Program in Biological Sciences in Public Health (BPH) at Harvard School of Public Health

Programs and Disciplines

BIOLOGICAL SCIENCES IN PUBLIC HEALTH (BPH) PROGRAM

The Program in Biological Sciences in Public Health (BPH), established in 1993, trains students in individual fields of biological research with a focus on prevention and better treatment of diseases affecting large populations. Students in the BPH program obtain a broad interdisciplinary knowledge of both mechanistic and quantitative approaches to biomedical research. The program trains research scientists in the following areas: molecular and integrative physiology; nutritional biochemistry; cellular and organismal metabolism; cancer cell biology; gene regulation in human disease; gene-environment and cell-environment interactions; inflammation and stress response; immunology; infectious diseases involving protozoa, helminths, viruses and bacteria. All of these areas are studied with an emphasis on cellular and molecular biology and genetic approaches to disease mechanisms.

Our research, whether basic or translational, is relevant to human health. Students apply cutting-edge technology to the solution of worldwide problems with a focus toward better treatment and prevention of human diseases. It has become increasingly evident that progress in disease prevention is optimally promoted by a close interaction between scientists from diverse disciplines, including genetics, cell biology, biochemistry, physiology, systems biology, and epidemiology. To achieve that goal, the BPH program is rooted in the rich and diverse environment of the Harvard School of Public Health, dedicated to advancing the public's health through learning, discovery, and communication. The field of public health is inherently multi-disciplinary and so, too, are the interests and expertise of the School's faculty and students, which extend across the biological, quantitative, and social sciences. With our roots in biology, we are able to confront the most pressing diseases of our time (e.g., AIDS, malaria, obesity and diabetes, and cancer), gaining insights into their underlying mechanisms and uncovering therapeutic opportunities. Core quantitative disciplines like epidemiology and biostatistics are also fundamental to analyzing the broad impact of health problems, allowing us to look beyond individuals to entire populations.

From advancing scientific discovery to training national and international leaders, the Harvard School of Public Health has been at the forefront of efforts to benefit the health of populations worldwide. Shaping new ideas in our field and communicating them effectively will continue to be priorities of the BPH program in the years ahead as we serve society's changing health needs. Disciplines include the following scientific areas:

GENETICS AND COMPLEX DISEASES

The complex interplay of biological processes with environmental factors as they apply to chronic, multigenic, and multifactorial diseases is the focus of the Department of Genetics and Complex Diseases. Department faculty aim to elucidate the molecular mechanisms underlying the intricate interaction between genetic determinants and their divergent responses to environmental signals to affect the health of human populations. Research focuses on several broad categories, including metabolism, stress response, and inflammatory signaling. Areas of study include diseases such as diabetes and cancer, disease-risk conditions such as obesity, age-related (chronic) diseases, and the normal aging process. These are investigated both at the mechanistic level and in the context of population studies.

IMMUNOLOGY AND INFECTIOUS DISEASES

The Department of Immunology and Infectious Diseases focuses on the biological, immunological, epidemiological, and ecological aspects of viral, bacterial, protozoan, and helminthic diseases of animals and humans and the vectors that transmit some of these infectious agents. Research emphasizes basic pathogenic mechanisms that may lead to better diagnostic tools, the development of vaccines and other immune interventions for prevention and control of infection and disease, and the identification of new targets for antiviral and antiparasite drugs. Laboratory-based research may be supplemented by field-based studies of epidemiological and ecological aspects of infectious disease transmission and control. Diseases of developing countries are emphasized, including HIV, tuberculosis, malaria, and other parasitic diseases. Immunologic studies focus on genetic regulation of the immune response; molecular mechanisms of the regulation of

class II genes; the function and regulation of T-cell-derived cytokines; and cytokines involved in the regulation of inflammation.

MOLECULAR AND INTEGRATIVE PHYSIOLOGICAL SCIENCES

The concentration focuses on normal and pathological functions of organisms. It centers on the respiratory system because the system presents an immense, thin surface area to the environment, and thus is an important route of entry to the body as well as a site of damage from toxins and infections. Areas of study include molecular and cellular mediators and adhesion molecules involved in pulmonary inflammation; toxic mechanisms of inhaled air pollution particles; biomechanics of cells and tissues in normal and diseased lungs; smooth muscle and airway constriction in asthma; and environmental agents and risk of lung infection.

NUTRITION

Current research covers a wide range of topics, including large prospective studies of dietary factors in relation to heart disease, cancer, diabetes, and ophthalmologic disease; development of methods to assess nutritional status by an analysis of body tissue; the interaction of nutritional factors with genetic determinants of disease; the interaction of nutritional factors and infectious agents; nutritional influence on blood pressure; effects of nutrition programs on the mental and physical consequences of malnutrition; nutritional determinants of blood lipid factors; lipoprotein metabolism; molecular mechanisms of diabetes and obesity and regulation of the intra- and inter-cellular delivery of macro-molecular nutrients; and the molecular mechanisms leading to atherosclerosis and thrombosis.

Research Facilities

Located in the Longwood Medical Area of Boston, the program brings together faculty in the biological sciences throughout Harvard University. The Medical Area, which includes the Harvard School of Public Health, Harvard Medical School, Harvard Dental School, and a cluster of hospitals, comprises one of the most concentrated areas of scientific research facilities in the United States. The interaction of faculty working at associated institutions, through joint teaching and research, enables the program to serve as a meeting place for biological, medical, physical, and chemical scientists. This provides students and faculty alike with a wider range of experience and techniques than may be found in any single discipline or department.

At the Harvard School of Public Health alone, modern research laboratories are housed on 18 floors of three buildings. Students have access to the Countway Library, one of the most complete biomedical research collections in the nation.

The main Harvard University campus in Cambridge encompasses a wide variety of strong academic departments and facilities in the humanities and sciences. The program specifically interacts with the biological sciences programs in molecular and cellular biology, organismic and evolutionary biology, and biophysics.

Program of Study

The program offers opportunities in a wide range of laboratory experiences and considerable interaction among the program components. Academic programs fulfill needs and goals through core and advanced courses, seminars, rotations in laboratories, and a qualifying examination. Rotations are an integral part of the program; they allow students to investigate several types of research and laboratories before choosing a dissertation laboratory. Students choose a dissertation laboratory by the end of the first year.

Although individual programs vary, generally students take a qualifying examination during their second year. After successful completion of the qualifying examination, the dissertation advisor supervises the doctoral candidate's research and study, with an advisory committee periodically reviewing progress.

Typically, about four years of laboratory work is needed to complete the dissertation research, which is defended before three examiners. Generally, students complete the degree in five to six years.

The Informal Curriculum

Outside of the classroom, the program sponsors a variety of activities that bring together students and faculty with a broad range of research interests. Important elements of this "informal curriculum" are seminars, journal clubs, and retreats. These sessions give students the chance to interact with faculty and postdoctoral fellows from laboratories throughout the Medical Area, and to learn about research in diverse fields. Student-run journal clubs and seminars provide opportunities to learn how to give talks, critically evaluate scientific literature, present data, and take part in group discussions. City-wide seminars draw researchers from all area institutions into a larger scientific community. Some students serve for at least one term as teaching assistants for graduate and medical school classes, or for undergraduate courses taught in Cambridge. Student organizations plan various social and academic activities.

Combined Degree Programs

The program, in conjunction with Harvard Medical School, offers a combined MD/PhD program to train physician-scientists to work at the forefront of biomedical research and to provide an interface between the most basic and technical research and its clinical application at the bedside. The program seeks to provide students with the most thorough and up-to-date medical education and training for research careers. Students who are interested in working toward simultaneous MD and PhD degrees should complete the application for admission to Harvard Medical School and the MD/PhD Program.

Admissions

Applicants wishing to do research in areas of metabolic dysregulation in complex disease (obesity, metabolic syndrome, cancer), health effects of environmental exposures (air pollution, lung infection, asthma), nutritional biochemistry (nutrient transport and metabolism), geneenvironment interactions (epigenetics, inflammation, stress response), immunology and infectious diseases (host-pathogen interactions and protozoa, helminths, viruses or bacteria) usually apply to the Biological Sciences in Public Health (BPH) program.

To qualify for admission, applicants must demonstrate strong enthusiasm and ability for the vigorous pursuit of scientific knowledge for optimal human health. Minimal requirements include a bachelor's degree and undergraduate preparation in calculus, physics, biology, and chemistry, both physical and organic.

To apply to the PhD Program in Biological Sciences in Public Health (program #8500), Graduate School of Arts and Sciences online admissions forms must be used. Completed applications and supporting documentation must be submitted online directly to the Graduate School of Arts and Sciences by the December 1 deadline. See www.gsas.harvard. edu.

Students are required to submit their application online via the online GSAS Harvard Integrated Life Sciences (HILS) admissions application. Please make it clear that you're interested in the Biological Sciences in Public Health (BPH) Program (admission code #8500); see GSAS Application Instructions and Information for more details, or contact the Graduate School Office of Admission and Financial Aid at:

Office of Admissions and Financial Aid

Harvard University 1350 Massachusetts Avenue Holyoke Center 350 Cambridge, MA 02138-3654 telephone: 617-495-5315, 617-495-5396 e-mail: admiss@fas.harvard.edu

The Office of Admissions and Financial Aid is open Monday through Friday, 9a.m.-5p.m., Eastern Standard Time.

Financial Aid and Cost of Study

Students receive full tuition and stipend support while they are enrolled and making satisfactory progress toward the PhD degree. International applicants are urged to seek financial support from their national governments and fellowship agencies. Limited international student funding is available. The program strongly encourages applicants to apply for support from extramural agencies.

Life in Boston

The Harvard School of Public Health is located in the Longwood Medical Area of Boston, across the Charles River from Cambridge. The two cities offer a geographically compact, yet rich and varied academic and cultural environment. Fortythree colleges and universities in the metropolitan area sponsor a multitude of cultural and intellectual activities, all easily accessible via public transportation. The close proximity to MIT, the natural science departments in Cambridge, and the medical schools at Boston University and Tufts University provides an unusual concentration of scientific research that draws visiting scientists from around the world. The main Harvard campus in Cambridge supports a wide variety of facilities for athletics and graduate student activities. Students have access to all the libraries of Harvard University, which is the largest university library system in the world.

In addition to a long list of renowned institutions, such as the Museum of Science and the Museum of Fine Arts, Boston itself is a museum, with hundreds of historical sites and an exciting range of architectural styles as well as ethnically diverse neighborhoods offering an international flavor.

Recreational opportunities in the Boston area are many and varied. Sports fans can follow the Patriots, Bruins, Celtics, or the Red Sox -Fenway Park is only a short walk from the Harvard School of Public Health. Within the city, the Charles River offers an afternoon of sailing and windsurfing, while the network of parks known as the "Emerald Necklace" winds its way from Kenmore Square, through Olmsted Park and past Jamaica Pond to the 265-acre Arnold Arboretum, which is both a city park and a Harvard research facility. Walden Pond and the Great Meadows Wildlife Refuge in Concord are within biking distance. The beaches of Cape Cod, and skiing, hiking, and camping in the Berkshires, Vermont, New Hampshire, and Maine are accessible in day trips.

The Longwood Medical Area

Immediately adjacent to the Harvard School of Public Health, are the Harvard Medical School, the Countway Medical Library - one of the most complete biomedical research collections in the country – and the research laboratories of seven affiliated hospitals and institutes. A free shuttle bus links the area with MIT and Harvard Square in Cambridge. Many students live near the Medical School or in neighboring Brookline; others find affordable housing elsewhere in Boston or in Cambridge. Harvard University provides dormitories for married students and graduate students in Cambridge. University housing is also available for single students in Vanderbilt Hall in the Medical Area, along with athletic facilities and a branch of the Harvard University Health Services. The Harvard School of Public Health houses the program offices as well as a graduate student lounge and computer facilities.

Important Addresses and Numbers

Information, program brochures, and application booklets may be requested from any of the following sources.

Online application submissions are required using the Graduate School of Arts and Sciences application form found at www. gsas.harvard. edu/admissions/. All support documentation must be scanned, uploaded and submitted online.

Office of Admissions and Financial Aid Graduate School of Arts and Sciences

ATTN: Biological Sciences in Public Health (BPH) Program; Harvard University Holyoke Center, 3rd floor 1350 Massachusetts Avenue Cambridge, MA 02138 (617) 495-5315 website: www.gsas.harvard.edu

Applicants with specific questions about the program may contact the Program Office via email at bph@hsph.harvard.edu.

Biological Sciences in Public Health Program Office

Harvard School of Public Health 655 Huntington Avenue, Building 2–113 Boston, MA 02115-6096 Visit website for complete contact information: http://bph.hsph.harvard.edu

Note: Graduate School of Arts and Sciences admissions forms must be used to apply for this program and must be submitted directly to the Graduate School of Arts and Sciences by the December 1 deadline.

Addresses for Constituent Departments at Harvard School of Public Health:

Genetics and Complex Diseases

www.hsph.harvard.edu/departments/genetic s-and-complex-diseases ATTN: BPH request for further information Harvard School of Public Health 655 Huntington Avenue, Building 2–107 Boston, MA 02115

Environmental Health

www.hsph.harvard.edu/departments/enviro nmental-health ATTN: BPH request for further information Harvard School of Public Health 655 Huntington Avenue, Building 1–1301 Boston, MA 02115

Immunology and Infectious Diseases

www.hsph.harvard.edu/departments/immun ology-and-infectious-diseases ATTN: BPH request for further information Harvard School of Public Health 651 Huntington Avenue, FXB-402 Boston, MA 02115

Nutrition

www.hsph.harvard.edu/departments/nutrition ATTN: BPH request for further information Harvard School of Public Health 655 Huntington Avenue, Building 2–305 Boston, MA 02115

MD/PhD Program

Harvard Medical School Medical Education Center Room 168 260 Longwood Avenue Boston, MA 02115 (617) 432-0991

Faculty

Andrea Baccarelli, MD, PhD

Mark and Catherine Winkler Associate Professor of Environmental Epigenetics

http://www.hsph.harvard.edu/faculty/and rea-baccarelli/ Identification of molecular and biological factors reflecting the impact of environmental exposures on human health, with particular interest in epigenetics.

Barry Bloom, PhD

Harvard University Distinguished Service Professor and Joan L. and Julius H. Jacobson Professor of Public Health

http://www.hsph.harvard.edu/faculty/barr ybloom/ Study of pathogenesis and protection in tuberculosis and development of vaccines.

Joseph Brain, SD

Cecil K and Philip Drinker Professor of Environmental Physiology

http://www.hsph.harvard.edu/faculty/jose phbrain/ Function and structure of pulmonary and hepatic macrophages; responses to inhaled gases and particles.

Barbara Burleigh, PhD

Associate Professor of Immunology and Infectious Diseases

http://www.hsph.harvard.edu/faculty/bar baraburleigh/ Studies of the molecular basis of host cell invasion, signaling and differentiation by the human pathogen, Trypanosoma cruzi.

Flaminia Catteruccia, PhD

Associate Professor of Immunology and Infectious Diseases

http://www.hsph.harvard.edu/faculty/fla minia-catteruccia/ Reproductive biology of malaria vector, Anopheles gambiae; development of new targets for vector control.

David Christiani, MD

Elkan Blout Professor of Environmental Genetics http://www.hsph.harvard.edu/faculty/davi d-christiani/ Assessment of the impact of workplace pollutants on health.

Immaculata De Vivo, PhD

Associate Professor in the Department of Epidemiology http://devivo.bwh.harvard.edu/ Discovery and characterization of genetic biological markers to assess disease susceptibility in human populations.

Manoj Duraisingh, PhD

Associate Professor of Immunology and Infectious Diseases

http://www.hsph.harvard.edu/faculty/ma noj-duraisingh/ Molecular mechanisms underlying the pathogenesis of human malaria.

Max Essex, DVM, PhD

Mary Woodard Lasker Professor of Health Sciences http://www.hms.harvard.edu/dms/virolog y/fac/Essex.html Study of human and primate T-lymphotrophic retroviruses, including agents that cause AIDS.

Sarah Fortune, MD

Assistant Professor of Immunology and Infectious Diseases

http://www.hsph.harvard.edu/faculty/sara h-fortune/ Secretion and pathogenesis in M. tuberculosis.

Jeffrey Fredberg, PhD

Professor of Bioengineering and Physiology

http://www.hsph.harvard.edu/faculty/jeffr ey-fredberg/ Identification of the mechanical basis of airway and lung parenchymal function at the levels of organ, tissue, cell, and protein.

Wendy Garrett, MD, PhD

Assistant Professor of Immunology and Infectious Diseases

http://www.hsph.harvard.edu/faculty/wen dygarrett/ Interplay between the innate immune system and intestinal microbial communities.

Tiffany Horng, PhD

Assistant Professor of Genetics and Complex Diseases http://www.hsph.harvard.edu/faculty/tiffa ny-horng/ Focus is on the transcriptional mechanisms that regulate inflammatory gene expression.

Gökhan Hotamisligil, MD, PhD

Chair, Department of Genetics and Complex Diseases, James Stevens Simmons Professor of Genetics and Metabolism

http://www.hsph.harvard.edu/GSH-LAB/ Regulatory pathways which control energy metabolism

Curtis Huttenhower, PhD

Assistant Professor of Computational Biology and Bioinformatics

http://www.hsph.harvard.edu/faculty/curt ishuttenhower/ Computational methods for systems biology using data mining in large genomic data collections.

Phyllis Kanki, DVM, DSc

Professor of Immunology and Infectious Diseases http://www.hsph.harvard.edu/faculty/phyl lis-kanki/ Study of epidemiology and biological characteristics of HIV-2 in West Africa.

Lester Kobzik, MD

Professor in the Department of Environmental Health, Professor of Pathology

http://www.hsph.harvard.edu/faculty/lest er-kobzik/ Lung macrophage differentiation and function; flow cytometry applications for respiratory cell biology.

Chih-Hao Lee, PhD

Associate Professor of Genetics and Complex Diseases http://www.hsph.harvard.edu/faculty/chih hao-lee/ Nuclear lipid receptors as therapeutic targets of metabolic diseases.

Tun-Hou Lee, SD

Professor of Virology

http://www.hsph.harvard.edu/faculty/tun hou-lee/Humoral response to retroviral infections in humans; identification of coding sequences of human retroviruses and their gene products.

Bernardo Lemos, PhD

Assistant Professor of Environmental Epigenetics http://www.hsph.harvard.edu/faculty/ber nardo-lemos/ Development of a functional and populational understanding of the mapping between genotypes, phenotypes, and environments.

Marc Lipsitch, DPhil

Professor of Epidemiology

http://www.hsph.harvard.edu/faculty/mar clipsitch/ Theoretical, statistical and experimental approaches to population biology and the epidemiology of infectious diseases.

Quan Lu, PhD

Assistant Professor of Lung Biology http://www.hsph.harvard.edu/faculty/qua n-lu/ Developing and applying genomewide RNAi tools to study receptor signaling and gene environment interactions.

William Mair, PhD

Assistant Professor of Genetics and Complex Diseases http://www.hsph.harvard.edu/faculty/willi am-mair/ Molecular pathways underpinning the aging process, with the goal of using this knowledge to develop novel therapeutic strategies to treat age-onset disorders.

Brendan Manning, PhD

Associate Professor of Genetics and Complex Diseases in the Faculty of Public Health

http://www.hsph.harvard.edu/faculty/ brendan-manning/ Signaling pathways underlying tumorigenesis and metabolic diseases.

Matthias Marti, PhD

Assistant Professor in Immunology and Infectious Diseases

http://www.hsph.harvard.edu/faculty/mat thiasmarti/ Host-pathogen interactions in malaria parasites.

James Mitchell, PhD

Assistant Professor of Genetics & Complex Diseases http://www.hsph.harvard.edu/faculty/jam es-mitchell/ Molecular mechanisms of lifespan extension by nutritional intervention.

Eric Rubin, MD, PhD

Professor of Immunology and Infectious Diseases http://www.hsph.harvard.edu/faculty/Eric Rubin.html Virulence factors of mycobacteria; acquisition of virulence determinants of Vibrio cholerae; generalized transposon mutagenesis systems for bacteria.

Frank Sacks, MD

Professor of Cardiovascular Disease Prevention, Professor of Medicine

http://www.hsph.harvard.edu/faculty/ frank-sacks/ Human lipoprotein metabolism, biochemical epidemiology involving lipoproteins and fatty acids and clinical trials in cardiovascular disease.

Stephanie Shore, PhD

Senior Lecturer on Physiology http://www.hsph.harvard.edu/faculty/ stephanie-shore/ Physiological and pharmacological aspects of bronchoconstriction.

Joseph Sodroski, MD

Professor in the Department of Immunology and Infections Diseases, Professor of Pathology http://www.hsph.harvard.edu/faculty/jose pj-sodroski/ Human immunodeficiency virus envelope glycoproteins; HIV-1 vaccine development.

Daniel Tschumperlin, PhD

Associate Professor of Bioengineering and Airway Biology

http://www.hsph.harvard.edu/faculty/dan ieltschumperlin/ Pathophysiology of asthma and pulmonary fibrosis within integrative frameworks that span the molecular to the tissue level, leading to novel preventive and therapeutic approaches to lung disease.

Marianne Wessling-Resnick, PhD

Director of the Biological Sciences in Public Health (BPH) Program, Professor of Nutritional Biochemistry http://www.hsph.harvard.edu/faculty/mar ianne-wesslingresnick/ Regulation of the cellular uptake of transferrin; membrane transport of iron.

Vishal Vaidya, PhD

Assistant Professor of Medicine & Environmental Health

http://bph.hsph.harvard.edu/faculty/Vish al-Vaidya Cellular and molecular mechanisms of kidney exposure biology with a special emphasis on biomarkers, biosensors and tissue regeneration.

Dyann Wirth, PhD

Department Chair, Richard Pearson Strong Professor of Infections Disease http://www.hsph.harvard.edu/faculty/dya nnwirth/ Molecular genetic analysis of gene

expression, malaria parasites.

Zhi-Min Yuan, MD, PhD

Professor of Radiobiology, Director of the John B. Little Center for Radiation Sciences and Environmental Health

http://www.hsph.harvard.edu/faculty/zhimin-yuan/ Elucidation of signaling mechanisms that regulate cellular stress responses; examining how stress signals affect cell behaviors in the context of cancer.