2021 Participating Bloomberg Distinguished Professors

Participating faculty are listed alphabetically by last name:

Rexford Ahima: Endocrinology, Diabetes, & Metabolism, SOM; Epidemiology, BSPH; Community-Public Health, SON

Project: Detection and Quantification of Physiological and Molecular Markers of Diabetes and Obesity: Students will have a brief course on the causes of diabetes and obesity and their impact on health, economy and society. They will also learn how small changes in lifestyle can reduce the chances of becoming diabetic and gaining weight. Laboratory animals will be fed high fat diet to induce diabetes and obesity. Students will be guided on how to collect and store serum samples. They will learn the laboratory techniques used to measure blood glucose levels, cholesterol, fatty acids, triglycerides, etc. Students will also learn how fat cells are grown in the laboratory. Undergraduate responsibilities: 1. Take notes and keep records of experiments.2. Prepare solutions and buffers. 3. Observe demonstrations of experiments
Preferred (or required) skills and/ or experience: not required
Positions available: 1
Work location: Bayview Medical Center, Asthma and Allergy Center, 5501 Hopkins Bayview Cir, Rm 2A62

Chuck Bennett: Physics and Astronomy, KSAS; JHU Applied Physics Lab (APL)

Project: Analysis of data from the Cosmology Large Angular Scale Surveyor (CLASS) telescopes, and/or other related cosmology. Participants will determine how to answer specific questions about data from the observatory and write software to determine answers.
Preferred (or required) skills and/ or experience: No specific requirements. However, Python and other software experience preferred. Some statistics knowledge is also useful.
Positions available: 1 - 2
Work location: Homewood campus, Bloomberg Center for Physics & Astronomy, 2nd floor

Arturo Casadevall: Molecular Microbiology & Immunology, BSPH; Infectious Diseases, SOM

Project: There are many areas of research exploring fungal pathogens and melanin pigments in the Casadevall lab. Some include:

1. Structure and function of catalytic antibodies. While most catalysis is thought to be carried out by enzymes, our lab and others have shown that antibodies can also carry out catalysis of the antigens that they bind.(Bowen 2016) We are working to characterize this catalysis and the kinetics against different types of targets (i.e. peptides, polysaccharides, nucleic acids). Current open projects include screening of antibodies for catalytic activity and determining the pH at which catalysis is most efficient.
2. The polysaccharide capsule of *Cryptococcus*. The *C. neoformans* capsule is required for causing Cryptococcosis disease in humans yet we understand very little about its assembly and structure. We apply multiple biochemical and biophysical techniques (i.e., light scattering, NMR, Mass Spec.) to understand the capsule polysaccharide structure, at both the micro and macromolecular level.
3. Invertebrate models of infectious disease are important to our understanding of how pathogens are able to cause disease in humans due to their inexpensive cost, easy maintenance, and high abundance compared to vertebrate models such as mice. In the context of the human pathogen *Cryptococcus neoformans*, it would be important to understand 1) if the fungus' virulence factors, such as melanin and laccase, function similarly during infections of *G. mellonella* as they do during mammalian infection, and 2) if the immune system of *G. mellonella* can detect and react to components of the fungus in a similar way as the mammalian innate immune system. This project will entail learning microbiological techniques, light microscopy, immunofluorescence microscopy, and how to work with a *C. neoformans* mutant library."
4. Human impact on the environment, such as climate change, land development, and intensive agricultural farming, hurt many beneficial insects and help harmful ones. Glyphosate, the most widely used broad-spectrum herbicide in the world, was shown to increase honeybee susceptibility to death and to opportunistic infection with *Serratia marcescens* by disrupting their gut microbiome. This herbicide has been also shown to inhibit several components of the immune system of Chinese mitten crab, *Eriocheir sinensis*, including the protein phenoloxidase (PO), a key component of the melanin-based immune response in insects. This study aims to gain a better understanding of insect's physiological

adaptations against natural and human-derived stressors, which can be influence to develop novel biological strategies to enhance insect's immunity therefore decreasing their vector efficiency.

Preferred (or required) skills and/ or experience: While no skills or experience are required, a familiarity with microbiology and biochemistry will be very helpful. Desire to learn and proactiveness.

Positions available: 1

Work location: East Baltimore campus, Bloomberg School of Public Health

Nilanjan Chatterjee: Biostatistics, BSPH; Oncology, SOM

Project: Big data analytics for building predictive models and clinical decision tools. Model building will require integration of multiple data sources on case-control genome-wide association studies, genomic databases and biobank based cohort studies. Participant responsibilities: Data analysis, programming in R/Python/JAVA etc

Preferred (or required) skills and/ or experience: Strong computational skills, ability to work with large datasets, some knowledge of statistical inference and models

Positions available: 1 - 2

Work location: Remote/ Virtual

Rama Chellappa: Electrical & Computer Engineering, WSE: Biomedical Engineering, SoM

Project: Geolocation of an image is a very challenging computer vision problem. In this project, we will apply emerging AI techniques for accurately geolocating a given image. The student will work with the BDP mentor and his research team to develop robust methods for geolocating an image.

Preferred (or required) skills and/ or experience: Knowledge of PyTorch will be useful. Knowledge of deep learning is preferred.

Positions available: 1

Work location: Remote/ Virtual

Christopher Chute: General Internal Medicine, SOM; Community-Public Health, SON; Health Policy & Management, BSPH

Project: Our team is creating a library of clinical profiles that characterize patient data for diseases and conditions in a statistical manner as a basic resource for open data science. These profiles are published in conformance with a FHIR resource we manage in partnership with the HL7 standards organization. These profiles are being prototypes in the NCATS Translator program for advancing translational research incorporating clinical data.

Students may choose diseases or conditions for the generation of new profiles. They will learn how to create phenotyping definitions for generating patient cohorts and describing the provenance of the profile in FHIR syntax. They will do quality control on the data used to generate the profile, and calculate correlations of the data using statistical packages. Contributions to the programming needed to enhance the automation of the clinical profile "pipeline" will be the main task.

Preferred (or required) skills and/ or experience: Familiarity with Python is required. Experience with R statistical package, clinical classifications, or FHIR would be desirable, but can be learned in the role.

Positions available: 1

Work location: East Baltimore campus, 2024 E. Monument Street, Suite 1-200

Andrew Feinberg: Oncology, Molecular Biology & Genetics, Psychiatry & Behavioral Sciences, SOM; Mental Health, Biostatistics, BSPH; Biomedical Engineering, WSE

Project: The laboratory is investigating the role of epigenetics in gene-environmental interaction in normal development and disease. Current student projects address the epigenetics of aging, computational analysis of DNA methylation in leukemia, epigenetic entropy and phenotype in the collaborative cross mouse, and epigenetics of neuropsychiatric disease. A summer project would involve computational and some laboratory analysis of epigenomic data, in collaboration with a graduate student or postdoc. Our research and publications are described in detail at http://feinberglab.jhu.edu Participant responsibilities/ tasks include coding in R, UNIX-based computational analysis of epigenomic data, hypothesis generation, experimental testing using ordinary molecular biology tools at the bench.

Preferred (or required) skills and/ or experience Laboratory experience in molecular biology is required, preferably from prior research. UNIX-based computing and facility in R programming is required. The student must commit to attendance in the lab and at laboratory meetings.

Positions available: 2

Work location: Homewood campus, Clark 101 and/ or East Baltimore, Rangos 5.

Paul Ferraro: Carey Business School; Environmental Health & Engineering, WSE and BSPH

Project: There are two projects in which undergraduate students can participate:
(1) A global study of the environmental effects of anti-poverty programs. Poverty reduction and environmental sustainability are two of the great global challenges of this century. This project is a harmonized, multi-country evaluation of the impacts of conditional cash transfer (CCT) programs on deforestation and fire in tropical countries;
(2) The effects of social comparisons on polluter behaviors. People often assess the appropriateness of their actions through comparisons to others. Do polluters do the same? This project aims to test a way to inexpensively reduce water pollution by using publicly available EPA data to create peer comparisons that show each polluting facility how its performance compares to other facilities in its state or its economic sector.
RAs work on data set creation, descriptive analyses and literature reviews. Participation in weekly lab meetings is also expected.
Preferred (or required) skills and/ or experience: No experience necessary. Evidence of programming experience preferred (python, R, Stata, ArcGIS).
Positions available: 2 - 4
Work location: Remote/ Virtual

Rachel Green: Molecular Biology & Genetics, SOM; Biology, KSAS

Project: Our laboratory has a number of exciting projects focused on understanding how diverse cellular stresses impact translation by the ribosome and lead to the activation of cellular signaling pathways. These projects involve mammalian tissue culture work, biochemistry and molecular biology, and computational analysis of high throughput sequencing data.
Preferred (or required) skills and/ or experience: Competency in experimental work from laboratory classes is a minimum.
Positions available: 2
Work location: East Baltimore campus, PCTB 7th floor

Matthew Kahn: Economics, KSAS; Economics and Business, CBS

Project: Undergraduates will work on projects related to urban and environmental economics. One such project is helping to finish his book manuscript (under contract with University of California Press) titled, How the Rise of Remote Work Will Reshape Our Cities. There are other projects related to new empirical research based on City of Baltimore research projects.
Preferred (or required) skills and/ or experience: Training in microeconomics, statistics and ideally some understanding of GIS software.
Positions available: 2
Work location: virtual/ remote

Rong Li: Cell Biology, SOM; Chemical & Biomolecular Engineering, WSE

Project: We study a cellular condition called aneuploidy. When cells are aneuploid, it means they contain an abnormal number of chromosomes. This occurs commonly in a variety of human diseases including birth defects and cancer. The BDP Summer Project in our lab will focus on understanding how genetic mutations lead to aneuploidy and the physiologic consequences of aneuploidy in 3D cell culture models known as organoids. Common genetic mutations in cancer are known to increase the frequency of aneuploidy, but the underlying mechanisms of this process are not well understood. Using cell and molecular biology techniques, our summer student will investigate this process. Additionally, it is not yet known how aneuploid and euploid (cells with the correct chromosome number) interact within tissues. By inducing aneuploidy in a subset of cells within an organoid, we can use a variety of techniques including live-cell imaging and transcriptome sequencing to better understand the consequences of aneuploidy within tissues. The findings of this project will help us better understand the basic biology of aneuploidy and could provide insights into better methods for preventing and treating cancer.

The BDP Summer student will be very involved in all aspects of the project. We will teach the student many techniques including cell culture, molecular cloning, live-cell imaging, and functional genomics. The student will work closely with a graduate student who will serve as an in-lab mentor. The student will also be expected to present their findings to Dr. Rong Li regularly to build their presentation skills.
Preferred (or required) skills and/ or experience: We do not expect any skills or experience. Our BDP student will be taught any skills needed for the project.
Positions available: 1
Work location: East Baltimore campus, Rangos Research Building 440

Steven Salzberg: Biomedical Engineering and Medicine, SOM; Computer Science, WSE; Biostatistics, BSPH

Project: Our lab currently works in three related but distinct areas:
(1) Genome Assembly. We develop genome assembly algorithms to use the latest generation of sequencing technologies, pushing the technology to take on ever-larger and more complex genomes, such as our current project to assemble the mega-genomes of the redwood and sequoia trees. We also apply these methods in collaborations with biologists to sequence the genomes of species ranging from bacteria to plants and animals.
(2) Transcriptome (RNA sequencing) analysis and gene finding. Over the past decade, members of the lab developed multiple programs for RNA-seq analysis that have been adopted around the world. Together these programs align and assemble RNA sequencing data to reconstruct a detailed picture of all the genes and gene variants that are expressed in a tissue sample. We have also built a new human gene catalog, CHESS, which is under continuous development and improvement.
(2) Metagenomics and microbiome analysis. Our particular focus here is using metagenomic sequencing to diagnose infections. We also design software to analyze metagenomics datasets, including the widely-used Kraken and Centrifuge systems.
Undergraduate interns will work with either a postdoctoral fellow or an advanced graduate student on a project that will be described at the time we offer the internship. For more details see http://salzberg-lab.org.
Preferred (or required) skills and/ or experience: Expertise in Python programming and Unix required. Familiarity with C/C++ is desired but not required.
Positions available: 2
Work location: Homewood, Wyman Park Bldg.

Michael Schatz: Computer Science, WSE; Biology, KSAS; Sidney Kimmel Comprehensive Cancer Center, SoM

Project: We have a variety of potential bioinformatics and software development projects available depending on the interests and background of the student. The central focus will be developing novel algorithmic, machine learning and/or high performance computing approaches for analyzing mutations in human and other genomes. We are also interested to develop novel visualizations of genomics data.
Students will be paired with a graduate student or post-graduate researcher to develop the project. The students will then implement the approach using C/C++, Java, python, R or UNIX depending on the specific project goals. Throughout the summer, students will produce a scholarly report of their work with a goal of submitting the results for publication in a scientific journal. Please see my lab website for current research (http://schatz-lab.org).
Preferred (or required) skills and/ or experience: Students must have programming experience (data structures or higher level course). Experience with genomics data and/or machine learning is preferred.
Positions available: 1 - 2
Work location: Homewood, Malone, 2nd floor

Jeremy Shiffman: International Health, BSPH; School of Advanced International Studies (SAIS)

Project: The antecedents of global health lie in tropical medicine: efforts by colonialists to ensure protection of their own citizens and soldiers from diseases endemic in their colonies. According to many critics of the field, the colonial legacy lives on. They argue that global health is not really 'global'. Rather it is a field characterized by the concentration of power and resources in the hands of a small number of organizations located in high-income countries—such as the Bill and Melinda Gates Foundation, the World Bank, USAID and a bevy of public-private partnerships. These organizations, critics claim, operate primarily in charity mode, offering funding, determining priorities, and dispensing expertise toward the end of instructing governments of low-income countries how to secure better health for their own citizens. These critiques of the field—frequently framed in terms of calls to 'decolonize global health'—have been heightened in the COVID-19 era.

This research project will take a historical perspective on global health, examining the primary aims, modes of operation and locus of power among organizations and institutions in this field. It will consider especially, in the wake of the COVID-19 pandemic and increasingly prominent calls to decolonize global health, whether we are on the cusp of change or even fundamental transformation in this field with respect to normative aims and dominant institutions, or rather if the status quo remains entrenched.

Under the careful guidance of the research team, the undergraduate will be responsible for gathering and reviewing documents to put together a report that draws on political science scholarship to examine the primary aims, modes of operation, and power dynamics in global health. Documents will include but not be limited to published scholarly articles,

grey literature, media reports, and reports from key international organizations, funders and NGOs in global health. The report will include a historical narrative and a timeline of major developments.

Preferred (or required) skills and/ or experience: Interest in global health. Some research experience, especially collecting and/or analyzing qualitative data. Undergraduate coursework in political science, sociology, anthropology, communications, history of medicine or other social sciences a plus but not required. Applicants should describe any relevant research experience in the application. Track record of conscientiousness and reliability in past work, both professional and academic.

Positions available: 1

Work location: Documents can be uploaded to Drop box, so there is no need to conduct this work in a particular place, although access to Johns Hopkins library and other libraries via web to gather documents will be crucial. I and others on the research team will exercise close supervision to ensure that the undergraduates learn and gain skills from the work, and perform the work carefully.

David Sing: Earth & Planetary Sciences and Physics and Astronomy, KSAS

Project: This project will involve the characterization of exoplanets using the transit technique. Both observation and theoretical modeling projects are available, working with data such as the Hubble Space. Overall goals include detecting atomic and molecular species in the atmospheres, and constraining the temperatures and abundances of the atmosphere. Preparatory projects as part of the Early Release Science Program for the upcoming James Webb Space Telescope are also available. The responsibilities will include tasks such as working with time series CCD data to extract exoplanet spectra, and/or using radiative transfer models to optimize spectral retrieval on planetary transmission or emission spectra.

Preferred (or required) skills and/ or experience: Prior experience or proficiency in a programming language is preferred but not required.

Positions available: 2

Work location: Homewood campus, Bloomberg Physics Building and Olin Hall

Carl Wu: Biology, KSAS; Molecular Biology & Genetics, SOM

Project: An intensive research project on single-molecule, live-cell imaging of chromatin factors designed for undergraduate students with interests in biochemistry, molecular, cellular and computational biology. Students use advanced fluorescence microscopy to visualize the single-molecule dynamic behaviors and spatial distributions of important nuclear proteins and chromatin factors in living cells of Saccharomyces cerevisiae as a model for epigenetic factors conserved in humans. Students will learn and apply imaging and computational tools to localize and track single protein molecules in real time and calculate their diffusive parameters. Students are expected to interpret and integrate data to acquire conceptual insights on chromatin functions, e.g. how chromatin proteins, enzymes, and very large protein complexes are organized in nuclear space and time. Students will also gain practical experience in yeast molecular genetics by engineering protein tags on designated nuclear and chromatin factors, and evaluating protein functionality under natural levels of expression. Potential for contribution of results for publication.

Preferred (or required) skills and/ or experience: Preference for students who have completed Advanced Cell and Molecular Biology Research Course on live-cell single molecule imaging, or courses in biochemistry, cell biology, biophysics, and genetics.

Positions available: 2

Work location: Homewood campus, UTL-382