# 2019 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:** Metabolic responses to time restricted feeding. Disruption of normal timing of feeding predispose to obesity, diabetes and other cardiovascular disease. My lab is exploring pathways in the brain, liver, muscle and adipose using mouse models and state-of-the-art in vivo and cellular techniques. Selected students will learn basic mouse handling and breeding, measurements of body composition, feeding and energy expenditure, tissue chemistry, and RNA isolation and gene expression analysis.
**Preferred (or required) skills and/ or experience:** Courses in biology, chemistry and mathematics.
**Positions available**: 2
**Work location:** Bayview Medical Center, Endocrinology Research Labs, Asthma and Allergy Center

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

**Project:** Fundamental cosmology research to explore the history of our universe, including the beginning. Two Johns Hopkins Cosmology Large Angular Scale Surveyor (CLASS) telescopes are now observing the sky. Two more telescopes are being prepared for deployment to northern Chile. Selected students will help with many aspects of the project, depending on their particular interests. Opportunities include development of new telescopes (even with no previous hardware experience), and data analysis including writing analysis software. Students will be paired with graduate students or post-docs until they become self-sufficient to take on independent responsibility. There is also the opportunity to shift area of participation for a broader base of research experience.
**Preferred (or required) skills and/ or experience:** Hardware and/ or computational skills are useful, but not required. A background in physics and/ or engineering is also useful.
**Positions available:** 2
**Work location:** Homewood campus, Bloomberg Center for Physics & Astronomy

**Filipe Campante:** International Economics, SAIS; Economics, KSAS

**Project:** What happens when people from places far apart meet and interact with one another? Specifically, how does that affect the way they see the world -- that is, their cultural values and attitudes -- and what they choose to do? This is a broad project that asks these questions using the "natural experiments" created by two major technological changes that facilitated that contact: (i) long-distance flights and (ii) long-distance calling. On (i), we will look at the causal impact of increased long-distance flight links on gender attitudes: does it lead to more gender equality in terms of attitudes and economic outcomes? On (ii), we will study the causal impact of cheaper phone calls between two places on migration between them, and economic convergence. Both of them build on a research agenda illustrated by "Long-Range Growth: Economic Development in the Global Network of Air Links" (Quarterly Journal of Economics, Volume 133, Issue 3, 1 August 2018, Pages 1395–1458). The student will help with the data analysis for the projects. We will provide access to the relevant data sets (from a variety of sources such as Gallup, the World Values Survey, and Censuses from multiple countries), which will for the most part be already cleaned up and ready to use, as well as guidance on what we want to do with them. At the same time, we encourage independent thinking on questions that can be asked, within the context of the projects, with the data sets at hand, as well as on how to add more data sources.
**Preferred (or required) skills and/ or experience:** Experience with the statistical package Stata is required, and with ArcGIS is desirable.
**Positions available:** 1
**Work location:** We will use Dropbox to host the relevant files, so the work can be done from anywhere.

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

**Project 1:** The polysaccharide (PS) capsule is a critical virulence factor for the pathogenic fungus Cryptococcus neoformans (Cn) yet our understanding of the structure of this capsule remains in its infancy. One of the aims of our group is to gain a better understanding of the PS that make up the capsule of Cn. This is done through study of the biological, chemical, and structural properties of these PS. We also have a catalytic antibody, 18B7, which cleaves PS of Cn which students may explore. Currently open projects for undergraduates within the PS group include:

1. Examining how the exopolysaccharide (EPS) of Cn changes over time in culture.
2. Determine how pH affects the shedding of EPS into the media.
3. Characterize the catalytic activity of 18B7 on EPS from Cn.
4. Something that interests you about polysaccharides from C. neoformans!

The student will work through different laboratory techniques in microbiology including culturing fungi and sterile culture techniques as well as techniques in biochemistry including HPLC, enzyme kinetics, Light Scattering, and NMR and molecular biology techniques including ELISA, cloning and creation of deletion mutants and monosaccharaide content assays.
**Preferred (or required) skills and/ or experience:** A basic understanding of microbiology and an interest in fungi and polysaccharides. Basic computer skills and a proactive attitude will be necessary.
**Positions available:** 1
**Work location:** East Baltimore campus, Bloomberg School of Public Health W5704
**Project 2:** Melanin is the pigment responsible for the color of human skin. But melanin is more than a coloring agent. The biomolecules are special because they readily absorb sunlight and transform the absorbed energy into thermal energy. This is why many animals and plants use pigments such as melanins for thermoregulation. Recently, we reported that fungi also use pigments to capture heat from electromagnetic radiation and regulate their temperature. The darker the colors, the more heat was absorbed. This project aims to measure the relationship between color and heat capture. It will involve exposing different color pigments to sunlight and measure their temperature using an infrared camera. The temperature values will be plotted against color to determine a mathematical relationship. The student will be responsible for studying basic concepts about blackbody radiation and thermal imaging, maintaining an organized laboratory notebook, communicating with the mentor, and following general laboratory rules. After training, they will take thermal images and analyze data, giving a small final presentation on their findings.
**Preferred (or required) skills and/ or experience:** Applicants should be curious, proactive and self-motivated. Basic computer skills are necessary.
**Positions available:** 2
**Work location:** East Baltimore campus, Bloomberg School of Public Health E5132

**Nilanjan Chatterjee:** Biostatistics, BSPH; Oncology, SOM
**Project:** Our group develops and applies methods for analysis of very large-scale genome-wide association studies to inform disease etiology/ biology, causality and genetic risk prediction. The studies involve discovery of new loci, understanding biology through integration of various molecular phenotypes and integration of information with epidemiologic risk-factors for the development of models for risk-stratification with the ultimate goal of developing strategies for precision medicine for disease prevention. Participants will learn and implement new tools into the current analysis pipeline, conduct simulation studies and data analysis and prepare presentations and posters on their project.
**Preferred (or required) skills and/ or experience:** Strong background in computing is needed. Some background in genetics and statistical inference will be desirable.
**Positions available:** 3
**Work location:** East Baltimore campus, Bloomberg School of Public Health E3612

**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 prototypes in the NCATS Translator program for advancing translational research incorporating clinical data. Students may choose disease 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 also 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:** 2
**Work location:** East Baltimore campus, 2024 E. Monument Street, Suite 1-200

**Lisa Cooper:** General Internal Medicine, SOM; Health, Behavior & Society, BSPH; Community-Public Health, SON
**Project:** The Johns Hopkins Center for Health Equity works to promote equity in health for at-risk populations through advancing scientific knowledge, promoting sustainable changes in practice and policy, partnering with communities, raising public awareness of health inequities, and training scholars. The research study is a pragmatic cluster randomized trial in which we will compare the effectiveness of clinic-based standard of care plus audit, feedback and education to an intervention that uses a collaborative care team, a community health worker and specialist consultation to deliver contextualized, appropriately stepped care (CC/Stepped Care) for reducing disparities and improving patient-centered outcomes among patients with hypertension. The goal of the study is to improve care for hypertension and reduce racial disparities related to health outcomes. Students will assist with manuscript preparation and maintenance of the reference library; work with study staff on data entry, data analysis and general summaries of research findings; participate in research team meetings; assist with preparation of study materials and presentations; perform literature reviews; assist in

coordination of and participation in study meetings, including agenda preparation and taking detailed meeting minutes; and assist with community engagement activities, including Community Advisory Board Meetings.
**Preferred (or required) skills and/ or experience:** none
**Positions available:** 2
**Work location:** Bayview and East Baltimore campuses

**Andrew Feinberg:** Oncology, Molecular Biology & Genetics, Psychiatry & Behavioral Sciences, SOM; Mental Health, Biostatistics, BSPH; Biomedical Engineering, WSE
**Project:** The lab is investigating the role of gene-environment interaction in disease. Our research is described at: http://feinberglab.jhu.edu. The summer project will involve computational and laboratory analysis of epigenomic data from model organisms in collaboration with a PhD student or post-doc. Students will be coding in R, UNIX-based computational analysis of epigenomic data, hypothesis generation, and experimental testing using ordinary molecular tools at the bench.
**Preferred (or required) skills and/ or experience:** Lab experience in molecular biology is required, preferably from prior research experience. UNIX-based computing and facility in R program is also required.
**Positions available: 2**
**Work location:** East Baltimore campus, Rangos Research Building

**Paul Ferraro:** Carey Business School; Environmental Health & Engineering, WSE and BSPH
**Project:** There are 3 projects selected students can select to work on:
(1) A field experiment aiming to induce behavioral change in third-party inspectors who are supposed to certify residential rental properties in MD as safe from lead hazards. In this project the student will be tasked with data collection, processing and analysis using MD Dept. of Environment databases. Some literature review and writing may also be necessary;
(2) A field experiment aiming to induce behavioral change in polluting facilities that discharge into rivers and other water bodies in the mid-Atlantic. The student will be tasked with data collection, processing and analysis using US EPA and state environmental agency databases. Some literature review and writing may also be necessary;
(3) A field experiment that explores how best to measure an individual's "patience" and how that patience affects the individual's behaviors and outcomes. The student will be tasked with literature review and writing and, depending on the timing, moderating experiments and making subject payments.
**Preferred (or required) skills and/ or experience:** Some familiarity with R or Stata is desirable but not required.
**Positions available:** 4
**Work location:** Homewood campus, Ames Hall (lab meetings), and remotely.

**Rachel Green:** Molecular Biology & Genetics, SOM; Biology, KSAS
**Project:** There are a number of ongoing translation-related studies in the lab, interest in this fundamental process in biology is important. We are broadly interested in quality control mechanisms in the cell during protein synthesis and we use biochemical and high throughput sequencing approaches to address these core interests. Undergraduate researchers will be assigned to a more senior member of the laboratory who will guide them in conducting independent experiments. Students will be required to keep an accurate notebook of all research and data, follow protocols closely, ask questions, comply with Institute policies and follow safety procedures.
**Preferred (or required) skills and/ or experience:** Introductory lab course (pipetting etc.) is beneficial, but will be covered.
**Positions available:** 2
**Work location:** East Baltimore campus, PCTB 714, 725 N. Wolfe St

**Taekjip Ha:** Biophysics & Biophysical Chemistry, SOM; Biophysics and Physics & Astronomy, KSAS; Biomedical Engineering, WSE
**Project:** During the research internship period, the student will learn basic concepts and laboratory skills in single molecule biophysics. The Ha laboratory develops and applies advanced single molecule fluorescence and mechanical measurement technologies. Scientific topics include chromatin biophysics, nucleic acid remodeling and cellular mechanics. Technologies include single molecule imaging, FRET, single molecule pull-down, fluorescence-force spectroscopy using hybrid instruments combining single molecule fluorescence and optical tweezers, tension gauge tether technology and super-resolution imaging. The student will participate in the weekly group meetings and all four subgroup meetings for the first week, and will write one page synopsis of a main project of every group member. The student will then identify a project to participate in and spend the remaining weeks to assist a group member in acquiring and analyzing the data. At the end of the training, the student will write a ten page term paper on the research performed and will give a group meeting presentation.
**Preferred (or required) skills and/ or experience:** none
**Positions available:** 2
**Work location:** Homewood campus, Mergenthaler Hall or East Baltimore campus, Wood Basic Science Bldg.

**Richard Huganir:** Neuroscience, SOM; Psychological & Brain Sciences, KSAS

**Project:** The Huganir lab is interested in the mechanisms underlying learning and memory and higher brain function as well as the mechanisms underlying neurological and psychiatric diseases such as autism, schizophrenia and Alzheimer's disease. The summer project will study the regulation of synaptic transmission in the brain at the molecular, cellular, circuit and behavioral level. The undergraduate will assist a postdoctoral fellow or senior graduate student in research projects using molecular biology, cell biology, biochemistry, mouse behavior or in vitro or in vivo microscopy techniques.
**Preferred (or required) skills and/ or experience:** Previous experience in a laboratory. Preferred interest in neuroscience.
**Positions available:** 2
**Work location:** East Baltimore campus, Hunterian 1008, 725 N Wolfe St

**Lawrence Jackson:** English and History, KSAS

**Project:** Mapping Billie Holiday's Baltimore: The researchers will work as assistants collecting data for a biographical project on the life of Billie Holiday and the African American community and musical traditions in Baltimore City between 1880 and 1940. Some of the collected information will be transferred to the ArcGis digital platform to show to the broader public in the fall. Undergraduate researchers will collect information from the US Census, Baltimore City Directories, library articles and books.
**Preferred (or required) skills and/ or experience:** Classes in historical research methods and writing and note taking as well as general knowledge of the 19th and 20th centuries are preferred.
**Positions available:** 2
**Work location:** Based on the Homewood campus, but research location will vary. There will be several trips to the Baltimore City Archives on Gorsuch Ave and to the Maryland State Archives in Annapolis.

**Patricia Janak:** Psychological & Brain Sciences, KSAS; Neuroscience, SOM

**Project:** Neural circuits of flexible behavior and reward learning: Research project available will be testing how a neural circuit that includes the amygdala, the orbitofrontal cortex, the striatum, and dopamine systems contributes to learning how environmental visual or auditory cues can come to predict the availability of a reward, either food or drug. How do neurons in these areas underlie this type of learning? After a cue-reward association is learned, how do neurons in these areas contribute to ongoing behavior controlled by the cue? And how can you un-learn this behavior if it is detrimental? This type of learning underlies much of our normal behavior, but also contributes to drug relapse triggered by environmental cues. How animals respond to reward cues also depends on the context. All of these questions are studied in rat behavioral models, in which rats in daily experimental sessions learn to association cue lights with reward. Activity in one or more of the above brain regions is monitored with in vivo electrophysiology or is manipulated using optogenetics or DREADD technologies. The details of the project will be worked out in conjunction with graduate students and postdocs in the lab. Responsibilities will include daily behavioral training and testing of rats, and analyzing these behavioral data, and may also include surgeries for electrode implants or virus infusions for optogenetic and DREADD studies. In addition, students will combine neural activity measures or manipulations with behavior measures to understand how the brain circuits tested contribute to the behavior; perform histological verification of electrode or virus placement; attend lab meetings; provide minor assistance in general lab organization and cleanliness; and be carefully trained and overseen by lab members, with a goal of helping them reach independence in some or all of these tasks when ready.
**Preferred (or required) skills and/ or experience:** No skills and experience are required, but prior work in a neuroscience or animal behavior lab is greatly preferred.
**Positions available:** 2
**Work location:** Homewood campus, Dunning Hall, 2nd floor

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

**Project 1:** This research aims to provide mechanistic insights into the direct relationship between two major manifestations of Parkinson's disease (PD): the accumulation of protein aggregates that contain alpha-synuclein (syn) and mitochondrial dysfunction. A recent study from our lab demonstrates that mitochondria import and degrade unstable cytosolic proteins, termed as MAGIC pathway (mitochondria as guardian in cytosol). Interestingly, our recent results suggest that syn is also imported into mitochondria for degradation under physiological conditions in budding yeast using a split GFP imaging system. Also the syn accumulation in the mitochondria matrix caused a dramatic decline of mitochondrial membrane potential. Our finding provides us a unique opportunity to exploit yeast for rapid and cost-efficient screening of compound libraries for novel therapeutic agents. Here the project is aimed at performing small molecule screens in syn split GFP strain for exploring therapeutic agents that protect mitochondrial against syn toxicity. We plan to screen chemical libraries for compounds that block syn import into mitochondria using the split GFP system. Meanwhile, we will also screen for compounds that block syn-reduced mitochondrial membrane potential using TMRM staining (measured by high throughput FACS or imaging). Project 1 tasks:

Screening a library of 2687 FDA-approved drugs or drugs in stage 2 clinical trials (Johns Hopkins Drug Library) with the goal to identify well-characterized drugs that may be repurposed for PD treatment. You can detect the syn split GFP signal after drug treatment by high throughput flow cytometry or imaging with confocal microscope. During the screening, any interesting drug candidates with decreased mitochondrial imported syn GFP signal will be isolated and then we will test their mitochondrial membrane potential using TMRM staining to check that whether they can rescue the reduced mitochondrial membrane potential. Lastly any strong hits obtained from the yeast screen will be immediate tested using RPE1 cells and neuronal cells for their effects on syn import into mitochondria or syn-reduced mitochondrial membrane potential.

**Preferred (or required) skills and/ or experience:** Highly motivated, multi-tasking team players with basic biology background, molecular & cellular biology courses and wet lab research experience preferred. Data analysis and prepare graphs for illustrations is required

**Positions available:** 1

**Work location:** East Baltimore campus, Rangos Research Building 440

**Project 2:** Though wound healing is necessary for survival, the scarring that often results can cause negative psychosocial effects such as self-consciousness and anxiety, thus interfering with one's ability to pursue hobbies and develop personal relationships. In addition, scar treatment often requires long-term medical treatment, and treatments are often costly and invasive. Despite these factors, there has been only incremental advancements in efficient scar treatment. Scars are essentially the replacement of the normal dermal tissue with a dense extracellular matrix (ECM) accumulation. An efficient method of scar-free wound healing is found in fetal wounds; this wound healing response is mediated by the assembly of the ECM protein fibronectin, in contrast to the collagen found in adult wound healing and in scar formation. This finding has led us to hypothesize that collagen deposition results in scar formation, whereas fibronectin deposition results in a wound healing response unaccompanied by scar formation. To test this hypothesis, we plan to utilize microneedles to inject into the wound a solution containing fibronectin, collagenase to digest collagen, and various growth factors implicated in the acute wound response. During the summer, the student will accomplish the following specific aims: Specific Aim 1: Development of microneedle arrays. For effective delivery of these proteins into the skin, we will use microfabrication methods to create arrays of microneedles approximately 50 micrometers in height. The microneedles will be composed of hyaluronic acid, a glycosaminoglycan commonly used to soften the skin, and will dissolve following penetration. Specific Aim 2: Performance testing microneedle drug delivery.

Fluorescent BSA will be injected into pig skin. Microscopy will be performed on the tissue sample following needle dissolution to ensure successful, even delivery throughout the epidermis. Specific Aim 3: Testing the effects on scar tissue. The microneedles will be loaded with fibroblast growth factor, keratinocyte growth factor, epithelial growth factor, collagenase, and fibronectin. Dose response experiments will be performed on patient-derived skin tissue samples, modifying the concentrations for each factor from zero to maximal values as determined by the literature. Each condition will be run in triplicate, and scar improvement will be graded in blinded before and after examinations.

**Preferred (or required) skills and/ or experience:** Wet lab experience and basic biology knowledge, microfabrication experience, and Matlab experience.

**Positions available:** 1

**Work location:** East Baltimore campus, Rangos research Building 440

**Ellen MacKenzie:** Health Policy & Management and Biostatistics, BSPH; Orthopaedic Surgery &Physical Medicine & Rehabilitation, SOM; Dean, Bloomberg School of Public Health

**Project:** Major Extremity Trauma and Rehabilitation Consortium (METRC), a national network of trauma centers that collaborate on studies designed to improve treatment and outcomes for both service members and civilians who sustain major orthopaedic trauma (www.metrc.org). Johns Hopkins serves as the data coordinating center for the Consortium, and coordinates over 20 studies in collaboration with our clinical partners throughout the country. METRC studies are designed to produce evidence for establishing best treatment practices for patients who have experienced severe orthopaedic trauma, and cover topics related to acute management, preventing infection, managing pain, addressing psychosocial consequences of trauma, and rehabilitation practices to optimize outcomes. The Consortium is also focused on developing methods and best practices for conducting clinical trials in this population. Most METRC projects are mid-way through completion. The undergraduate(s) working with this team would have the opportunity to learn about clinical trial management from the perspective of a data coordinating center. Students would be paired with specific study teams and would engage in activities such as 1) reviewing data collected for accuracy and completion; 2) communicating with centers around data quality; 3) performing literature reviews and summarizing results; 4) updates study administrative databases with grants and contracts information; 5) potentially assisting with drafting memos, procedures, or manuscripts; and 6) potentially shadowing research coordinators to learn about consent and follow-up procedures.

**Preferred (or required) skills and/ or experience:** Proficient office computing skills - Word and Excel are required, Access would be preferred. Strong written and verbal communication skills. Experience with synthesizing evidence from medical journals preferred.

**Positions available:** 2

**Work location:** East Baltimore campus, Public Health Bldg, 415 N Washington St

**Stephen Morgan:** Sociology, KSAS; School of Education

**Project:** Crime and Policing in Baltimore: For summer 2019, we will continue to analyze changes in police tactics and policy since the 1990s, such as the discontinuation of stop and frisk practices, deployment of community policing, and decriminalization of Marijuana possession. We will focus on Baltimore since 2010, analyzing both publicly available data on crime incidents and arrests as well as a unique data source of audio recordings. Primary tasks, under the supervision of Professor Morgan and a graduate student research assistant include: (1) Write and mange code to organize and analyze millions of audio files (2) Through targeted transcription and feature coding, enhance a labeled dataset of tones and utterances from these audio files (3) Assist in the development of routines for keyword and tone detection within the corpus of audio recordings (4) Assist in the development of measures of police activity that can be merged with publicly available data on crime incidents and arrests in Baltimore (5) Assist in exploratory data analysis of audio files, such as to determine the feasibility of sentiment analysis

**Preferred (or required) skills and/ or experience:** Required: interest in crime, policing, current events, and/ or public policy in Baltimore City; excellent attention to detail and ability to meet deadlines. Preferred: Programming experience in R or Python; coursework in computer science, data mining, and statistics.

**Positions available:** 2

**Work location:** Homewood campus, Mergenthaler Hall, 5th floor.

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

**Project:** The Salzberg Lab is a computational biology lab that develops novel methods for analysis of DNA and RNA sequences. Our research includes software for aligning and assembling RNA transcript data (RNS-seq), whole genome assembly, and microbiome (or metagenomics) analysis. We work closely with biomedical scientists to apply these methods to current problems arising in a broad spectrum of biomedical research areas. For more info, visit http://salzberg-lab.org. The lab has a constantly changing array of projects, including sequencing the genomes of new species (currently we are working on the redwood and sequoia, among others), creating a new human gene catalog, and using sequencing as a tool to diagnose infections. Undergraduates will be assigned to work on one of current projects, usually under the supervision of an advanced grad student or postdoc.

**Preferred (or required) skills and/ or experience:** Our lab is 100% computational so students must have prior experience in the UNIX operating system and at least one of the following program languages: Python, Perl, or C/ C++.

**Positions available:** 2

**Work location:** East Baltimore campus, Welch Medical Library, 1st floor

**Nilabh Shastri:** Pathology, SOM; Biology, KSAS

**Project:** We research mechanisms of immune surveillance. Immune surveillance allows the immune system to detect intracellular viruses or cancer cell mutations by the presence of "flags" on surface of affected cells. These "flags" are protein fragments chaperoned to the cell surface by MHC molecules. Failure of the MHC molecules to carry out their normal functions can result in immune evasion by viruses, tumors or even cause metabolic disorders. In the summer projects, we will examine the mechanisms that allow MHC molecules to function and how these mechanisms fail in cancer or infected cells or in genetically altered animal models. Participating students will work on: (1) Molecular analysis of genetically altered mice and immune cells. (2) Preparation and analysis of recombinant DNA constructs. (3) Transfer of recombinant DNA into mammalian cells and their functional analyses. (4) Performing assays to measure immune functions.

**Preferred (or required) skills and/ or experience:** Chemistry lab experience; measurement and manipulation of liquids and cells; and sterile technique are preferred.

**Positions available:** 2

**Work location:** East Baltimore campus, Miler Research Building, Room 606

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

**Project:** Many global health policy and advocacy communities claim that their issue of concern - whether that be diabetes, cancer, HIV/AIDS, adolescent health or malaria - is 'neglected.' In other words, they argue that their issue does not receive the attention and resources it deserves: it is not on the 'global health agenda.' However, these communities and many scholars use the term 'global health agenda' loosely, leaving it unclear just what they are referring to. In consequence, it is not clear how exactly we should determine whether or not an issue is on the 'global health agenda' and/or the extent to which it is. This research project will involve (1) reviewing existing scholarship as a means of gaining conceptual clarity on the meaning of the term 'global health agenda' and (2) developing quantitative indicators to delineate the agenda status of global health issues. By doing so, scholars, policy-makers and practitioners will be able to get a better handle on just which global health issues are indeed neglected, and which are receiving sufficient attention and resources. Under the guidance of the research team, the undergraduates will be responsible for gathering global health documents and coding them, as a means of quantifying the agenda status of global health issues. These documents will include but not be limited to media

reports, World Health Organization resolutions, published scholarly articles, national health plans and reports on global health funding from various donors.
**Preferred (or required) skills and/ or experience:** Interest in global health. Some research experience, including collecting or analyzing qualitative and/or quantitative data. Familiarity with excel. 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:** 2
**Work location:** Documents will 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.

**David Sing:** Earth & Planetary Sciences and Physics and Astronomy, KSAS
**Project:** The project will involve the characterization of exoplanets using the transit technique. Both observation and theoretical modeling projects are available, working with data from such facilities as the Hubble Space Telescope. 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 undergraduate 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 programing language is preferred.
**Positions available:** 2
**Work location:** Homewood campus, Bloomberg Physics Building and Olin Hall

**Alex Szalay:** Physics and Astronomy, KSAS; Computer Science, WSE
**Project:** Study the scaling properties of galaxy halos in large cosmological simulations, and interpret the velocity distribution in terms of the so-called halo model, and a linear infall. Study how this changes with redshift, and whether this could lead to an observable effect. Students will develop Python code to characterize the relative motions of galaxy halos in the INDRA simulations, and repeat the experiments over several hundred realizations as well as two or three different redshifts.
**Preferred (or required) skills and/ or experience:** Experience in Python, some background knowledge of astronomy and classical mechanics.
**Positions available:** 2
**Work location:** Homewood campus, Bloomberg Physics Building

**Michael Tsapatsis:** Chemical & Biomolecular Engineering, WSE; Research & Exploratory Development, APL
**Project 1:** Process Design and Mathematical Modeling: Develop a process-scale assessment (techno economic analysis) of novel energy-efficient membrane separation processes. The student will formulate equation-based mathematical models of the new technologies to compare with the current industrial practice like distillation. Students will formulate mathematical models of membrane performance and process. Solve the equation-based models using numerical methods and interpret the results. Prepare a written report and present the find the findings and recommendations for future work.
**Preferred (or required) skills and/ or experience:** Experience with Matlab and/ or ASPEN is required.
**Positions available:** 1
**Work location:** Homewood campus, Croft Hall
**Project 2:** Crystal Growth and Dissolution: This is an experimental project to study the stability of a class of porous materials (metal-organic-frameworks *MOF*) in various solvents including water. The student will perform MOF crystal growth and dissolution experiments using microscopy. Students will set up a flow device allowing observation of crystals as they grow or dissolve in a solution containing various solvents. Collect and analyze rate data. Prepare a written report and present findings and recommendations for future work.
**Preferred (or required) skills and/ or experience:** Experience with optical microscopy and inorganic synthesis is required.
**Positions available:** 1
**Work location:** Homewood campus. Croft Hall

**Vesla Weaver:** Political Science and Sociology, KSAS
**Project:** Students will join a Yale/Hopkins research team for the Portals Criminal Justice Dialogues project and help with research related to the eventual book. Unfreedom is expanding around the world — even in democratic societies. The population passing through prisons and detention centers today in the U.S. eclipses the number of historically enslaved people in North America and those confined under white rule during apartheid. Within America's poorest and most historically oppressed communities, even people who are physically free characterize their relationship to government as one marked by surveillance, extraction, and expendability. Our vision is to network subjugated communities around the U.S. through Portals, immersive, live, interconnected environments that give people the sense of sharing the same room. Over the past three years, working with Portal_Curators, in eleven neighborhoods and five cities across the U.S. and one in

Mexico City, we amassed the most extensive collection of first-hand accounts of the police by those who are policed to date. Students will work on gathering background information and relevant reports on the policing regimes in each of the sites, compile literature reviews of relevant research, help with the execution of new Portals sites, working with the survey data and conversational transcripts, writing up results from the qualitative coding, as well as some archival work on historical narratives of police.

**Preferred (or required) skills and/ or experience:** Students of any field are welcome though the project is most related to Sociology, Political Science, African American Studies, History, and Political Thought. Students with a knowledge and interest in race-class subjugation, policing and criminal justice, deliberative democracy, inequality, urban politics, black history and political thought, narratives and political discourse, civic empowerment, and quantitative or qualitative methods are encouraged to apply. Experience with analyzing data (and statistical software Stata, R); experience with doing archival research; experience searching electronic databases (Google Scholar; ProQuest Historical Newspapers; Roper's iPoll, Statistical Abstract, etc.); experience with qualitative coding and text extraction software. Many students will not yet have these skills - a desire to learn how to do research is imperative.

**Positions available:** 2 - 3

**Work location:** Homewood campus

**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 upper level students who have completed Advanced Cell and Molecular Biology Research Course on live-cell single molecule imaging.

**Positions available:** 2

**Work location:** Homewood campus, UTL-382

**Alan Yuille:** Cognitive Science, KSAS; Computer Science, WSE

**Project:** Please refer to https://ccvl.jhu.edu/projects/ for all possible projects and responsibilities

**Preferred (or required) skills and/ or experience:** Students MUST have taken at least one of the following courses: "Probabilistic Models of the Visual Cortex," Dr. Alan Yuille; "Machine Learning: Deep Learning," Dr. Gregory Hager; or "Computer Vision," Dr. Haider Ali. Students should be proficient with "Python, TensorFlow, PyTorch." Students should also have an interest in at least one of the six topics listed on the CCVL link listed above.

**Positions available:** 1

**Work location:** Homewood campus