructor required.

**EMD 566b / HPM 566b, Critical Issues in Global Health**  Kaveh Khoshnood
The course focuses on critical challenges to the health of the poor in low- and middle-income countries and pays particular attention to how these health gaps can be addressed in low-cost and highly effective ways. The course covers the architecture, politics, and governance of global health; key trends in approaches to meeting the health needs of the poor in low- and middle-income countries; and how science and technology can be harnessed for this purpose. It examines the burden of disease and the determinants of this burden; covers the leading causes of illnesses, disability, and preventable death from communicable and noncommunicable diseases, with special attention to women and children; and focuses particular attention on key health systems issues and recent efforts to overcome them, especially in low-income settings.

**EMD 567, Tackling the Big Three: Malaria, TB, and HIV in Resource-Limited Settings**
Malaria, tuberculosis, and HIV account for more than five million deaths worldwide each year. This course provides a deep foundation for understanding these pathogens and explores the public health issues that surround these infectious diseases in resource-limited settings. Emphasis is placed on issues in Africa, but contrasts for each disease are provided in the broader developing world. The course is divided into three sections, each focusing in depth on the individual infectious disease as well as discussions of interactions among the three diseases. The sections consist of three to four lectures each on the biology, individual consequences, and community/public health impact of each infectious disease. Discussion of ongoing, field-based research projects involving the diseases is led by relevant faculty (research into practice). The course culminates with a critical discussion of major public health programmatic efforts to tackle these diseases, such as those of PEPFAR, the Bill & Melinda Gates Foundation, the Global Fund, and the Stop TB Partnership. Prerequisite: EMD 518.

1 Course cr

**EMD 580a / HPM 580a, Reforming Health Systems: Using Data to Improve Health in Low- and Middle-Income Countries**  Robert Hecht
Health systems in low- and middle-income countries are in constant flux in the face of myriad pressures and demands, including those emanating from the current COVID-19 pandemic. Under such conditions, how can senior country officials and their international partners make the best decisions to reform health systems to achieve universal coverage and improve the allocation and use of resources to maximize health gains, including on scale-up of programs to fight infectious diseases and address other health problems? The course provides students with a thorough understanding of health systems, health reforms, and scaling up—their components, performance, and impacts—by teaching the key tools and data sources needed to assess options and make coherent and effective policy and financing choices. Using these frameworks, students analyze case examples of major country reforms and of scaling up of national disease programs (e.g., AIDS treatment, immunization, safe motherhood, mental health services, cardiovascular illness prevention, etc.) and prepare a paper applying what they have learned to real-world health systems challenges. This course is open to all Yale students with interest in the topic.

**EMD 582b, Political Epidemiology**  Gregg Gonsalves
Political epidemiology is the study of the impact of welfare regimes, political institutions, and specific policies on health and health equity. This course emphasizes the last among these—the effects of specific policies on health outcomes in infectious diseases and other areas of human health and development. The course takes an issues- and methods-based approach, looking at how to evaluate the effects of political determinants of health (e.g., immigration, education, fiscal and environmental policies) through experimental and quasi-experimental methods, as well as various techniques associated with policy modeling (e.g., Markov models, systems dynamics, microsimulation, spatial models). Prerequisites: EPH 509 or a similar introductory course in statistics. S&DS 541, MATH 241, or a similar introductory course in probability is recommended but not required, and a review of probability is offered in the first discussion section.

**EMD 584a / SBS 584a, Advanced Global Health Justice Practicum: Fieldwork**  Ali Miller, Amy Kapczynski, and Gregg Gonsalves
The course is primarily for students who previously have enrolled in EMD 596/SBS 596; however, new students will be considered. Permission of the instructor required.

**EMD 596b / SBS 596b, Health Justice Practicum and Fieldwork**  Ali Miller, Amy Kapczynski, and Gregg Gonsalves
This experiential course introduces students to the social and political determinants of health and to techniques to mobilize for health justice. A health justice approach prioritizes processes of power building, particularly with the most marginalized and vulnerable, rather than technocratic or top-down change. The course includes a weekly seminar component and project work. Students undertake projects, typically in interdisciplinary teams with outside partners, commonly on issues related to sexual rights and gender justice, health equity, access to medicines, and structural responses to infectious disease. Projects are selected with an eye toward the development of both public health and legal skills, and students are expected to reflect on how academic and NGO-based advocates can best leverage their position and skills in support of community or grassroots groups. Projects are likely to build on the work of GHJP on the COVID-19
crisis and also focus on the misuse of the carceral powers of the state, for example via reform of current policing and criminalization of sex work. Students are evaluated by their work product and class participation rather than a final examination. They should be prepared to spend approximately 18 hours per week on the course; they should also be prepared for possible travel (typically during spring break) depending on the project. Resources are available for travel as needed. This course fulfills the YSPH OPHP practicum requirement. Enrollment limited to twelve. Meets according to the Law School calendar. Permission of the instructors required; an application must be submitted to health.justice@yale.edu by 4:30 p.m. on Nov. 1. 2 Course cr

EMD 600a or b, Independent Study or Directed Readings  Staff
Independent study or directed readings on a specific research topic agreed upon by faculty and student. By arrangement with faculty. For M.S. and Ph.D. students only.

EMD 625b, How to Develop, Write, and Evaluate an NIH Proposal  Christian Tschudi
This pragmatic skills-building course aims to provide a mentored, guided structure for developing a significant research project and leads students through the steps of assembling a grant application following the NIH mechanism: either the predoctoral National Research Service Award (NRSA, F31) or the Exploratory/Developmental Research Grant Award (R21). Students are provided detailed information on each aspect of NIH grants: fundamentals of good grant writing, general preparation of grant application (e.g., specific aims, research strategy, analysis of reviews, and strategies of rebuttal and reapplication), identifying study sections, program officers and scientific review officers (SROs), research strategy, and detailed descriptions of the different types of funding mechanisms. Students develop skills to objectively review an NIH grant proposal and write a scientific critique.

EMD 670a and EMD 671b and EMD 672a, Advanced Research Laboratories  Christian Tschudi
This course is required of all EMD Ph.D. students and is taken for three terms. The course offers experience in directed research and reading in selected research laboratories. The first two terms must be taken in the first year of the doctoral program, and the third term is normally taken in the summer after the first year. Open only to doctoral students.

EMD 680, Advanced Topics in Tropical Parasitic Diseases  
An introductory topic-based course in modern parasitology. For each topic there is an introductory lecture followed by a journal club-like discussion session of relevant papers selected from the literature. The course provides an introduction to basic biological concepts of parasitic eukaryotes causing diseases in humans. Topics include strategies used by parasitic eukaryotes to establish infections in the host and approaches to disease control, through either chemotherapy, vaccines, or genomics. In addition, emphasis is placed on evaluating the quality and limitation of scientific publications and developing skills in scientific communication. Prerequisite: permission of the instructor. 1 Course cr