



# BDP Summer 2025

## Undergraduate Research Projects



### Participating BDPs and Research Teams:

[Rexford Ahima, Diabetes:](#) Medicine, SOM;  
Epidemiology, BSPH; SON

[Nicole Baumgarth, Immunology and Infectious Diseases:](#) Molecular Microbiology and Immunology, BSPH; Molecular and Comparative Pathobiology, SOM

[Chuck Bennett, Space, Experimental Astrophysics and Cosmology:](#) Physics and Astronomy, KSAS; Space Sector, APL

[Otis Brawley, Oncology and Epidemiology:](#) Oncology, SOM; Epidemiology, BSPH

[Melinda Buntin, Health Policy and Economics:](#) Health Policy and Management, BSPH; Carey

[Nilanjan Chatterjee, Biostatistics and Genetic Epidemiology:](#) Biostatistics, BSPH; Oncology, SOM

[Kris Chesky, Performing Arts Health:](#) Peabody Conservatory, PI; Physical Medicine and Rehabilitation, SOM

[Lisa Cooper, Equity in Health and Healthcare:](#) Medicine, SOM; Health, Behavior and Society, BSPH; SON

[Andrew Feinberg, Epigenetics:](#) Medicine, Oncology, Molecular Biology & Genetics, Psychiatry & Behavioral Science, SOM; Mental Health, Biostatistics, BSPH; Biomedical Engineering, WSE

[Paul Ferraro, Human Behavior and Public Policy:](#) Carey; Environmental Health and Engineering, WSE; BSPH

[Jessica Gill, Trauma Recovery Biomarkers:](#) SON; Neurology, SOM

[Rachel Green, Biology and Genetics:](#) Molecular Biology and Genetics, SOM; Biology, KSAS

[Richard Haganir, Neuroscience and Brain Sciences:](#) Neuroscience, SOM; Psychological and Brain Sciences, KSAS

[Theodore "Jack" Iwashyna, Social Science and Justice in Medicine:](#) Medicine, SOM; Health Policy and Management, BSPH

[Patricia Janak, Associative Learning and Addiction:](#) Psychological and Brain Sciences, KSAS; Neuroscience, SOM

[Ebony McGee, Innovation and Inclusion in the STEM Ecosystem:](#) SOE; Mental Health, BSPH

[Ian Phillips, Philosophy & Psychological and Brain Sciences:](#) Philosophy, Psychological and Brain Sciences, KSAS

[Steven Salzberg, Computational Biology and Genomics:](#) Biomedical Engineering, SOM; Computer Science, WSE; Biostatistics, BSPH

[Jeremy Shiffman, Global Health Policy:](#) International Health, BSPH; SAIS

[Carl Wu, Chromatin Biology and Biochemistry:](#) Biology, KSAS; Molecular Biology and Genetics, SOM

## Project Descriptions:

### [Rexford Ahima, Diabetes:](#) **Medicine, SOM; Epidemiology, BSPH; SON**

**Project:** Detection and Quantification 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 or tasks:**

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:** None

**Positions available:** 1

**Work location:** Bayview Medical Campus, 5501 Hopkins Bayview Circle, AAC2A.58

**Nicole Baumgarth, Immunology and Infectious Diseases: Molecular Microbiology and Immunology, BSPH; Molecular and Comparative Pathobiology, SOM**

**Project:** Research in the Baumgarth lab encompasses studies on the regulation of immune responses to infections and B cell biology. Much of our work has focused on the regulation of B cell and B cell subset responses using mouse models to two very different pathogens and immune responses: Acute influenza virus infection, an infection that fully resolves and induces highly protective and long-lived B cell-mediated immunity; and B cell responses to *Borrelia burgdorferi*, a bacterial spirochete and the causative agent of Lyme disease that causes non-resolving infection. We are trying to learn from the successful responses to influenza what components of the immune response to *B. burgdorferi* are altered/subverted by the bacteria so that they can establish persistent infection. Knowing that would help us to develop better therapies that could boost the immune system to help overcome the infection.

For example, we are exploring why CD4 T cell responses are ineffective after *B. burgdorferi* infection and why germinal center responses, hallmark responses for the development of high-quality antibodies, are collapsing rapidly. We are also exploring the differences in the immune responses to vaccination with influenza virus and influenza infection to understand better why vaccines are not as good at inducing long-lived immunity. Specifically, we have identified infection-induced inflammatory signals as critical for shaping the quality of the antibody response to influenza virus infection. Other projects in the laboratory explore the regulation and function of natural IgM, a product of innate-like B-1 cells, both as immune regulatory molecule and in immune defense and the projection of a neurotransmitter, acetyl choline, by B cells and how that is regulating immunity. Summer project can be developed on all these various research projects, depending on the interest of the student.

**Undergraduate responsibilities or tasks:** Students will learn skills commensurate with their project. Typical skills we teach in the lab are general laboratory skills such as generating buffers, working with sterile technique, working with BSL2 pathogens, high dimensional flow cytometry, ELISA and ELISPOT, handling of mice in research projects. Developing and experimental protocol, calculating and documenting research results, reading of research papers, giving laboratory presentations about their project. Each undergraduate will be guided by a senior student or post-doc as well as the lab-manager in their day-to-day research. The entire lab meets once a week for a 2h lab-meeting (once a month held as a journal club) and bi-weekly smaller group meetings, depending on the project of the student. Individual meetings with the PI are held also - usually biweekly.

**Preferred (or required) skills and/ or experience:** We do not expect the student to know any techniques or skills, or even have an understanding of microbiology or immunology, but bringing a healthy dose of curiosity and desire to learn about the immune response to pathogens, and how one actually goes about doing that in a research lab is critical.

**Positions available:** 1-2

**Work location:** BSPH W4008

**Chuck Bennett, Space, Experimental Astrophysics and Cosmology: Physics and Astronomy, KSAS; Space Sector, APL**

**Three possible projects:**

1. This project seeks to determine if the cosmic microwave background radiation (the afterglow of the origin of the universe) is consistent with the current standard model of cosmology. Many have claimed deviations from expected behavior on the largest scales across the sky and this project seeks to examine these claims and independently analyze space mission data using our group's deep expertise.

**Undergraduate responsibilities or tasks:** The undergraduate will play a key role in developing and running the software needed to understand the archival space mission data in detail. The undergraduate will be guided by and closely work with senior JHU scientists on specific tasks.

2. This project relates to the exciting new Canadian Galactic Emission Mapper (CGEM) radio astronomy effort. The CGEM telescope will map a large fraction of the sky to provide the data needed to better quantify the Milky Way polarized microwave emission, and use that improved data and understanding to separate those signals from the polarized microwave signal that has travelled across the universe for billions of years.

**Undergraduate responsibilities or tasks:** The undergraduate will play a key role in developing and running the software needed to characterize the system, and to analyze the incoming science data. The undergraduate will be guided by and closely work with senior JHU scientists on specific tasks.

3. This project relates to the JHU Cosmological Large Angular Scale Surveyor (CLASS) telescope array that operates high in the Andes Mountains of northern Chile. The two major goals of the research are to determine how and when the first stars formed, and to determine the nature of the first fraction of a second of the universe. To achieve these goals, This research group builds new instrumentation and analyzes data from the survey. Undergraduates have assisted in the past with both instrument development and/or data analysis.

**Undergraduate responsibilities or tasks:** The undergraduate will play a key role in developing custom software needed to analyze the incoming science data and/or participate in the design and/or construction of new hardware.

**Preferred (or required) skills and/ or experience:** Coding skills preferred, especially Python. Knowledge of the statistical analysis of measurement data is also valuable. Neither is required.

**Positions available:** 1-2

**Work location:** Hybrid; Homewood campus, Bloomberg Center for Physics & Astronomy, 2<sup>nd</sup> floor

**Otis Brawley, Oncology and Epidemiology: Oncology, SOM; Epidemiology, BSPH**

**Project:** Documenting racial and socioeconomic disparities in cancer, heart disease, and diabetes. Creating tables and helping to write a review paper.

**Undergraduate responsibilities or tasks:** Literature searches, writing, interviewing doctors who care for underprivileged patients.

**Preferred (or required) skills and/ or experience:**

Computer literate a must

Good writing skills and analytic mind a plus

**Positions available:** 1

**Work location:** CRB2 and remote/virtual

**Melinda Buntin, Health Policy and Economics: Health Policy and Management, BSPH; Carey**

**Project:** The summer researcher(s) will assist in developing a model to evaluate the impact of bundled payment policies on hospital decision-making. Additionally, they may support projects analyzing Medicare policies of interest including site-neutral payment alignment and post-acute care.

**Undergraduate responsibilities or tasks:** Review of potential data sources; obtain, clean, and organize data for analysis; analyze data for research projects; conduct literature review and synthesize Medicare policy information.

**Preferred (or required) skills and/ or experience:** Highly detail-oriented, deep curiosity about health care policy, strong communication skills, advanced Excel, STATA, R, or SAS skills a plus.

**Positions available:** 2

**Work location:** Hybrid; 2 days of team meetings at 555 Pennsylvania Ave. NW in Washington DC most weeks.

**Nilanjan Chatterjee, Biostatistics and Genetic Epidemiology: Biostatistics, BSPH; Oncology, SOM**

**Project:** Analysis of large scale genetic, biomarkers and epidemiologic data for understanding disease etiology and development of models for risk prediction.

**Undergraduate responsibilities or tasks:**

- 1) Coding
- 2) Data analysis and visualization

**Preferred (or required) skills and/ or experience:**

- 1) Coding skill in R and/or Python
- 2) Background in statistical modeling

**Positions available:** 2

**Work location:** Hybrid

**Kris Chesky, Performing Arts Health: Peabody Conservatory, PI; Physical Medicine and Rehabilitation, SOM**

**Project:** Together with faculty from JHU Bloomberg School of Public Health and Materials Science engineering, we are responding to the need for earplugs specifically for musicians and/or for people wanting to protect themselves from potentially dangerous levels of sound energy produced during music activities. Our focus is on understanding characteristics of various materials that may provide natural listening experiences and effective attenuation levels. As we move beyond modeling, we are preparing for testing attenuation characteristics in a simulated ear canal mounted into a anatomically correct head test fixture.

**Undergraduate responsibilities or tasks:** Responsibilities include contributing as a team member to the development of replicable testing protocols for objective assessment of frequency-specific attenuation patterns as a function of structural characteristics of various materials used. Laboratory facilities and related equipment are currently being developed in the Bloomberg School of Public Health.

**Preferred (or required) skills and/ or experience:** We are seeking students who are interested in this research topic, sticklers for detail, and technically oriented. Not necessary, but skills in music, audio, computer science, electrical engineering, and/or materials science engineering would be helpful.

**Positions available:** 3

**Work location:** School of Public Health - 615 N Wolfe St, Baltimore

**Lisa Cooper, Equity in Health and Healthcare: Medicine, SOM; Health, Behavior and Society, BSPH; SON**

**Project:** Students will have the opportunity to participate as a study team member at the Mid-Atlantic Center for Cardiometabolic Health Equity (MACCHE) at the Johns Hopkins Center for Health Equity (JHCHE). JHCHE and MACCHE work 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. Center research teams use patient and broad stakeholder engagement and apply principles of community-based participatory research to refine and adapt intervention protocols and materials to the needs of participating organizations, clinic sites, and populations.

The goal of MACCHE is to test the effectiveness of several evidence-based strategies for improving cardiometabolic health outcomes among disadvantaged populations, using community-based and patient-centered research principles that may be translated into clinical and public health practices. MACCHE consists of four research programs, spanning several locations in Maryland:

- 1) Healthy for Two, focuses on maternal and infant health, will assess the effectiveness of health coaching and home-visit interventions in reducing postpartum weight retention among high-risk Black and Latinx women.
- 2) UNLOAD Heart Failure is examining community-based interventions for improving cardiorespiratory fitness in adults of low socioeconomic status across urban, rural, and suburban settings.
- 3) LINKED-HEARTS focuses on improving team-based care for blood pressure control among socially disadvantaged adults with uncontrolled hypertension plus diabetes or chronic kidney disease.
- 4) DASH-Life is pilot-testing a “Food is Medicine” approach, which includes coach-guided grocery ordering and lifestyle intervention, in adults with hypertension and type 2 diabetes residing in Baltimore Healthy Food Priority Areas (previously ‘food deserts’)—a population at very high risk for adverse cardiometabolic health outcomes.

Three MACCHE cores support the three research projects:

- 1) The Administrative Core carries out the overall administration of the grant, providing infrastructure and support for data harmonization, management and analysis, patient recruitment and retention, and intervention adaptation and implementation.
- 2) The Community Engagement Core implements a shared governance structure to reinforce stakeholder leadership and ownership; advance, facilitate, and evaluate MACCHE’s community-engaged research and investigator development initiatives; and employ community-centered strategies to translate, disseminate, and sustain MACCHE initiatives.
- 3) The Investigator Development Core established and supports a pilot project program for early-stage investigators and create a mentoring network and community for pilot project awardees, to support innovative research related to chronic disease disparities.

**Undergraduate responsibilities or tasks:** Undergraduates will be invited to participate in recurring MACCHE workgroup meetings with principal investigators, co-investigators, and study staff. Undergraduates may assist in notetaking, data collection, data entry, research participant recruitment, stakeholder engagement activities, literature reviews, research material development including patient education materials, data tables, and figures. MACCHE study staff will assist undergraduates in identifying specific, recurring responsibilities during their time at the Center as well as a specific project for their program requirements.

***(cont.)***

*(Cooper, cont.)*

**Preferred (or required) skills and/ or experience:** Must be able to prioritize and coordinate multiple tasks. Must have the ability to work well and communicate effectively with others. Must have strong organizational skills, attention to detail, be able to work independently and as part of a team. Excellent oral and written communication skills. Proficient in software applications such as MS Windows, Excel, Word, and PowerPoint. Experience with research, public health, and/or health disparities/health equity through coursework or practical experiences is preferred, but not required.

**Positions available:** 2

**Work location:** Primarily remote with some hybrid days on the E. Baltimore Campus, 2024 E. Monument St building. Fully remote may also be OK.

**Andrew Feinberg, Epigenetics: Medicine, Oncology, Molecular Biology & Genetics, Psychiatry & Behavioral Science, 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>

**Undergraduate responsibilities or tasks:** 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, Human Behavior and Public Policy: Carey; Environmental Health and Engineering, WSE; BSPH**

**Project:** There are two projects in which undergraduate students can participate:

An empirical study of the factors that contribute to the resilience of human and non-human individuals and communities in the face of negative shocks, like extreme events from climate change.

An empirical study that aims to replicate and extend several high-impact environmental science (social and natural science) publications to determine how robust the results are.

**Undergraduate responsibilities or tasks:** In project (1), the student will be tasked with helping us assess prior studies on the topic and understanding where the important gaps are in these literatures. In project (2), the student will be tasked with data analysis (specifically analyses of publications that aim to estimate the effect of one variable on another variable, such as the effect of shark conservation regulations on shark mortality).

**Preferred (or required) skills and/ or experience:** For project (1), the main requirement is interest in the topic. Some familiarity with statistics, behavioral science, economics or ecology, as well as the software R, Python, or Stata, is desirable but not required. Project (2) will require prior experience with statistics and data analysis.

**Positions available:** 2

**Work location:** Remote/virtual participation is possible. Weekly virtual lab meetings with at least one in person meeting in June at either Homewood campus in Ames Hall or in Harbor East at Carey Business School (optional – if student prefers all remote, we can accommodate that preference).

**Jessica Gill, Trauma Recovery Biomarkers: SON; Neurology, SOM**

**Project:** Traumatic brain injury and proteomics related to recovery in emergency department patients, as well as athletes.

**Undergraduate responsibilities or tasks:** Assay samples, prepare for experiments, data analytics

**Preferred (or required) skills and/ or experience:** Some wet lab if possible, writing, analyses

**Positions available:** 1

**Work location:** Some wet lab if possible, writing, analyses

**Rachel Green, Biology and Genetics: Molecular Biology and Genetics, SOM; Biology, KSAS**

**Project:** This project will use cell biology and biochemical approaches to better understand how a bacterial toxin from Legionella inhibits mTOR, a master regulator of eukaryotic translation.

**Undergraduate responsibilities or tasks:** The student will work together with a post-doc to perform western blots, PCR/cloning, and mammalian tissue culture. If needed, the undergraduate may also perform biochemical techniques such as protein purification and immunoprecipitation.\

**Preferred (or required) skills and/ or experience:** None required. Please indicate in your statement your interest in continuing research credit during the academic year.

**Positions available:** 1

**Work location:** JHU SOM - PCTB 7th floor

**Richard Haganir, Neuroscience and Brain Sciences: Neuroscience, SOM; Psychological and Brain Sciences, KSAS**

**Project:** To study the regulation of synaptic transmission in the brain at the molecular, cellular, circuit and behavioral level. The 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.

**Undergraduate responsibilities or tasks:** Assist 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:** Medical School Campus, 725 North Wolfe Street, 1001 Hunterian Building

**Theodore "Jack" Iwashyna, Social Science and Justice in Medicine: Medicine, SOM; Health Policy and Management, BSPH**

**Project:** We have an ongoing array of projects around the social organization and outcomes of intensive care units, with particular attention to: (a) developing a learning health system; and (b) understanding the ways in which racial bias warps clinical decision-making, and eradicating that.

**Undergraduate responsibilities or tasks:** Depending on skills, the undergraduate may conduct literature or systematic reviews, lead chart extractions, conduct systematic surveys, or conduct statistical analyses. Where consonant with the students' goals, enthusiasm, and effort, authorship on a published paper is my default goal for any student--but that sometimes requires willingness to remain in contact after the summer (e.g. approval of final manuscript, revisions, copyright forms). Anyone who makes a substantive contribution will at least earn authorship even if they cannot remain in touch.

**Preferred (or required) skills and/ or experience:** Either a social science class with basic qualitative methods introduction; or a statistical reasoning class (can include sociological methods, econometrics, or epidemiology/biostats). More advanced skills or experience are certainly welcome.

**Positions available:** 2

**Work location:** Remote/virtual

**Patricia Janak, Associative Learning and Addiction: Psychological and Brain Sciences, KSAS; Neuroscience, SOM**

**Project:** In these studies, we examine the neural activity in realtime that is associated with intake of food or drugs/alcohol using in vivo electrophysiology or in vivo calcium imaging. We examine the neural activity patterns acquired during behavior to study how different food and drug rewards are encoded by neural activity patterns. In addition, we study the neural activity that underlies the decision subjects

make to seek reward. Most projects involve simultaneous recording of a group of neurons within a single subject, so our data analysis approaches seek to understand how neuronal populations work in functional ensembles to mediate the behaviors we are investigating.

**Undergraduate responsibilities or tasks:** The student would assist a senior lab member in studies of reward learning and/or alcohol and drug use. In these studies, we examine the neural activity in realtime that is associated with intake of food or drugs/alcohol using in vivo electrophysiology or in vivo calcium imaging. Experiments involve training rats in the experimental procedures, recording the neural activity during the behavior, and processing and analyzing the data.

**Preferred (or required) skills and/ or experience:** Prior experience with rodent experiments is always helpful. Background in matlab or python also useful. But, if you don't have either of these, it's ok.

**Positions available:** 1-2

**Work location:** Homewood Campus, Dunning 2nd floor

**Ebony McGee, Innovation and Inclusion in the STEM Ecosystem: SOE; Mental Health, BSPH**

**Project:** The R-RIGHTS team is working on several research projects involving Black Joy in STEM, Afrofuturism, and Blackness in Video Games to improve the experiences and career possibilities of Black, Latinx, Asian, and Indigenous students in engineering and computer science. The research team is searching for a qualified candidate to assist with duties surrounding these projects.

**Undergraduate responsibilities or tasks:**

- Managing data collection
  - Scheduling qualitative interviews with participants
  - Ensuring participants receive compensation
- Conducting research and literature reviews
  - Generating paper ideas and potentially co-authoring research papers
- Supporting the research team
  - Attend research group meetings
  - Handle note-taking, scheduling, creation of presentations, etc.
- Attending regular staff meetings
  - Opportunities to generate and workshop your research ideas
- Other duties as assigned
  - Support the team when planning luncheons, retreats, and museum trips.

**Preferred (or required) skills and/ or experience:**

The ideal candidate for this position will be a junior with the following competencies:

- Exceptional organizational and time management skills
- Strong experience with Microsoft Office Suite (Word, Excel, & PowerPoint)
- Works well with racially diverse teams
- Eagerness to learn and take initiative, yet willing to ask for support

**Positions available:** 2

**Work location:** Mt Washington Campus

**Ian Phillips, Philosophy & Psychological and Brain Sciences: Philosophy, Psychological and Brain Sciences, KSAS**

**Project:** I am currently writing an intellectual biography of the philosopher, Gareth Evans ([https://en.wikipedia.org/wiki/Gareth\\_Evans\\_\(philosopher\)](https://en.wikipedia.org/wiki/Gareth_Evans_(philosopher))). Evans was a philosopher of mind, language, and logic. He is widely regarded as the most important British philosophical talent of his generation, although his life was tragically cut short by cancer at the age of 34. The summer project would involve various forms of research assistance in relation to this project. This would likely include: transcribing and checking interviews, text comparison (e.g., between different drafts of his book and papers), fact checking, and chronology building. Evans was also involved in a fatal shooting in Mexico City in 1978. If the student was able to read Spanish, this would be particularly helpful in translating local media, producing a timeline of the events, and helping contextualize them.

**Undergraduate responsibilities or tasks:** Research assistance, likely including: transcribing and checking interviews, text comparison, fact checking, and chronology building. If student can read Spanish, then also: translating local Mexican media and related sources (see further details in overview).

**Preferred (or required) skills and/ or experience:** Applicants should be interested in philosophy and/or intellectual biography. Ability to read Spanish preferred but not essential. Experience of research assistance including, e.g., using transcription or text comparison tools or doing archival work also preferred.

**Positions available:** 1

**Work location:** Primarily remote/virtual but optional meetings in person if applicant is on campus.

**Steven Salzberg, Computational Biology and Genomics: Biomedical Engineering, SOM; Computer Science, WSE; Biostatistics, BSPH**

**Project:**

We work in four different areas, and each student will be assigned a graduate student or postdoctoral fellow as a mentor in one of these (which you can find out more about at [salzberg-lab.org](http://salzberg-lab.org)):

- Computational gene finding and genome annotation. We have been working for many years on methods to identify genes, ranging from methods for bacterial gene finding to the development of a new human gene database, called CHESS. We're now using ColabFold as a new way to identify functional gene variants
- Transcriptome (RNA sequencing) analysis. Over the past decade, members of the lab along with our collaborators have developed multiple programs for RNA-seq analysis that have been adopted around the world. These include the Bowtie, TopHat, and Cufflinks programs, and more recently the HISAT and StringTie programs, with over 100,000 citations collectively. 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.
- Metagenomics and microbiome analysis. We have developed a variety of tools to analyze metagenomics data sets, including the widely-used Kraken and Centrifuge systems.
- 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 recent projects assembling the genomes of the redwood and sequoia trees. We apply these methods in collaborations with biologists to sequence the genomes of species ranging from bacteria to plants and animals. See our Genome Projects page for a partial list of the many genomes we have assembled and published over the years.

**Undergraduate responsibilities or tasks:** Interns will be assigned a workstation in the lab and are expected to be at the lab in person during regular working hours throughout the internship. Interns write software and analyze data as directed by the PI and graduate student supervisors. Attend bi-weekly lab meetings.

**Preferred (or required) skills and/ or experience:** Expertise in Unix and Python is required. Expertise in C++ and R is a plus but not required.

**Positions available:** 2-3

**Work location:** Homewood Campus, Wyman Park Building, in person

**Jeremy Shiffman, Global Health Policy: International Health, BSPH; SAIS**

**Project:** *(Note: Summer 2024 project TBD and posted in January; projects below are examples from Summer 2023)*

The concepts of ‘social’ and ‘commercial’ determinants of health are now widely accepted in the global health field. The concept of ‘political’ determinants of health, by contrast, has received less attention in the global health field than its social and commercial counterparts. There is a need to define this concept more precisely, and to inject it more centrally into the global health field. Politics shapes health outcomes at all levels, and an understanding of politics and of governance arrangements—institutions and rules that shape collective action—sheds light on the ways in which power structures population health outcomes.

We have been invited by a prominent medical journal to put together a series of articles on the political determinants of health. We expect the series will:

- Clarify the meaning of the concept of ‘political determinants of health’;
- Develop a framework, grounded in innovative political and social science research, which identifies the major political determinants of health and the relationships among them;
- Specify the ways in which politics shapes population health outcomes at global, national and local levels, and;
- Draw out a concise set of implications for action on political determinants to improve population health.

**Undergraduate responsibilities or tasks:** Under the careful guidance of the research team, the undergraduates will be responsible for gathering and reviewing documents that will underpin two of the proposed series papers. One undergraduate will be primarily responsible for supporting the introductory paper that defines the concept of political determinants of health and presents the conceptual framework. Another undergraduate will be primarily responsible for supporting the second paper, which examines how political and governance factors at the global level shape population health. They will be supervised by BDP Jeremy Shiffman and Associate Research Professor Yusra Shawar. Their primary responsibilities will be to collect and organize relevant articles, and produce synthesis reports on key themes.

**Preferred (or required) skills and/ or experience:** Interest in global health. Some research experience, especially collecting and/or analyzing qualitative data, and producing synthesis reports. Undergraduate coursework in public health, 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:** 2

**Work location:** Articles can be uploaded to Dropbox, 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.

**Carl Wu, Chromatin Biology and Biochemistry: Biology, KSAS; Molecular Biology and Genetics, SOM**

**Project:** The Wu lab uses advanced fluorescence microscopy to visualize the single-molecule dynamic behaviors and spatial distributions of nuclear proteins and chromatin factors in living cells or in vitro on surface immobilized DNA and chromatin. Students will learn and apply single-molecule imaging and computational tools to localize and track single protein molecules in real time and calculate their kinetic parameters to acquire insights on the accessibility and occupancy of chromatin targets and the influence of the epigenetic landscape on target search and gene expression.

**Undergraduate responsibilities or tasks:** Students will join ongoing projects on imaging of chromatin and transcription proteins, working under mentorship of senior graduate students or postdoctoral fellows. Responsibilities include practice of molecular genetics and cell biology, cell culture, microscope imaging, computation and data analysis, reading and discussion of current scientific literature.

**Preferred (or required) skills and/ or experience:** Preference for students who intend to undertake post-graduate research towards a PhD and have completed courses in biochemistry, molecular biology, biophysics, or genetics.

**Positions available:** 2

**Work location:** Homewood campus, UTL 382 research lab