EXROP
HOWARD HUGHES MEDICAL INSTITUTE

MBL
Biological Discovery in Woods Hole

EXceptional Research Opportunities Program Alumni visit to the Marine Biological Labs at Woods Hole | July 19-22, 2015

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Undergraduate and Graduate Programs
Science Education
4000 Jones Bridge Road
Chevy Chase, MD 20815
www.hhmi.org/exrop

HHMI EXROP Alumni Event

Jully 19-22 2015

Sunday, July 19

3:00p	Depart Boston area for Woods Hole
6:00p	Arrive at Woods Hole from Boston area
Evening	Dinner with MBL Course Directors and Education representatives

Monday, July 20

8:00a	Breakfast with MBL course partner
Morning	Attend courses lectures with MBL course partner
12:00p	Lunch with Course Directors/course faculty
Afternoon	Attend course laboratory with course partner
6:00p	Dinner with MBL course partner, other students and course faculty
Evening	Attend course laboratory with course partner

Tuesday, July 21

8:00a	Breakfast with MBL course partner
Morning	Attend courses lectures with MBL course partner
12:00p	Lunch with Whitman Center Investigators
Afternoon	Visit the Grass Laboratory and HHMI Laboratory
6:00p	Dinner with MBL course partner, other students and course faculty
Evening	Attend course laboratory with course partner

Wednesday, July 22

8:00a	Breakfast, exit meeting with Education Office representatives
Anytime	EXROP Alumni can visit Martha's Vineyard, attend courses/labs, or depart Woods Hole for Boston

MBL Course: Biology of Parasitology

Taylor Brown
University of California, Los Angeles
2014 EXROP Student

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My name is Taylor Brown, and I have recently graduated from UCLA with my Bachelors of Science in microbiology, immunology, and molecular genetics with a minor in biomedical research. I will begin my PhD in the biosciences (molecular biology) program at UCLA this fall, in the immunity, microbes, and molecular pathogenesis focus area. My undergraduate research mentors include Dr. Heather R. Christofk (in the Department of Molecular and Medical Pharmacology at UCLA) and Dr. Tyler Jacks (in the Biology Department at the Koch Institute at MIT; he was my HHMI EXROP summer mentor). In the lab of Dr. Christofk, I was studying a protein found in humans and the herpesvirus, and how an amino acid difference between the two versions of the protein could potentially alter its enzymatic activity, enhance viral replication, and change the metabolism of the host cell. In the lab of Dr. Tyler Jacks, I was studying how CRISPR mutations in circadian rhythm proteins effected the growth and transformation of lung adenocarcinoma. I have a molecular biology research background, but I am interested in learning more about the immune system and how cancer, parasites, and bacteria evade our immune system. I took my first immunology and bacterial infection class this year, and loved both of them. I would like to learn more about host pathogen interactions, particularly bacterial and parasite infections and how our immune system fights, or fails to fight, these infections. Although I have been actively searching for cancer immunology related grad school rotations at UCLA (and will be rotating in at least one cancer immunology lab during my first year in grad school), I believe the Biology of Parasitology or Microbial Diversity courses that the MBL has to offer will help me focus more on what host-pathogen interactions I am particularly interested in, and will help me decide where I should spend my last two rotations. I am also excited to see firsthand how a parasitology and microbiology laboratory differ from the molecular biology and cancer biology labs that I am used to working in.

MBL Course: Biology of Parasitology

Maureen Carey
University of Virginia
2013 EXROP Student

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My name is Maureen Carey, and I am rising second year graduate student at the University of Virginia. I graduated from Lafayette College in May 2014 with a BS in biology, and then joined the Microbiology, Immunology, and Cancer Biology Department at here at UVa.

During my EXROP summer, I went to the University of Texas at Austin to study evolutionary parasitology in Dr. Daniel Bolnick's lab. At Austin, I had my first forée into bioinformatics research and characterized the immune gene, Bcl6, in two recently-diverged threespine-stickleback populations. Dr. Bolnick's lab found this gene to be highly correlated with the differential infection by cestode tapeworms in these fish populations; my analysis found the gene did indeed undergo divergence. I then completed my honors thesis at Lafayette College studying transcriptional changes in Borrelia burgdorferi-infected (Lyme disease) mouse heart and brain tissue via RNA-seq with Dr. Eric Ho. As Dr. Ho's first student, I had the exciting opportunity to create datasets for the lab and his future students, to see the project from beginning (mouse infections) to end (presentation of the bioinformatics analysis), and to elucidate the sources and effects of inflammation in this Lyme disease model.

These experiences led me to join the labs of Drs. Jason Papin and Jennifer Guler here at UVa. I now study the metabolic perturbations induced by drug resistance in Plasmodium falciparum. Using metabolomics and metabolic modeling, I aim to investigate the parasite's metabolic network to identify functional cellular changes in resistant clones to better understand, prevent, and treat anti-malarial resistance. I am currently doing computational work, so I am very excited to have this opportunity to shadow a student in the Biology of Parasitology course, to learn about wet-lab techniques applicable to my project, and to better understand the shared characteristics of apicomplexans. Additionally, I am in one of only two parasitology labs at UVa, so I am excited to meet other researchers with similar interests and complementary skills to mine.

MBL Course: Microbial Diversity

Karina Perlaza
University of California, San Francisco
2013 EXROP Student

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My name is Karina Perlaza and I'm currently transitioning from a first-year grad student to a second year. I recently chose the Peter Walter lab for my theses work. As for my project, I'm currently in the process of determining what branch of the UPR captivates me the most so hopefully by the time I'm at MBL, I'll have a more focused direction.

I earned my Bachelors of Arts degree in biology at Hunter College in NYC. Here, I worked under the mentorship of Thomas Schmidt-Glenewinkel where I investigated the relationship between impaired energy metabolism and protein aggregation in Alzheimer disease. In my junior year of college, I was accepted into the HHMI EXROP program where I spent a summer in the Peter Walter lab. In the Walter Lab I studied a branch of protein localization known as the co- translational protein targeting pathway. I investigated the dynamics of membrane association by FtsY, a bacterial SRP receptor, by developing a size-exclusion chromatography-based binding assay with FtsY and nanodiscs. The next year, I seized the opportunity to come back to the Walter lab via the HHMI Capstone Program. Here, I continued to investigate the same pathway, but more specifically, I probed the contribution of each domain of FtsY in recognizing both naked nanodiscs and nanodiscs with its respective translocon embedded.

Entering graduate school, I didn't know what to expect. I was pleasantly surprised to learn that it had everything to do with exploring new science fields and questions. During my first year, I took a course called Classical Papers in biology led by Bruce Alberts and Cynthia Kenyon. They challenged us to think about crazy yet tangible ideas that have yet to be tackled in science. Our group proposed experiments to understand the mechanism by which a particular fungus targets jungle ants. One of the major difficulties was the fact that this fungus has not yet been cultivated and manipulated genetically. Although the proposal was hypothetical, it would be great to understand how one can approach this problem. Thus, I am specifically interested in microbial diversity due to idea of using bioinformatics to study not-yet-cultivated microbes.

MBL Course: Microbial Diversity

Daisha Steadman
Georgia State University
2008 EXROP Student

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My name is Daisha Steadman-Crawford. I obtained my BS in biology from Georgia State University, my MS in science education from H. Lehman College and I am first year graduate student enrolled in a dual program to obtain a MS in biology (concentration: molecular genetics & microbiology) and a PhD in science education at Georgia State University. As an undergraduate student I conducted research on the swarming motility of the opportunistic pathoghen *Pseudomonas aeruginosa* in Dr. Chung Dar Lu's lab. As a previous HHMI Summer EXROP student at Albert Einstein Yeshiva University I had the profound opportunity while interning in Dr. William R. Jacob's lab to study pyrazinamide activity against *M. smegmatis* to determine its potential antibacterial mechanism of action against *M. tuberculosis*. As a current graduate student I am interested in continuing research on opportunistic pathogens especially those that have developed antibiotic resistance mechanisms. During my visit to the Marine Biology Laboratory (MBL) I hope to learn about the latest research techniques performed and topics being taught on microorganisms especially those that my produce natural antibiotics that may be used in the future to combat the growing biological challenge of treating individuals with bacterial infections that have developed strong resistance to the current antibiotics that are commonly used by medical health professionals.

MBL Course: Neural Systems & Behavior

Javier How
University of California, San Diego
2013 EXROP Student

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As an undergraduate at Florida International University, I majored in biology and worked in the lab of Alexander Agoulnik. In my time there I was able to co-author a publication on the fate of spermatogonial stem cells in cryptorchid mice. I also worked on *in vivo* assays for an agonist of relaxin, a peptide hormone that is involved in diverse physiological aspects such as birth and fibrosis. During my HHMI EXROP experience I worked with Michael Shadlen at Columbia University, where I attempted to find optimal parameters (namely, Δx and Δy) for a random dot kinematogram, with the side goal of attempting to verify aspects of the Motion Energy model that pertained to such parameters. I then spent the following summer at UCSF in the lab of Matthew Jacobson, where I attempted to identify potentially novel substrates for a family of proteins unique to microbes (ie TRAP proteins).

I will now head to UCSD's graduate program in neurosciences, with a broadly-defined interest in how collections of neurons in different areas of the brain communicate with each other as they process information. This communication can be described as sets of computations, and it eventually informs behavior. However, one has many choices available when deciding on model organisms or methodology. Vision, for instance, has been well studied in many different species, and the literature reflects conserved computational mechanisms. The Neural Systems & Behavior course would be very useful because in it one uses different model organisms and techniques, and studies different aspects of perception and behavior. This course reflects the approach I would like to take in my research projects - the combination of molecular- and systems-level information. As I decide in which labs I will do my rotations, this visit will provide valuable insight into some options in terms of species and methodology. Furthermore, it will make me aware of what MBL has to offer for whichever projects I pursue later on.

MBL Course: Neural Systems & Behavior

Elelbin Ortiz
University of Pennsylvania
2013 EXROP Student

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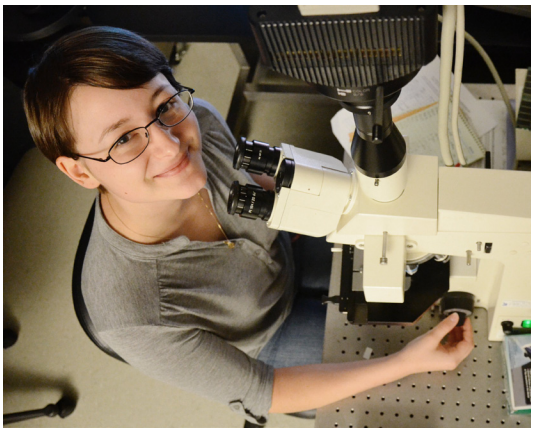
My name is Elelbin Amanda Ortiz and I recently graduated from the University of Maryland, Baltimore County (UMBC) with a BS in biochemistry and molecular biology. This upcoming fall, I will attend the University of Pennsylvania as I pursue a PhD in neuroscience.

During my four years as an undergraduate, I worked in the laboratory of Dr. Phyllis Robinson characterizing the visual systems of several organisms, including the endangered species, the whooping crane. The summer of my sophomore year, I had the opportunity to work in the laboratory of Dr. Robert Sah at the University of California, San Diego through the EXROP program. During this summer, I determined how biochemical fluctuations of synovial fluid after injury can affect lubrication properties and potentially lead to osteoarthritis. Returning to the Robinson lab after this summer, I began studying melanopsin, a visual pigment involved in many functions such as the pupillary light reflex and the photoentrainment of the circadian rhythms. My thesis project involved studying the role of the melanopsin carboxyl-tail in deactivation, adaptation, and trafficking.

Through these research experiences, I have learned how vital resilience, inquisitiveness, and collaboration is to the scientific process. Currently, I have a strong background in biochemical approaches and techniques. As I prepare to begin my PhD I am interested in gaining more experience, especially with neural circuits. I am excited to participate in the Neural Systems and Behavior class and learn of the resources that this class offers graduate students over the summer.

MBL Course: Neural Systems & Behavior



Rebecca Senft
Harvard University
2014 EXROP Student

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Rebecca is currently entering her first year of graduate school at Harvard University, where she will study neuroscience and begin rotations in the fall. She recently earned her Bachelors of Arts degree at Swarthmore College and completed her honors thesis there under the mentorship of Alexander Baugh. This work explored the links between stress physiology and glucocorticoid receptor expression iin the brains of wild-caught great tits (*Parus major*).

In the summer of 2014, Rebecca was an EXROP student studying at Duke University under the guidance of Erich Jarvis. Here, she studied the neurogenetic basis of vocal learning and in particular, the role of an axon guidance molecule, *slit1* in the evolution of vocal learning. This project focused on *in vitro* validation of plasmids designed to modify *slit1* levels. These plasmids were made into lentiviruses in order to modulate *slit1* levels *in vivo* to test the hypothesis that low levels of *slit1* in motor output regions are necessary to form a monosynaptic projection seen only in vocal learners.

Both of these research experiences greatly strengthened her interest in pursuing a career in understanding the molecular basis of behavior. Both projects have also illuminated the importance of examining individual differences in neuroscience experiments. She hopes to learn more about the MBL course in neural systems and behavior in order to become exposed to a wider variety of lab techniques and learn more about merging quantitative methods with work on neural systems.

MBL Course: Neurobiology

Christine Liu
University of California, Berkeley
2013 EXROP Student

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My name is Christine Liu and this fall I will be a second year graduate student in the Helen Wills Neuroscience Institute at UC Berkeley. I graduated from the University of Oregon with a double major in biology and psychology because there was no independent neuroscience major. Eager to study neuroscience, I sought research experience in my first year at Oregon. I worked in Dr. Michael Wehr's lab studying the circuitry in rodent auditory cortex for the next several years. HHMI-EXROP gave me the opportunity to branch out into a different field by working in the lab of Dr. Matthew Scott. I conducted a genetic screen with *Drosophila melanogaster* to study Niemann Pick Type C disease. This immersive experience confirmed my interest in basic research and gave me the resources and support I needed to pursue graduate school.

Now, I am seeking to understand the circuitry underling nicotine addiction Dr. Stephan Lammel's lab. We use optogenetic tools to specifically target certain projections in the mesolimbic reward pathway. Currently, I am conducting slice electrophysiology experiments but I would like to incorporate behavior into my studies. However, nicotine self-administration is known to be difficult to induce in mice. My interest in attending the MBL-HHMI EXROP event stems from the desire to gain tools and advice to continuously improve as a researcher. Learning more fundamental information about neurobiology and neuroscience will benefit my understanding of the midbrain, a personal frontier in my research. The course itself can introduce me to new techniques, new perspectives on old knowledge, and fill gaps in knowledge I may have from my undergraduate education in biology and psychology, but not neuroscience directly. The environment at MBL will allow me to discuss and develop my research ideas with scientists I normally would not have the opportunity to converse with, ultimately improving my research by gaining input from people outside of my lab and field. All in all, I am looking forward to how this experience can help me improve and grow as a researcher!

MBL Course: Neurobiology

Krissy Lyon
Harvard University
2011 EXROP Student

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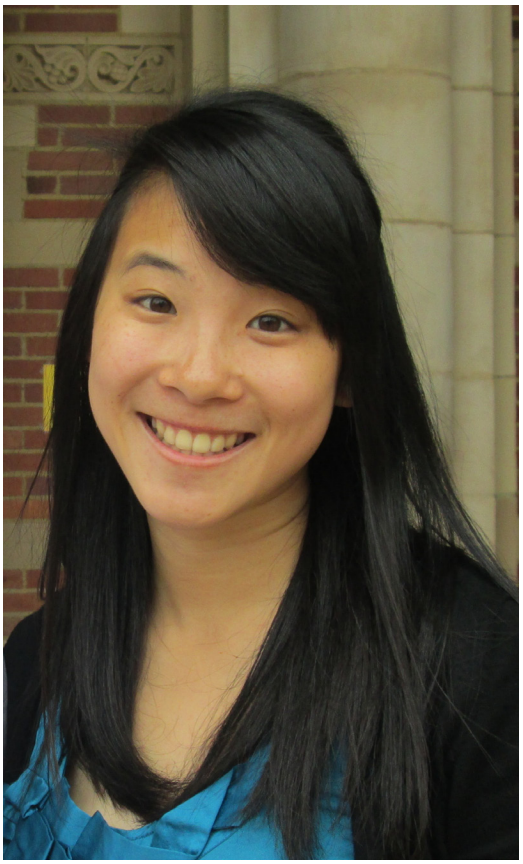
My name is Krissy Lyon and I'm finishing my first year of graduate school in the program in neuroscience at Harvard University. I earned a BA in biology from Lewis & Clark College in Portland, Oregon. At Lewis & Clark, I had the opportunity to study the role of the hypothalamic-pituitary-adrenocortical axis in impulsivity behavior through the John S. Rogers Science Research Project. Additionally, I worked in a developmental neuroscience lab under the mentorship of Tamily Weissman-Unni.

My EXROP experience allowed me to conduct research in the lab of David Ginty at Johns Hopkins University. In this lab, I was able to delve into the cellular and molecular mechanisms behind the development and function of the peripheral nervous system. My project aimed to identify novel genes involved in axon guidance. Ultimately, we found that the extracellular matrix protein dystroglycan binds the axon guidance cue Slit to regulate its distribution during development indicating a novel role for dystroglycan in axon guidance. Through the HHMI Capstone Award, I was able to return to the Ginty lab for an additional summer where I worked to understand the subsets of interneurons that receive inputs from low-threshold mechanoreceptors, which are responsible for conveying light touch sensation.

Following a year of rotations, I have joined Susan Dymecki's lab where I will study the serotonergic system of the brain stem with the goal of understanding how distinct subtypes of serotonergic neurons contribute to distinct functions such as depression, aggression and respiration. With this goal in mind, I am excited to attend a portion of the Neurobiology course and learn more about MBL. Techniques such as microscopy, electrophysiology, and data analysis will be integral to my graduate work.

MBL Course: Physiology



Vivian Chen
Stanford University
2012 EXROP Student

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My name is Vivian Chen and I was a 2012 EXROP Student and 2013 Capstone Fellow in the lab of Peter Walter at the University of California, San Francisco (UCSF). In June of 2013, I earned a Bachelor of Science in molecular cell and developmental biology from University of California, Los Angeles (UCLA). In the fall, I will be starting my second year of graduate school in the Department of Biology at Stanford University.

At UCLA, I was first introduced to research when I entered UCLA's Undergraduate Research Consortium in Functional Genomics taught by HHMI professor, Utpal Banerjee. There I learned the fundamentals of research while participating in a genetic screen investigating blood cell development in fruit flies. I then joined the Banerjee lab as an undergraduate research student, where I learned that research is a process which includes both success and rewards as well as troubleshooting, mistakes, and constant learning. I studied the blood cell response to sterile mechanical injury in *Drosophila melanogaster*. Through the HHMI, I also had the honor of working with Peter Walter where I studied a cellular stress response to the accumulation of misfolded proteins in Saccharomyces cerevisiae called the selective autophagy of endoplasmic reticulum (ER-Phagy). In the Walter lab, I learned how to ask focused questions, design effective experiments, and incorporate high quality controls.

Now at Stanford, I decided to join the lab of Martin Jonikas at the Department of Plant Biology Carnegie Institution of Science. In the Jonikas lab, I am studying a special type of photosynthesis organized by a non-membrane bound organelle called the pyrenoid observed in *Chlamydomonas reinhardtii* and many other algae. This research will provide insight into the inefficiency of carbon fixation in land crops. Through the Physiology class at Woods Hole, I hope to gain some exposure to new techniques and tools that will help to visualize the unique cellular landscape required for this photosynthetic system.

MBL Course: Physiology

Kendall Condon
Massachusetts Institute of Technology
2014 EXROP Student

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My name is Kendall Condon, and I'll be starting my PhD at MIT this fall in the Biology department. I received my BA in molecular and cell biology from the University of California, Berkeley.

My interest in research began as a high school student doing organic chemistry in Dr. Joseph Noel's lab at the Salk Institute for Biological Studies. It was here that I learned there is far more to science than the pages in a textbook and that I wanted to be one of the scientists slowing solving part of the puzzle.

At Berkeley, I was excited to continue doing research and joined Jennifer Doudna's laboratory in the spring of my freshman year. Here I had the privilege to study the DEAD-box protein family through many diverse techniques, including crystallography, classical biochemistry and yeast genetics. Then as an EXROP student I was able to spend the summer in Joachim Frank's laboratory at Columbia University using Cryo-Electron Microscopy to study Ryanodine receptors. Through this experience I realized I enjoyed many aspects of the computational biology field. I followed up on this interest by taking a python class during my senior year and incorporating Next Generation Sequences techniques into my senior thesis on DEAD-box proteins.

Currently, with the generous EXROP Capstone award, I am spending a second summer in Joachim Frank's laboratory learning more about Ryanodine receptors. I chose to attend the Physiology: Modern Cell Biology Using Microscopic, Biochemical, and Computational Approaches class this summer, because I intend to continue working on the interface between classical molecular biology techniques and novel computational analysis. It will also be a great opportunity to solidify my understanding of computational biology in action.

MBL Course: Physiology

Juan Pablo Ruiz
National Institutes of Health/ University of Oxford
2013 EXROP Student

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Juan Pablo Ruiz is a first-year NIH/Oxford DPhil candidate in biomedical sciences. Juan Pablo started doing research as a freshman at the University of Miami (UM), where he received his BS in biomedical engineering with a second major in English (creative writing concentration). He fell in love with the biology of stem cells during his time at UM, working in Dr. Herman Cheung's tissue engineering lab. There, he studied the effects of nicotine on the elasticity of mesenchymal stem cells (MSCs), and how these changes in elasticity led to differences in the cells' ability to differentiate into tissues of interest, mainly cartilage and bone. As an engineer, he is fascinated by the concept of using the combination of stem cells, bioreactors, and scaffolds as systems to model and engineer tissue *in-vitro*. As a senior in Dr. Cheung's lab, he designed a bioreactor to couple electrical and mechanical stimulus to MSCs in an attempt to differentiate them into beating cardiomyocytes for cardiac regeneration following myocardial infarction.

As an EXROP and Capstone recipient, Juan Pablo got the chance to work at the Harvard Stem Cell Institute in Dr. Jeffrey Karp's tissue engineering lab for two summers. There, he modified the membranes of MSCs in different ways to increase their homing to target tissues and avoid entrapment in other areas after intravenous infusion. After graduation, Juan Pablo travelled to Tanzania on a Fulbright scholarship to study the prevalence of trypanosome infection in cattle populations of the Ngorongoro Crater Conservation Area. Currently, he is a first-year NIH/Oxford student working on his DPhil. His work spans three labs, those of Dr. Catherine Porcher and Dr. Roger Patient at Oxford, and that of Dr. Andre Larochelle at the NIH. The interest of these three labs is in better understanding hematopoietic stem cell (HSC) biology in order to differentiate and culture them *in-vitro* for therapeutic purposes. Juan Pablo plans to study the developmental processes which give rise to HSCs at Oxford in an effort to translate those processes to in-vitro culture protocols that can then be better explored at the NIH for HSC differentiation. He hopes that the physiology course at Woods Hole can give him a better understanding of microscopy (and other) techniques, so that he can better explore HSC biology in his PhD research and beyond.

Christy Schultz

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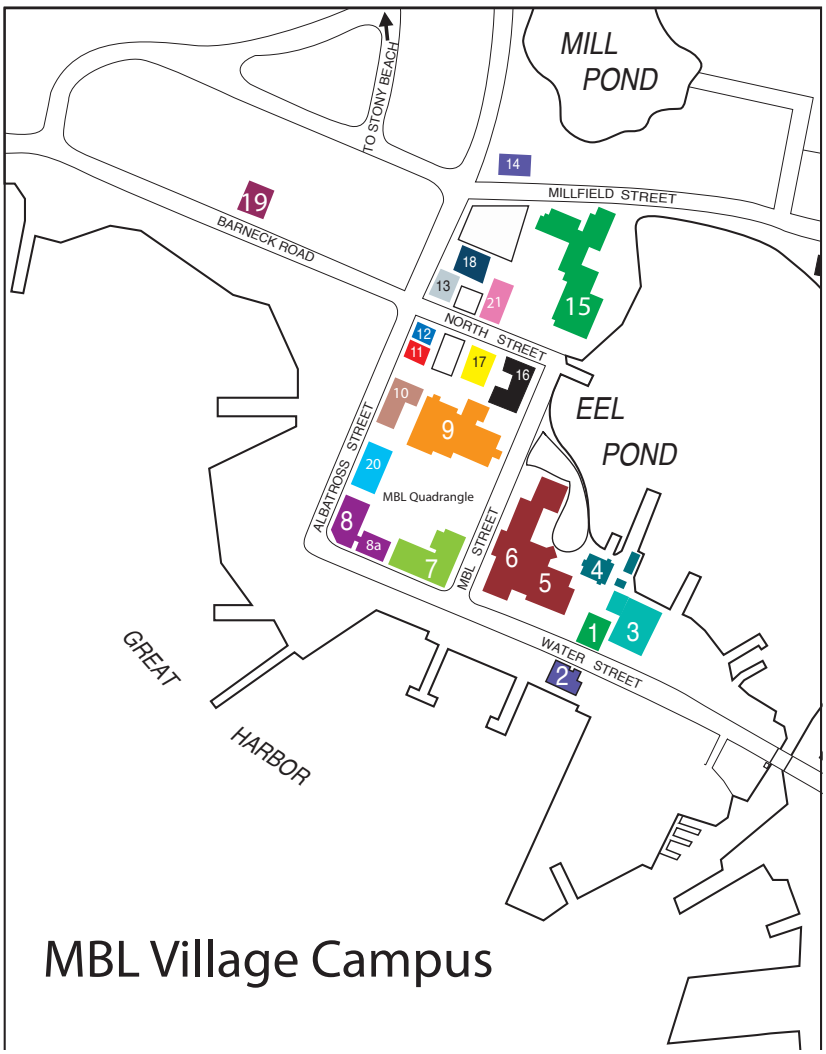
Christy joined the Howard Hughes Medical Institute (HHMI) in 2008. At HHMI, Christy serves as a Program and Special Projects Coordinator responsible for leading the Exceptional Research Opportunities Program (EXROP), and EXROP Capstone program, science education fellowship initiatives focused on providing select undergraduate students from disadvantaged backgrounds and groups underrepresented in the sciences with outstanding summer research experiences.

In addition to her role within the Undergraduate and Graduate Programs group Christy contributed to the successful launch of the Institute's volunteer initiative with the goal of providing volunteer opportunities for ~300 potential employees across 11 departments to help our neighbors in need.

Prior to joining HHMI, Christy worked at The Healthwell Foundation as a Program Associate (2008) and Program Specialist (2006-2008). During her time at the Foundation Christy was responsible for overseeing many aspects of program and grants management to provide financial assistance to under-insured patients living with chornic and life-altering illnesses - helping them afford their medical treatments.

Christy has a BA in art history from Hood College and will begin a Masters in business adminstration from the University of Maryland in fall 2015.

Event attendees will be staying at the SleepyHollow Motor Inn located at
527 Woods Hole Road, Woods Hole, MA 02543
(508-548-1986)
http://www.shmotel.com/



1 Candle House (Administration)
2 100 Water Street (Pierce Exhibit Center, Satellite Club, MBL Club)
3 Marine Resources Center
4 Collection Support Facility
5 Crane Wing (Labs, Shipping)
6 Lillie Laboratory (Labs, Service Shops, MBLWHOI Library)
7 Rowe Laboratory (Labs, Speck Auditorium)
8 Environmental Sciences Laboratory
8a Homestead Administration (Human Resources, Education Dept.)
9 Loeb Laboratory (Research and Teaching Labs, Lecture Rooms)
10 Brick Apartment House
11 Veeder House Dormitory
12 David House Dormitory
13 Broderick House (IT)
14 Crane House
15 Swope Center (Registration, Cafeteria, Dormitory, Meigs Room)
16 Ebert Hall Dormitory
17 Drew House Dormitory
18 15 North Street (Carpentry Shop)
19 Smith Cottage and Barneck Road Property
20 C.V. Starr Environmental Sciences Laboratory
21 11 North Street
MBL Parking