**Rexford Ahima**: Endocrinology, Diabetes, & Metabolism, SOM; Epidemiology, BSPH; Community-Public Health, 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. Prepare solutions and reagents
2. Conduct research
3. Participate in group discussions

**Preferred (or required) skills and/or experience**: 1. Ability to follow instructions 2. Document experimental procedures

**Positions available**: 1

**Work location**: Bayview Campus, Asthma & Allergy Building, Rooms 2A58

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

**Project**: The research project relates to the Cosmological Large Angular Scale Surveyor (CLASS) telescope array that Johns Hopkins University operates high in the Andes Mountains of northern Chile. The two major goals of the research are: (1) to determine, via measurement, the detailed process that led to the first stars forming; and (2) to determine, via measurement, the nature of the first fraction of a second of the creation of the universe. To achieve these goals, CLASS conducts a survey of the polarized cosmic microwave background radiation (the remnant glow from billions of years ago) over most of the sky. The research group builds new instrumentation and analyzes data from the survey. Undergraduates assist in CLASS instrument development and/or survey data analysis.

**Undergraduate responsibilities or tasks**: Specific student projects, either hardware or software, will be assigned partially based on student skills and preferences.

**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, 2nd floor

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

**Project**: There are many areas of research exploring fungal pathogens and melanin pigments in the Casadevall lab. Please indicate the project(s) you are interested in. Some include:

1. Structure and function of catalytic antibodies. While most catalysis is thought to be carried out by enzymes, our lab and others have shown that antibodies can also carry out catalysis of the antigens that they bind (Bowen 2016). We are working to characterize this catalysis and the kinetics against different types of targets (i.e. peptides, polysaccharides, nucleic acids). Current open projects include screening of antibodies for catalytic activity and determining the pH at which catalysis is most efficient.
2. The polysaccharide capsule of Cryptococcus. The C. neoformans capsule is required for causing Cryptococcosis disease in humans yet we understand very little about its assembly and structure. Recently we have established a protocol for the isolation of both the shed exopolysaccharide (EPS) and the attached capsular polysaccharide (CPS). Current projects involve determining the protein content of EPS and CPS, defining the differences between the polysaccharide in EPS and CPS and exploring how these polymers are assembled. We apply multiple
Christopher Chute

Nilanjan Chatterjee

2. Since the pandemic, there is an ever-growing demand for COVID – 19 research. Chute’s team have been involved in the development and maintenance of COVID data registries and the research over COVID patients both nationally and regionally. Current projects/registries include but are not limited to:

1. The National COVID Cohort Collaborative (N3C) has collected electronic health record (EHR) data from over 60 academic health centers across the country (now over 6 million patients and data on over 2.2M patients with COVID). The analysis is performed on this existing registry under IRB00249128: “National COVID Cohort Collaborative (N3C): A national resource for shared analytics.” Domain experts including clinicians, epidemiologists, data scientist, computer engineers have been active in research across different clinical specialties.

2. The State of Maryland, in partnership with the Chesapeake Regional Information System for our Patients (CRISP) HIE in Maryland, has authorized the creation of a registry of COVID patients. Chute’s team are collaborating with researchers from Johns Hopkins School of Medicine and School of Public Health to perform analysis over the

3. With the polysaccharide capsule being an essential virulence factor for C. neoformans we are also interested in its use as a therapeutic. In conjunction with our synthetic chemist collaborators we have a series of synthesized and naturally derived polysaccharide conjugate vaccines that we are testing for their efficacy to protect against cryptococcal infection and disseminated disease. This project involves mouse work as well as immunology and will be done in conjunction with a team of people in the lab to describe the mouse response to the vaccines and their protective capacity against cryptococcosis.

4. In addition to its polysaccharide capsule, C. neoformans is also protected from host cell defense mechanisms by a protective layer of melanin pigment deposited in the cell wall. During infection, neurotransmitters like dopamine and epinephrine are used by the yeast cells as chemical precursors for the synthesis of melanin. We study melanin production by C. neoformans in the lab by providing the cells with melanin precursors in defined culture media. Preliminary data suggests that there may be differences in precursor preference for different strains of C. neoformans, this could correlate with differences in virulence. We are exploring this hypothesis using several strains of C. neoformans grown in the presence of different precursors, and at different temperatures, then monitoring pigment production.

5. In malaria transmitting mosquitoes, diets can alter gut microbiota at the larval and adult stages, which in turn modulates the insect immunity, particularly against Plasmodium parasites. In response to dietary L-DOPA, we have found that adult female Anopheles gambiae mosquitoes, major malaria vector in Africa, exhibit a wide range of melanin-associated physiological processes ranging from immune defenses to cuticle and eggshell pigmentation. We are exploring the translational applications of these processes including examining the impact of environmental temperature on mosquito egg embryo survival, determining the chitin content of mosquito eggshell and its ability to cope with desiccation, and assessing melanization and antimicrobial activities in newly-emerged adults mosquitoes. Student will learn a wide range of laboratory methodologies ranging from basic mosquito biology procedures, dynamic light scattering, colorimetric determination, light microscopy to intrathoracic injections of adult mosquitoes.

Undergraduate responsibilities or tasks: Varies depending upon project. Please see project descriptions.

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

Positions available: 2

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

Nilanjan Chatterjee: Biostatistics, BSPH; Oncology, SOM

Project: Big data analytics for building predictive models and clinical decision tools, including those for long term management of COVID-19. Model building will require integration of multiple data sources on case-control genome-wide association studies, genomic databases and biobank based cohort studies.

Undergraduate responsibilities or tasks: Data analysis, programming in R/Python/JAVA etc

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

Positions available: 2

Work location: Hybrid of remote and in person

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

Project: Since the pandemic, there is an ever-growing demand for COVID – 19 research. Chute’s team have been involved in the development and maintenance of COVID data registries and the research over COVID patients both nationally and regionally. Current projects/registries include but are not limited to:

1. The National COVID Cohort Collaborative (N3C) has collected electronic health record (EHR) data from over 60 academic health centers across the country (now over 6 million patients and data on over 2.2M patients with COVID). The analysis is performed on this existing registry under IRB00249128: “National COVID Cohort Collaborative (N3C): A national resource for shared analytics.” Domain experts including clinicians, epidemiologists, data scientist, computer engineers have been active in research across different clinical specialties.

2. The State of Maryland, in partnership with the Chesapeake Regional Information System for our Patients (CRISP) HIE in Maryland, has authorized the creation of a registry of COVID patients. Chute’s team are collaborating with researchers from Johns Hopkins School of Medicine and School of Public Health to perform analysis over the

3. With the polysaccharide capsule being an essential virulence factor for C. neoformans we are also interested in its use as a therapeutic. In conjunction with our synthetic chemist collaborators we have a series of synthesized and naturally derived polysaccharide conjugate vaccines that we are testing for their efficacy to protect against cryptococcal infection and disseminated disease. This project involves mouse work as well as immunology and will be done in conjunction with a team of people in the lab to describe the mouse response to the vaccines and their protective capacity against cryptococcosis.

4. In addition to its polysaccharide capsule, C. neoformans is also protected from host cell defense mechanisms by a protective layer of melanin pigment deposited in the cell wall. During infection, neurotransmitters like dopamine and epinephrine are used by the yeast cells as chemical precursors for the synthesis of melanin. We study melanin production by C. neoformans in the lab by providing the cells with melanin precursors in defined culture media. Preliminary data suggests that there may be differences in precursor preference for different strains of C. neoformans, this could correlate with differences in virulence. We are exploring this hypothesis using several strains of C. neoformans grown in the presence of different precursors, and at different temperatures, then monitoring pigment production.

5. In malaria transmitting mosquitoes, diets can alter gut microbiota at the larval and adult stages, which in turn modulates the insect immunity, particularly against Plasmodium parasites. In response to dietary L-DOPA, we have found that adult female Anopheles gambiae mosquitoes, major malaria vector in Africa, exhibit a wide range of melanin-associated physiological processes ranging from immune defenses to cuticle and eggshell pigmentation. We are exploring the translational applications of these processes including examining the impact of environmental temperature on mosquito egg embryo survival, determining the chitin content of mosquito eggshell and its ability to cope with desiccation, and assessing melanization and antimicrobial activities in newly-emerged adults mosquitoes. Student will learn a wide range of laboratory methodologies ranging from basic mosquito biology procedures, dynamic light scattering, colorimetric determination, light microscopy to intrathoracic injections of adult mosquitoes.

Undergraduate responsibilities or tasks: Varies depending upon project. Please see project descriptions.

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

Positions available: 2

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

Nilanjan Chatterjee: Biostatistics, BSPH; Oncology, SOM

Project: Big data analytics for building predictive models and clinical decision tools, including those for long term management of COVID-19. Model building will require integration of multiple data sources on case-control genome-wide association studies, genomic databases and biobank based cohort studies.

Undergraduate responsibilities or tasks: Data analysis, programming in R/Python/JAVA etc

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

Positions available: 2

Work location: Hybrid of remote and in person
patients. The primary goal is to use EHR data from CRISP to identify predictors of COVID-19 infection and measures of severity, including emergency department (ED) use, hospitalization, intensive care unit (ICU) admission, ventilator use, and death.

**Undergraduate responsibilities or tasks:** During the project, the students will learn about the features of real world generated data/Electronic Health Record about COVID patients and how these align with and differ from clinical/public health knowledge. The student will participate in an existing research project under the supervision of postdocs and other senior researchers from Chute’s team. The work duties include data collection, data curation and data analysis/hypothesis test. The students may also attend the routine research meetings and make presentations when prepared. The students may also be tasked with literature review and help with the manuscript preparation.

**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, and remote.

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**Jeff Coller:** Molecular Biology and Genetics, SOM

**Project:** Development of a novel RNA therapeutic for the treatment of haploinsufficiency disorders. The Coller lab focuses on the understand of mRNA stability and its relationship to mRNA translation. We have created three technologies that allow us to manipulate mRNA stability in the human body. We are developing these in an effort to ameliorate genetic epilepsies that are classified as haploinsufficiency disorders. In addition, we are working closely with biopharma to assist in the development of next generation mRNA-based vaccines and therapies.

**Undergraduate responsibilities or tasks:** Test various versions of novel therapeutics. Help conduct genetic assays for mechanism of action studies. Conduct biochemical assays for nucleotide binding to RNA binding proteins.

**Preferred (or required) skills and/or experience:** Basic understanding of molecular biology, genetics, and biochemistry is a major plus.

**Positions available:** 2

**Work location:** Medical School - 725 N. Wolfe St., PCTB 503

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**Lisa Cooper:** General Internal Medicine, SOM; Health, Behavior & Society, BSPH; Community-Public Health, SON

**Project:** Students will have the opportunity to participate as a study team member on numerous research projects at the Johns Hopkins Center for Health Equity (JHCHE). JHCHE 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. 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.

**Undergraduate responsibilities or tasks:** Undergraduates will be invited to participate in recurring workgroup meetings with principal investigators, co-investigators, and study staff. Undergraduates may assist in note taking, data collection, data entry, research participant recruitment, stakeholder engagement activities, literature reviews, research material development including patient education materials, data tables, and figures. 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.

**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:** Various options available; fully remote or hybrid are both acceptable, although exact tasks will vary depending on a student’s location.

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

**Project:** There are at least three projects in which undergraduate students can participate:

1. 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.
2. A behavioral study of the persistence of conservation practices after they are adopted by agricultural producers. There are many studies that focus on adoption, but few that study what happens after adoption. The study may branch out beyond the study of behaviors of agricultural producers to the environmentally friendly behavior change more broadly.

3. An empirical study of the mechanisms through which additional nutrients affect the functioning of ecosystems.

4. Other behavioral or ecological studies may be available in 2022.

**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 this literature. In project (2), the student will be tasked with some data analysis and literature review to help us understand the economic, psychological, and cultural factors that affect the persistence of environmental behaviors. In project (3), the student will be tasked with some data analysis and literature review to help us understand how ecologists have tried to empirical identify mechanistic processes in experimental and non-experimental ecosystems.

**Preferred (or required) skills and/or experience:** Some familiarity with statistics, economics or ecology, as well as the software R or Stata, is desirable but not required.

**Positions available:** 3

**Work location:** Remote/virtual participation is possible. Weekly lab meetings may be conducted on Homewood campus in Ames Hall.

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

**Project:** The Green lab summer projects will involve a mixture of biochemical and molecular biology assays (such as western blot, qPCR, and cell culture) and analyzing complex datasets to better understand current Green lab research topics.

**Undergraduate responsibilities or tasks:** Reporting to lab on time and communicating (as agreed upon) with the graduate student/postdoctoral fellow supervising the summer student/project, maintaining an accurate, complete notebook of work completed in the lab, maintain lab safety protocols while in the lab, asking questions, being a good lab citizen.

**Preferred (or required) skills and/or experience:** Prior lab research experience is preferred, basic math (converting units in metric system) and computer skills.

**Positions available:** 2

**Work location:** School of Medicine, 725 N. Wolfe St. PCTB 714

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**Lawrence Jackson:** English, History, KSAS; Center for Africana Studies; Director Billie Holiday Center for Liberation Arts

**Project:** We will be transforming historical material into digital data to create a digital historical map. Students will georeference historical maps onto modern digital map street grids of Baltimore City to recreate the social worlds of Frederick Douglass and Billie Holiday.

**Undergraduate responsibilities or tasks:** Students will write a computer program to extract building outlines and heights from existing maps and historical photographs to recreate the 200 block of Dallas Street in Fells Point and the 1200 & 1300 blocks of Pennsylvania Avenue. We will also use Baltimore City Directories, Eastern Police District Ledgers, and the U.S. Census (digitally available on Ancestry.com) to people the maps.

**Preferred (or required) skills and/or experience:** An interest in public history and perhaps some skill in computer software design are preferred but not required.

**Positions available:** 2

**Work location:** TBD; hybrid (virtual with some in-person work with historical documents)

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**Kathryn McDonald:** 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:** 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. 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). 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.

**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

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**Eliana M. Perrin, MD, MPH:** Pediatrics, SOM; SON; BSPH

**Project:** I am a new Bloomberg Distinguished Professor, pediatrician, and obesity prevention, health disparities and primary care researcher. I have many ongoing projects that look at the relationships between social determinants of health (food insecurity, housing, etc) and child health outcomes, particularly in families and communities that have been systematically disadvantaged. I also am a Principal Investigator on an NIH grant that is a randomized controlled trial to prevent obesity in children in doctor’s offices starting when they are newborns. Finally, I am working to reboot a primary care consortium bringing together the Schools of Medicine, Nursing, and Public Health as well as the Johns Hopkins Community Physicians to elevate the stature of primary care throughout Hopkins in the areas of research, clinical care best practices, advocacy/policy, and education (getting undergrads who are going to medical and nursing school to keep thinking about primary care)! I have a variety of projects that could use undergraduate student help depending on the student’s interests and emerging priorities.

**Undergraduate responsibilities or tasks:** The responsibilities and tasks depend on the specific project(s). Broadly speaking, the tasks include: literature searches, help with manuscripts and grants, development and organization of obesity prevention materials, participant screening and questionnaires, help with interviews and/or focus groups, data entry, etc.

**Preferred (or required) skills and/or experience:** Preferred ability to speak/write in Spanish; work with Excel; make power points; experience with human subjects research; experience with data entry and/or analysis. None of those are required, though.

**Positions available:** 1-2

**Work location:** Much of the work can likely be virtual; some in person work at the David Rubenstein Building near the hospital downtown.

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

**Project:** Our lab works on (1) whole-genome assembly, (2) transcriptome or RNA sequencing analysis, (3) computational gene finding, and (4) microbiome methods and analysis. All of our work is computational, and we collaborate closely with experimental and clinical labs to collect genomic data from humans and a wide range of other species. For more information, please visit the lab page, [https://salzberg-lab.org/](https://salzberg-lab.org/).

**Undergraduate responsibilities or tasks:** Summer interns are assigned to work with a Ph.D. student or a postdoctoral scientist, who provides close supervision throughout the internship. Interns attend lab meetings and learn about other research in the lab as well as their own projects. All work involves programming, usually around one or more DNA or RNA sequencing data sets.

**Preferred (or required) skills and/or experience:** Familiarity with the Unix operating system and the command line is required. Strong programming skills in Python, Perl, or C++ (any one of these) are required as well.

**Positions available:** 2

**Work location:** Homewood, Wyman Park Bldg.

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

**Project:** What are the core moral beliefs that underpin and motivate the work of global health actors? How do these beliefs differ across individuals, and with what implications for the kinds of global health policies they support? Moral foundations theory is a framework that analyzes the essential values at the heart of individuals’ complex moral worlds. The theory is grounded in five key “moral foundations” of care/harm, fairness/cheating, loyalty/betrayal, authority/subversion, and sanctity/degradation. The theory has been applied to various topics including liberalism and conservatism in the United States, vaccine hesitancy and attitudes towards refugees. However, it has yet to be applied extensively to global health actors to understand their deeper moral motivations. In this study, we will apply moral foundations theory to a contentious global health issue: how best to prevent death
among women from unsafe abortion. We will examine the moral beliefs among actors addressing this issue in organizations working (1) globally, such as the WHO and the Catholic Church; (2) nationally, in countries such as Nigeria and Brazil, and (3) locally, among service providers in these and other countries. Our goal is to begin to bring moral foundations theory into the sphere of global health to ascertain how useful it is at unearthing fundamental moral differences or similarities across a range of actors, on issues that may spark radically different policy beliefs.

**Undergraduate responsibilities or tasks:** Under the careful guidance of the research team, the undergraduates will be responsible for gathering and reviewing documents to put together reports on moral foundations theory and policy and provider approaches to prevention of death among women due to unsafe abortion. One undergraduate will primarily be responsible for a report on more liberal actors and the other for a report on more conservative actors, but the two will collaborate on both. They will be supervised by a third researcher currently embarking on preliminary research on these themes. Documents will include but not be limited to published scholarly articles, grey literature, media reports, and reports from international organizations, funders, NGOs and grassroots activists. The reports will include a historical narrative, a timeline of major developments, and a list of potential key individuals to interview in each of these areas as identified in the key documents collected.

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

**Positions available:** 2

**Work location:** Documents 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.

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

**Project:** This project will involve the characterization of exoplanets using the transit technique. Observational projects are available, working with data from the Hubble Space and soon-to-be launched James Webb Space Telescope (JWST). Overall goals include detecting atomic and molecular species in the atmospheres, and constraining the temperatures and abundances of the atmosphere. Preparatory projects will be part of the JWST Early Release Science Program for the JWST.

**Undergraduate responsibilities or tasks:** The responsibilities will include tasks such as working with time series CCD data to extract exoplanet spectra, and/or using radiative transfer models to optimize spectral retrieval on planetary transmission or emission spectra.

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

**Positions available:** 2

**Work location:** Homewood campus, Bloomberg Physics Building or Olin Hall

**Sabine Stanley:** Morton K. Blaustein Chair, Earth & Planetary Sciences, KSAS

**Project:** Project 1: Investigations of Saturn's dynamo: Saturn has a unique global magnetic field that results from interesting behavior in the planet’s deep interior. Planetary magnetic fields are generated in their interiors through vigorous motions of electrically conducting fluids, a process called dynamo action. We can simulate these processes with computer models of the relevant physics. Previous dynamo simulations done by our group found that certain thermal perturbations at the top of the dynamo region are capable of reproducing a Saturn-like magnetic field, but the cause of these thermal perturbations is unclear.

Project 2: This project aims to characterize external magnetic fields in Earth’s magnetosphere of unclear origin which have been found to interfere with vital observations of Earth’s internal geomagnetic field that we depend on for navigation and space hazard mitigation. To this end, state of the art, 3D physics based magnetospheric models will be used in conjunction with solar wind data to 1) detect the external field in the simulation, and 2) identify the source and dynamics that govern the field. The undergraduate researcher will work in close collaboration with and assist the graduate student leading the project and postdocs and scientists in the group and at JHU APL.

**Undergraduate responsibilities or tasks:** Project 1: In this project, the undergraduate researcher will learn about planetary interiors and dynamo theory, and investigate the thermal evolution of Saturn’s deep atmosphere, in collaboration with a postdoc from the group. The goal is to investigate possible causes for the thermal perturbations
embedded in Saturn’s deep atmosphere. Project 2: Specific responsibilities will include tasks such as running the simulations based on inputs from various datasets, visualizing the results of the simulation, writing short bits of code to obtain specific results from the simulation, and constructing and analyzing time series datasets. There will also be an opportunity to explore the undergraduate researcher’s own interest within the scope of the project and hone science communication skills along the way.

**Preferred (or required) skills and/or experience:** Interest in Earth and planetary science accompanied with a desire to learn and proactiveness. A familiarity with programming languages and data science will be very helpful.

**Positions available:** 2

**Work location:** Virtual and/or Homewood Campus, Olin Hall.

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**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 of model eukaryotic organisms. Students will learn and apply 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 gene expression.

**Undergraduate responsibilities or tasks:** Students will join ongoing projects on live-cell imaging of chromatin and transcription proteins, working under mentorship of senior graduate students or postdoctoral fellows. Responsibilities include practical 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