

BDP Summer 2024 Undergraduate Research Projects as of January 2, 2024



- FINAL -

Participating BDPs and Research Teams:

<u>Nicole Baumgarth:</u> Molecular Microbiology and Immunology, BSPH; Molecular and Comparative Pathobiology, SOM

James Bellingham: Mechanical Engineering, WSE; APL

<u>Chuck Bennett:</u> Physics and Astronomy, KSAS; JHU Applied Physics Lab (APL)

Melinda Buntin: Health Policy and Management, BSPH; Carey

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

Nilanjan Chatterjee: Biostatistics, BSPH; Oncology, SOM

Kris Chesky: Peabody Conservatory, PI; Physical Medicine and Rehabilitation, SOM

<u>Christopher Chute:</u> General Internal Medicine, SOM; SON; Health Policy and Management, BSPH

Jeff Coller: Molecular Biology and Genetics, SOM; Biology, KSAS

<u>Mikala Egeblad:</u> Cell Biology, Oncology, SOM; SKCCC; Convergence Institute

<u>Andrew Feinberg:</u> Medicine, Oncology, Molecular Biology & Genetics, Psychiatry & Behavioral Sciences, SOM; Mental Health, Biostatistics, BSPH; Biomedical Engineering, WSE Rachel Green: Molecular Biology and Genetics, SOM; Biology, KSAS

Richard Huganir: Neuroscience, SOM; Psychological and Brain Sciences, KSAS

Theodore "Jack" Iwashyna: Pulmonary and Critical Care Medicine, SOM; Health Policy and Management, BSPH

<u>Kathryn McDonald:</u> SON; Armstrong Inst for Patient Safety & Quality, General Internal Medicine, SOM; Malone Center for Engineering in Healthcare, WSE; Hopkins Business of Health Initiative, Carey & BSPH

Eliana M. Perrin: Pediatrics, SOM; SON; BSPH

Ian Phillips: Philosophy, Psychological and Brain Sciences, KSAS

Hanna Pickard: Philosophy, KSAS; Berman Institute of Bioethics

<u>Steven Salzberg:</u> Biomedical Engineering and Medicine, SOM; Computer Science, WSE; Biostatistics, BSPH

Vesla Weaver: Political Science and Sociology, KSAS

<u>Carl Wu:</u> Biology, KSAS; Molecular Biology & Genetics, SOM

Project Descriptions:

<u>Nicole Baumgarth:</u> 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

James Bellingham: Mechanical Engineering, WSE; APL

Project: This project would explore the application of LLMs and Formal Methods to evaluation of legal and financial agreements. Such agreements are developed routinely in business and government enterprises, typically at great cost and often with little detailed understanding by key participants. This project will explore the application of AI and AI verification tools to such agreements to reduce transaction costs, accelerate business processes, and reduce errors.

Undergraduate responsibilities or tasks: The undergraduate would be responsible for scripting LLM interactions to convert existing contractual agreements to a form that could be used for formal verification. This would start with the development of use cases. The student would need to learn an 'off the shelf' formal method language (Imandra) and help define scenarios in which formal verification provides useful insight.

Preferred (or required) skills and/ or experience: Familiarity with application and customization of Large Language Models. Willingness to learn formal methods. Interest in business and finance - familiarity a financial analysis a big plus.

Positions available: 2

Work location: Stieff Silver Building - IAA

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

Three possible projects:

 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.

(cont.)

Bennett, Cont.

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: 2

Work location: Homewood campus, Bloomberg Center for Physics & Astronomy, 2nd floor

Melinda Buntin: Health Policy and Management, BSPH; Carey

Project: The summer researcher will be involved in the specification of a model of demand for workers in the post-acute and long-term care spheres and be part of the foundational work of the new Center for Health Systems and Policy Modeling.

Undergraduate responsibilities or tasks: Review of potential data sources; obtaining, cleaning, and organizing data for modeling; literature review and synthesis of factors influencing worker decisions about education and employment; inventory and analysis of policy options for influencing the future workforce.

Preferred (or required) skills and/ or experience: Highly detail-oriented, deep curiosity about health care policy, 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.

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

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

- 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. To better understand cryptococcal polysaccharides we use multiple biochemical and biophysical techniques (i.e., light scattering, NMR, Mass Spec.). Current open projects include identifying genes/proteins involved in synthesis and assembly of the capsule, determining how polysaccharides change as cells age, solving the polysaccharide structure of the strain Mu-1, and examining the effects of pH on capsule
- 3. Vaccines against Cryptococcal meningitis: Cryptococcus is the only known encapsulated yeast, like encapsulated bacteria which cause bacterial meningitis, we hope to exploit cryptococcal polysaccharides for vaccine development. Current open projects include purifying and characterizing capsular polysaccharides for vaccine development, and development of hybridoma cell lines to test the protective capacity of antibodies to inhibit cryptococcal disease in mice.
- 4. Melanin is the pigment responsible for the color of human skin, but melanin is more than a coloring agent, it is also a virulence factor and an immune compound in insects. Current open projects include characterization of the relationship between pigment and heat capture, characterization of the contents of melanin-containing vesicles, investigation of molecular structure of melanin assemblies at, and their interactions with, the cell wall, investigation of the role of melanin, and its interactors, in the mosquito immune system, and characterization of cell cycle, growth rates, and budding of melanized and non-melanized C. neoformans.

Undergraduate responsibilities or tasks: Students will work closely with a mentor during the first 3 weeks to learn relevant techniques. They will then work independently, but with the help of the mentor and other lab members, on their chosen project.

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 are a must, and some basic computer skills are an asset.

Positions available: 2

shedding.

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

Nilanjan Chatterjee: Biostatistics, BSPH; Oncology, SOM

Project: Analyze big data generated by genetic and epidemiologic studies to understand underlying causal mechanisms and predict risks of complex diseases. Current emphasis of the lab include development of machine learning methods for integration of disparate datasets and flexible analysis of studies from ancestrally diverse populations.

Undergraduate responsibilities or tasks:

1) Data analysis

2) Code development in R and python

Preferred (or required) skills and/ or experience: Coding proficiency (required) Some background coursework in statistics and computational algorithms desirable

Positions available: 2

Work location: Mostly virtual

Kris Chesky: Peabody Conservatory, PI; Physical Medicine and Rehabilitation, SOM

Project: Students will help in the conceptualization of a new and sustainable JH research lab designed to assess how hearing protectors attenuate musical sounds. The lab will be designed for both subjective and objective testing protocols of existing and new types of hearing protectors.

Undergraduate responsibilities or tasks: The student will be tasked with reviewing literature, US and global standards for earplug testing, room characteristics/constraints and technologies for generating sound levels needed for testing, technologies for measuring sound levels in a simulated ear canal, and novel analytic protocols for understanding frequency-specific attenuation characteristics important for understanding the quality of music while listening with earplugs.

Preferred (or required) skills and/ or experience: Preferred interests include public health, music, acoustics, engineering, sound generation and measurement, product testing, data analytics, occupational safety and health, audiology, and hearing conservation.

Positions available: 2

Work location: Remote/virtual

<u>Christopher Chute:</u> General Internal Medicine, SOM; SON; Health Policy and Management, BSPH

Project: Seeking to experiment with a very large EHR clinical dataset to discover the properties of anonymization techniques beyond HIPAA de-identification efforts.

Undergraduate responsibilities or tasks: HPC programming of methods to measure k-level anonymity among permutations of clinical variable. *(cont.)*

Chute, cont.

Preferred (or required) skills and/ or experience: Python required. R and Jupyter desirable.

Positions available: 1

Work location: Remote/virtual, occasional meetings on E Baltimore campus a plus

Jeff Coller: Molecular Biology and Genetics, SOM; Biology, KSAS

Project: Conduct research on mRNA stability and translation.

Undergraduate responsibilities or tasks: mRNA Northerns, PCR, western blots.

Preferred (or required) skills and/ or experience: Basic understanding of chemistry and molecular biology.

Positions available: 2

Work location: PCTB 725 Wolff St. Room 504

Mikala Egeblad: Cell Biology, Oncology, SOM; SKCCC; Convergence Institute

Project: While immunotherapy has revolutionized cancer treatment, unfortunately the vast majority of metastatic cancers remain incurable. This project is focused on identifying and eliminating mechanisms of cancer treatment resistance. We use a topical compound to inflame cutaneous tumors in mice with the goal of unleashing the immune system against the cancer. We are interested in understanding which immune cell types infiltrate these tumors upon treatment with the topical compound. Identifying these cell types will be important for the development of rational combination therapy strategies. We use histological and flow cytometric analyses to determine the immune profiles of these tumors.

Undergraduate responsibilities or tasks: Based on their interest, the undergraduate student will have the opportunity to learn from a postdoctoral mentor how to perform the following techniques: cell culture, tumor cell injections, tumor measurements, tissue fixation, immunofluorescence, immunohistochemistry, and preparation of samples for flow cytometry and antibody staining. The student will have the opportunity to become independent in any of the above technique(s) that is/are of particular interest to them.

Preferred (or required) skills and/ or experience: Not required.

Positions available: 1

Work location: East Baltimore Campus. Rangos, room 440.1

<u>Andrew Feinberg:</u> Medicine, 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

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

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

Project: This project focuses on defining the role of two cellular kinases, GCN2 and ZAK, in triggering the ribotoxic stress response using biochemical approaches.

Undergraduate responsibilities or tasks: Student will work together with a post-doc to perform sitedirected mutagenesis and protein expression to characterize variants of GCN2 and ZAK in various biochemical assays.

Preferred (or required) skills and/ or experience: None required. **Positions available:** 2

Work location: JHU SOM - PCTB 7th floor

Richard Huganir: 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: Pulmonary and Critical Care Medicine, SOM; Health Policy and Management, BSPH

Project: Can we use advanced data science to help primary care clinicians help patients fully recover from acute respiratory failure and pneumonia? Can we get hospitals to buy medical devices that are not racially biased? Can we identify policies and practices within the hospital that help it provide more equitable and efficient care? Undergraduates will participate in one of several fast-moving research projects seeking to improve the outcomes and equity of care we deliver by improving the organizational structures that deliver the care--"making the right thing the easy thing."

Undergraduate responsibilities or tasks: Depending on the student's skills and interests, and the particular phase of the project at the time the student becomes involved, students may: (a) read and analyze parts of the medical record to serve as ground-truth validations of evolving algorithms or dataextraction; (b) conduct statistical analyses to detect patterns and outcomes of care; or (c) analyze semistructured interviews with key informants to understand their values and explanatory frameworks. Most of this work will be independent with roughly weekly meetings with faculty, staff, and other key team members.

Preferred (or required) skills and/ or experience: Folks with SQL database skills, R/stata statistical analysis skills, or previous experience with qualitative coding will have those skill put to use.

Positions available: 2

Work location: Hybrid

<u>Kathryn McDonald</u>: SON; Armstrong Institute for Patient Safety & Quality, General Internal Medicine, SOM; Malone Center for Engineering in Healthcare, WSE; Hopkins Business of Health Initiative, Carey & BSPH (Health Policy and Management)

Project: *(NOTE: This description may be made more specific in January 2024)* The "dry lab" focuses on patient safety and health care quality research with an equity lens. We work to understand how systems (e.g., health care delivery organizations, public health organizations, social service organizations, networks of organizations) shape what happens to patients and frontline health care workers as they produce health and reduce suffering from illness. Ongoing projects include exploring diagnostic excellence (safety, quality, and equity) and patients' diagnostic journeys; generating innovative care for aging; advancing measures of patient experiences and outcomes; analyzing decision-making; and improving coordination of care. A cross-cutting project aims to develop an interdisciplinary research base for facilitating "knowledge to action" research. We are bringing together several interdisciplinary areas pertinent to this goal: implementation science, systems science and management & organization science.

Undergraduate responsibilities or tasks: Undergraduates will gain experience in various stages of research depending on the specific research project (ongoing and new ones generated by undergraduates). Research stages include formulating research questions, selecting methods and data sources, executing research plans, and summarizing research progress (both papers and presentations). As part of the Center for Patient Reported Measures of Diagnostic Excellence, students will work with stakeholders, support learning communities, and participate in interviews, presentations, dissemination activities.

Preferred (or required) skills and/ or experience: none required, but interested in students who want to engage deeply in the topic

Positions available: 2

Work location: East Baltimore Campus, School of Nursing, with possibility for hybrid or virtual

Eliana M. Perrin: Pediatrics, SOM; SON; BSPH

Project: I am a general pediatrician and clinical researcher. I work on a lot of research on childhood obesity, food insecurity, other social determinants of health, health equity, and best practices in primary care.

Undergraduate responsibilities or tasks: Literature searches, working on IRBs, recruiting participants, creating charts, support with presentations, meeting notes, entering data, dissemination of research.

Preferred (or required) skills and/ or experience: Preferred experience with research as research assistant. Preferred ability to speak Spanish, Definitely need to know Excel, Microsoft Word including track changes, Powerpoint.

Positions available: 1-2

Work location: Hybrid

Ian Phillips: Philosophy, Psychological and Brain Sciences, KSAS

Project: Are affordances part of perceptual experience? If so, what effects do social and demographic variables have on affordance perception? Affordances are opportunities our environments offer to us in perception. The concept combines the perceptual experience of perceiving the world with the motivational pull to act upon it. Theorists have postulated 'action affordances' (such as climbing a tree, opening a door or picking up a water bottle to drink from it), 'social affordances' (such as noticing that someone is lost or needs help), or 'mental affordances' (such as seeing a group of objects and being pulled to count them). The goal of the present project is to make progress in determining what kinds of affordances if any characterize human perceptual experience, and more specifically the effects of different social and demographic variables on perceived opportunities for action.

Undergraduate responsibilities or tasks: Students will work with Prof. Ian Phillips as well as his collaborator, Prof. Chaz Firestone and his lab to design, code, run and analyze data to make progress on the research question above.

Preferred (or required) skills and/ or experience: Preferred: Experience with designing, coding, running and analyzing data from online experiments. Background in psychology, in particular vision science.

Positions available: 1

Work location: Ames Hall (Firestone Perception & Mind Lab) as well as some virtual meetings.

Hanna Pickard: Philosophy, KSAS; Berman Institute of Bioethics

Project: I am completing a book arguing for a new, interdisciplinary paradigm for addiction that synthesizes and extends my research on the topic (see

https://www.hannapickard.com/addiction.html). I need a research assistant who will be able to fact-find, fact-check, help with literature searches and summarize articles, prepare references, check citations, proofread, and in general assist me in getting the manuscript ready for submission to the publisher.

Undergraduate responsibilities or tasks:

Fact-finding, fact-checking, literature searches, preparation of summaries of articles, preparation of references, checking of citations, proofreading, general assistance with preparation of the manuscript.

Preferred (or required) skills and/ or experience: Strong capacity for independent work and selfmotivation; excellent attention to detail; strong record of academic success and achievement; basic research skills; interest in learning about addiction and interdisciplinary perspectives.

Positions available: 1

Work location: Remote/virtual.

<u>Steven Salzberg</u>: Biomedical Engineering and Medicine, 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):

- 1. 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.
- 2. 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.
- 3. 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.
- **4.** Metagenomics and microbiome analysis. We have developed a variety of tools to analyze metagenomics data sets, including the widely-used Kraken and Centrifuge systems.

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 biweekly 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

Vesla Weaver: Political Science and Sociology, KSAS

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

The research team will work on two projects:

1) Students will conduct ongoing research for Professor Weaver's book project, The State From Below: Racial Authoritarianism in American Democracy, based on the largest collection of narratives about policing, state violence, and resistance collected to date. Student researchers will mainly be working on collecting and analyzing several sources or oral history and testimony from the black archive collected throughout the 20th century. We will particularly be working on oral histories of black police officers as well as black police leagues including the Guardians and especially the Afro-American Patrolmen's League. We will be analyzing several themes across this cumulated set of sources that were not part of a single oral history or narrative collection project but that together represent a substantial range of Black counterpublic understandings (and critiques and aspirations) of American democracy via interactions with the state's more coercive institutions.

2) The American Prison Writing Archive research project. The Archive is the first fully searchable digital archive of non-fiction essays and poetry by incarcerated people. It is the largest body of prison witness ever amassed – at forty-one percent of the entire canon of slave narratives. However, the real importance is not its size but in how it demands a reorientation of whose expertise matters in the documentation of history (and its transformation!)-- What if we made the unfree central purveyors of knowledge in society? The 3,300 essays by incarcerated writers across 400 prison facilities offer the most extensive corpus of experiential, grounded knowledge about confinement in our time. It has already given rise to projects that offer unprecedented glimpses into living prison experience, such as "The Zo," from The Marshall Project. With funding from the Mellon Foundation, we are expanding the APWA to 10,000 essays, reaching underrepresented authors and locations, collaborating with other sites of prison witness, and expanding its visibility and impact. Students will help conduct research using the archive's holdings, help with reading essays and subject tagging/coding them, and develop thematic curations as well as data visualizations for the web interface.

Undergraduate responsibilities or tasks: For the first project, The State From Below, researchers will analyze several black American oral histories from various archives along with a team of graduate students; as well as work on filling out research on black police leagues during the 1970s and 1980s using online databases like the Afro-American Patrolmen's League records and ProQuest Historical Black Newspapers. If students have a quantitative skillset, they will analyze survey data on policing from the 2020 Cooperative Multiracial Post-Election Survey; conduct structural topic modeling and natural language processing of the transcripts.

For the second project, The American Prison Writing Archive, the tasks will be to help develop curations for both the website as well planned anthologies; examine several themes within the corpus of first-person witness of incarceration during the 21st Century; as well as help with subject tagging of essays.

Preferred (or required) skills and/ or experience:

- Experience with producing data visualizations (word clouds, maps, thematic patterns in the data, over time trends)
- Experience or interest in working with digital archives and with oral history collections
- Experience doing quantitative analysis using R, Stata (preferred, not required)
- Experience with doing literature reviews

Positions available: 2-3

Work location: Remote with regular meetings on campus with research team

Carl Wu: Biology, KSAS; Molecular Biology & 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 live-cell and in vitro 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 have completed the Biology Department Advanced Cell and Molecular Biology Research Course on live-cell single-molecule imaging, or courses in biochemistry, molecular biology, cell biology, biophysics, or genetics.

Positions available: 2

Work location: Homewood campus, UTL-382 lab