

HWS Student Summer Research 2009

Eight Week Research Internships with HWS Faculty are open to HWS students in a number of fields.*

*(*Typical duration; may vary by project)*

Internships generally include a stipend of \$420/wk plus room.

Applicants should first speak to the faculty sponsor for the project and then obtain & submit an application to the Provost's Office, Coxe Hall, 2nd floor.

Deadline for applications is 5:00 pm, Monday, February 23, 2009.

(Forms available at http://www.hws.edu/academics/pdf/undergrad_research_app.pdf.)

All positions are tentative and subject to final funding and approval from the faculty and the Provost's Office.

Biology/Env. Studies/ Geoscience (Joint Project)

Sedimentation and Invasive Species Establishment in Seneca Lake, NY

Faculty Contacts: Professor Meghan Brown, Biology Department (mbrown@hws.edu) and Professor Tara Curtin, LAN 110, Geoscience Department (curtin@hws.edu)

Students will work on Seneca Lake to investigate sedimentation processes and the distribution of the resting stages of invasive zooplankton on a seasonal basis. The project involves a significant amount of field work on the William Scandling using state-of-the-art equipment, and equally demanding time in the laboratory processing samples. This position involves study from both a geoscience and biological science perspective. This project will be conducted by Prof. Meghan Brown and Prof. Tara Curtin in conjunction with students in the Biology Department.

Requirements: Strong background in geoscience, limnology, biology, and/or field research. Preferred experience with sediment collection and processing and/or with plankton sampling and identification.

Length and start date: 8 weeks; starting date negotiable.

Biology/Environmental Science

Oneida Lake: Ecological impacts and management of invasive European frogbit

Faculty Contact: Professor Meghan Brown, Biology Department (mbrown@hws.edu)

Student will work on Oneida Lake to investigate effects and controls of an invasive aquatic plant. The project involves a significant amount of field work collecting samples and equally demanding time in the laboratory processing samples.

Requirements: Strong background in biological science, limnology, and/or field biology. Preferred experience with plankton sampling and identification.

Length and start date: 8 weeks starting in late June.

Biology/Environmental Studies

Audubon's Seabird Restoration Student Intern Program.

Faculty contact: Professor Mark Deutschlander, Biology Department

Hobart and William Smith students have the unique opportunity to participate in the internationally-known Audubon Seabird Restoration Program (a.k.a. "Project Puffin"). This internship is a paid position directly through the Audubon Society (final selection of an intern will be made by Audubon biologist Stephen Kress). Students will participate in behavioral studies and monitoring breeding colonies of seabirds such as puffins and terns. This project requires tent camping on small isolated islands off the coast of Maine for the summer. Students must be in good health, good shape, willing to "rough it", and prepared to live on a small island with one or a few other individuals for the summer. Interns will begin June 1 and end August 14. The position includes a stipend of \$200/week, room and board, and transportation to the islands. For more information about the program, visit www.projectpuffin.org. Interested students should contact Prof. Deutschlander for more information before applying. THIS INTERNSHIP IS AVAILABLE TO GRADUATING SENIORS AS WELL AS OTHER STUDENTS.

Biology/ NYS Agricultural Experiment Station

Applied and Basic Biology at the NYS Agricultural Experiment Station

Faculty Contact: Professor Tom Glover, Biology Department

These projects may include work in

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| Plant and insect genetics | Horticultural science |
| Bioinformatics | Plant pathology / microbiology |
| Genomics | Applied ecology / integrated pest management |
| Insect behavior and phenology | Toxicology |
| Food science | |

We anticipate 4 to 6 internships this summer and will place students according to their general interests and academic backgrounds. Projects will be completed in the laboratories and field plots of the world-renowned NYS Agricultural Experiment Station and students will live on the HWSC campus.

Chemistry

Rates and Mechanism of Indium Mediated Allylation

Faculty Contact: Professor Walter Bowyer, Department of Chemistry (bowyer@hws.edu)

Reactions at metal surfaces are important in many areas of chemistry, but tools to study them are relatively limited. We study reactions of organobromides at indium surfaces using photomicroscopy and NMR spectrometry in order to measure the rate and determine the mechanism of the reaction.

Requirements: Student researchers must have taken Chem 110 and 240. They must be enthusiastic about chemistry, working hard, and learning new skills.

Solid-Phase Synthesis of Cysteine-Containing Potential Anticancer Compounds

Faculty Contact: Professor Justin S. Miller, Department of Chemistry (jsmiller@hws.edu)

Students will synthesize potential anticancer chemotherapeutics using new synthetic methodology that has been developed in the Miller laboratory. The new methodology is based on solid-phase resins capable of supporting the synthesis of peptidic molecules containing at least one cysteine residue. Along with the synthesis of potential anticancer agents, these resins will find a range of applications involving efficient synthetic routes towards other valuable, biologically relevant targets and their analogs.

Requirements: Open to first-, second-, and third-years with at least one year of chemistry by Summer 2009.

Developing New Synthetic Methods in Heterocyclic Chemistry

Faculty Sponsor: Professor Erin Pelkey, Department of Chemistry (pelkey@hws.edu)

The objective of this research is to design and develop new synthetic methods that can be utilized in the preparation of nitrogen heterocycles with demonstrated biological activity (anti-inflammatory, anti-cancer, anti-HIV, etc). The utility of these methods will be evaluated through their application to the synthesis of staurosporinone, heterocyclic analogs of staurosporinone, 3-pyrrolin-2-one analogs of Vioxx, and the aristolactam alkaloids. Staurosporinone is a potent inhibitor of protein kinase C (potential anti-cancer agent) and an important building block used in the synthesis of the indolocarbazole alkaloids. The aristolactam alkaloids also possess promising anti-cancer activity with one possible mode of action involving the intercalation of DNA.

Requirements: Open to first-, second-, and third-years with at least one year of chemistry by Summer, 2009. (Tentative dates are May 26 – July 17.)

Determination of Aggregation Phase Diagram for Amyloid-like Peptides via Computer Simulation

Faculty Contact: Professor Alan van Giessen, Department of Chemistry (vangiessen@hws.edu).

Research in the van Giessen group focuses on the understanding of the formation and behavior of protein aggregates that play a crucial role in neurodegenerative diseases such as Alzheimer's Disease (AD). Students will use Molecular Dynamics simulations of a coarse-grained peptide model to determine the concentration-temperature phase diagram of Amyloid-like peptides. The goal is to determine under what conditions the peptides form stable, β -sheet aggregates similar to those seen in patients suffering from AD. In the process, students will help to determine the pathway or pathways by which the aggregates form and identify the dominant forces during the aggregation.

Requirements: Open to all first-, second-, and third-year students with at least one semester of chemistry by summer, 2009. Familiarity with programming in C is preferred.

Environmental Studies

Finger Lake Water Quality & Watershed Hydrogeochemical Interactions

Faculty Contact: Professor John Halfman, LAN 112, Environmental Studies Program (halfman@hws.edu)

Students will work on environmental/hydrogeochemical/water quality problems associated primarily with Seneca Lake and its watershed, but the investigations also include additional Finger Lakes. The project involves a significant amount of field and laboratory work, at times under stressful conditions, and is in cooperation with Seneca Lake Pure Waters Association, the Finger Lakes Institute, and other watershed protection agencies.

Requirements: Strong background in geoscience/environmental science and desire to work outside in wet environments.

China Water Resources (Interdisciplinary)

Faculty contact: Professor Darrin Magee, Environmental Studies Program

The research assistant will work with Professor Magee in Geneva to conduct research on water resources in China, including the South-North Water Transfer Project, hydropower, and contemporary water quality issues. The RA will work with Professor Magee to understand as best as possible the socioeconomic, biophysical, and geopolitical implications of large-scale water engineering projects. This research assistantship is best suited to a student with a solid grounding in environmental studies and an interest in Asia.

Requirements: Solid library (esp. use of journal databases) and web research skills; ability to work independently and think creatively; ability to organize, summarize, and evaluate information from different sources; ability to read Chinese highly desirable

Water Resources Research Assistant (Interdisciplinary)

Faculty contact: Professor Darrin Magee, Environmental Studies Program

The research assistant will work in Geneva with Professor Magee and Professor Kinne, who are writing an interdisciplinary textbook on water. The primary responsibility of the RA will be to conduct interdisciplinary research on water resources, summarizing, organizing, and analyzing the information in a manner useful to the writing of the textbook. This research assistantship is best suited to a student with a solid grounding in environmental studies and an interest in thinking about why water matters from a variety of perspectives.

Requirements: Solid library (esp. use of journal databases) and web research skills; ability to work independently and think creatively; ability to organize, summarize, and evaluate information from different sources.

The Finger Lakes Institute

Environmental Education

FLI Contact: Marion Balyszak, Director balyszak@hws.edu.

The student will assist the Finger Lakes Institute's Education Outreach Coordinator with the coordination of teacher professional development workshops about the environment and geology of the Finger Lakes region. In addition, the student will assist with the development of activities and lessons for middle school youth participating in summer science camp programs on campus.

This is a ten-week position from June 1- August 7, 2009

Requirements: Background knowledge on environmental education and sciences and/or geosciences is preferred.

Ecological impacts and management of invasive European frogbit

FLI Contact: Marion Balyszak, Director balyszak@hws.edu.

The student will work with the Finger Lakes Institute's Research Scientist, Dr. Bin Zhu to conduct research on effects and controls of an invasive aquatic plant - European frogbit. The project involves a significant amount of field and laboratory work. This is a five-week position from July 6 - August 7, 2009.

Requirements: Strong interest in aquatic plants and invasive species, desire to work outside in wet environments, and swimming is a must.

Geoscience

Watkins Glen State Park Geology

Faculty Contact: Professor Nan Crystal Arens, LAN 111, Geoscience (arens@hws.edu)

Watkins Glen State Park preserves not only the scenic wonder of the falls, but the rich geologic history of the development and in-filling of the Acadian tectonic basin. Despite tremendous public interest in this highlight of Finger Lakes Geology, no detailed work on the sedimentology and depositional environments of the Watkins Glen section has yet been performed. This project will measure a detailed stratigraphic section of the Watkins Glen sediments to document changes in grain size, bed thickness, paleocurrent direction, palynoflora and fauna as the Acadian deltas migrate over this region. In addition to a scientific publication, this project will also produce a brochure for the public on the Park's geology.

Paleobotany of Utah's San Rafael Swell

Faculty Contact: Professor Nan Crystal Arens, LAN 111, Geoscience (arens@hws.edu)

Early Cretaceous sediments of Utah's San Rafael Swell have been extensively studied for the dinosaurs and other vertebrates they preserve. In contrast, little work has documented the climate and vegetation of this time and place. Aside from a few bits of fossil wood (conifers) and an unusual fern (*Tempskyia*), we know virtually nothing about the Early Cretaceous flora of the Western Interior. However, a chance discovery (by Profs. Arens and Kendrick) in 2005 of a rich deposit of angiosperm (flowering plant) leaf fossils offers great potential. The locality was recollected in 2007 and we now have approximately 300 specimens available for study. This project will prepare and curate the collection, develop hypotheses of taxonomic affinity, conduct a climate analysis and place the leaves in an ecophysiological and evolutionary context.

Paleobotany of "Salad Coulee" Stillwater County, Montana

Faculty Contact: Professor Nan Crystal Arens, LAN 111, Geoscience (arens@hws.edu)

This is the first summer of a three-year project to reconstruct the Cretaceous-age vegetation of an upland site in Central Montana. The overall goal will be to understand how species are distributed on the landscape and how this mosaic of vegetation changes through time as the latest Cretaceous climate warms in response to rising atmospheric pCO₂. During this first summer, we will work with a small collection made during 2008 to develop a field identification manual that will be used during 2010 to census the flora in the field. Students will work with the fossils and literature to identify and illustrate the forms we have collected so far, and begin a database into which our major collections will go.

Meteorological Research

Faculty Contact: Professor Neil Laird, LAN 107, Geoscience Department (laird@hws.edu)

Students will investigate several aspects of lake-effect snow storms over large and small lakes, such as Lake Tahoe, the Great Salt Lake, and the Great Lakes. Additional studies will include investigations of the development and evolution of thunderstorms in the Great Lakes region and the impact of lake breezes on near shore climates.

Requirements: Coursework in meteorology is essential. Prior experience with meteorological data, statistical methods and established computer skills are preferred. Should have excellent oral and written communication skills and be willing to work within a collaborative group setting and independently.

VORTEX2 (Verifications of the Origin of Rotation in Tornadoes Experiment-2) field project and radar data analysis.

Faculty contact: Professor Jeffrey Frame, Geoscience Department (frame@hws.edu)

The research project entails two parts, participation in the VORTEX2 field experiment and the analysis of separately collected, but related, radar data in a lab on campus. The student will join the faculty supervisor and the VORTEX2 field project on the Great Plains of the United States immediately after the conclusion of final exams at the end of the Spring Term, 2009. The student will play a yet-to-be-determined role in the project, although this role may include driving vehicles, operating observational equipment with the purpose of obtaining accurate scientific measurements, operating communications equipment, or documenting portions of the project. The field experiment has a scheduled end date of June 10, 2009.

The second portion of the project will begin after the field project has terminated and the student and faculty supervisor have had time to travel back to campus. During the second phase of the project, the student will determine good case studies of squall lines and other linear convective systems dissipating over the Appalachian Mountains of the Eastern United States. Analysis of these case studies will continue throughout the remainder of the project.

Requirements: A valid driver's license, good driving record, the ability to interact well with other people for an extended period of time, the ability and dietary flexibility to be on the road with limited

stops for 12+ hours in a day and to be living out of a suitcase for up to five weeks, and the ability to handle the pressure of being close to severe weather phenomena, likely including but not limited to intense thunderstorms, lightning, large hail, strong winds, and tornadoes are essential. Coursework in meteorology is also essential.

Mathematics and Computer Science

Making Sense of a Lake of Data

Faculty Contact: Professor Stina Bridgeman, Lansing 312, Mathematics / Computer Science Department (bridgeman@hws.edu)

The goal of this project is to develop a web-based interface for entering, editing, retrieving, visualizing, and exploring data gathered by a network of monitoring equipment to be deployed in Seneca Lake this spring. Depending on the student's skills and interest, the project can focus more on the data entry/editing/retrieval part of the interface or on the visualization/exploration part. The data will be used for scientific research at HWS and other institutions, and for many other purposes in the wider community - this is your chance to get in on the ground floor of creating a tool that will be used for years to come!

Requirements: Either solid SQL, database programming, and website programming skills (e.g. CPSC 343 and/or 271) or strong Java programming skills (e.g. CPSC 225) required. Good programming habits and some ability to debug code and figure out new things independently are also essential. Familiarity with Swing is a plus.

Studies in garbage collection (the computer science kind)

Faculty contact: Professor Marc Corliss, Mathematics and Computer Science Department

For languages with automatic memory deallocation (e.g., Java), one critical component of the compiler is the garbage collector. The garbage collector is responsible for automatically freeing areas of memory that were previously allocated but are no longer needed. While it is straightforward to build a simple garbage collector that works, it is much more challenging to build one that is also efficient (i.e., one that adds little to the overall running time of the program). In this project, the student will explore various approaches to high-performance garbage collection and look for ways to improve upon existing techniques. The student will apply and test their discoveries with an existing compiler for the Bantam Java language.

Requirements: The student must be a strong programmer and have taken CPSC 433 (Compilers).

Mathematics and Dengue Fever

Faculty contact: Professor Jonathan Forde, Mathematics and Computer Science Department

Dengue is a mosquito-borne virus affecting roughly 40 million people per year, with outbreaks occurring every 5-6 months. There are 4 different strains, and it is conjectured that infection with two of these strains in succession leads to the more dangerous form of Dengue, called Dengue Hemorrhagic Fever, which can be fatal. Simultaneously, infection with one strain leads to some immunity from the others. This raises many interesting questions about the interactions of the strains.

Two separate but very closely related programs will be underway, one focusing on the epidemic spread of the strains of Dengue in the human population, and another focusing on the interaction of the viral strains with the host's immune system. We will begin by gather information this disease from the scientific literature, and then use mathematical modeling, differential equations, computer simulation and any other convenient tools to understand this complex disease system.

Requirement: Completion of a course on differential equations (like Math 237).

Resolving Propagation Fronts Numerically

Faculty contact: Professor Jaime H. Barrera, Mathematics and Computer Science Department

Nuclear reactors encase their dangerous contents in steel-reinforced concrete that can become weakened due to erosion from moisture. A similar degradation occurs when other steel-reinforced structures naturally come into contact with moisture. This project is aimed at determining service life of such structures through the numerical solution of the nonlinear partial differential equations that govern it.

Requirements: The successful candidate must have a working knowledge of computer programming, calculus, and some knowledge of numerical computing.

Mathematics Education

Mathematical Pedagogy

Faculty Contact: Paul Kehle, Education Department, Merritt Hall 101, kehle@hws.edu

This is an applied research project focused on the development of mathematical pedagogy and resources for teachers working with at-risk students. The emphasis will be on the particular needs of high school and college students in their study of mathematics. Work will include intensive support of the HWS Higher Education Opportunity Program's Summer Institute mathematics course, study of mathematics education research literature and study of research on at-risk students.

Requirements: Student must be a current junior or senior pursuing a major in mathematics and enrolled in the Teacher Certification Program. An interest in urban education, fluency in Spanish, and experiences with students from under-represented groups are preferred.

Physics

Gravitational Physics

Faculty contact: Professor Steven Penn (penn@hws.edu)

Our research group is part of the LIGO Project (Laser Interferometer Gravitational Wave Observatory), which operates two observatories in the US and works closely with observatories in Europe. Our goal is to make a first detection of gravity waves, first predicted by Einstein in 1916. Once we have the sensitivity to measure gravity waves, we will engage in observations of the many energetic phenomena in the universe that can only be seen using gravity waves. To get a sense for the LIGO Project you may watch the movie "Einstein's Messengers" which is located at <http://www.ligo.caltech.edu/einstein.ram>.

In our laboratory, we work on understanding and lowering the thermal noise in LIGO. Thermal noise is the main limiting factor to increasing the observatory's sensitivity. Thus our work has significant impact on the entire project. Yet the work is basically materials physics and the experiments can be successfully performed by undergraduate physics majors. While we all work together on lab projects, each student will have a project for which they will be mainly responsible and which will lead to publishable research work. In addition, students will learn many of the techniques useful to experimental physicists and engineers, including electronics, vacuum technology, optics, machining, and data analysis.

Ultra-cold Atomic Physics

Faculty contact: Professor Pasad Kulatunga, Department of Physics (Kulatunga@hws.edu)

In my lab we study ultracold atoms that are cooled and confined using lasers and magnetic fields. This summer project is to investigate dynamics of optically trapped atoms. We have successfully trapped and characterized atoms in a magneto-optical trap. These atoms will be trapped purely optically. A tightly focused laser creates an optical potential well in which atoms of low kinetic energy can be trapped. Such trapped atoms are used to create quantum logic gates for quantum computing and to create exotic states of matter. An important factor that characterizes the trapped atoms (thus the fidelity of logic gates) is the

atom temperature. This summer we will optically trap atoms and investigate the temperature dependence of the atoms as a function of various experimental parameters. We use cutting edge techniques to trap and manipulate atoms. These projects will familiarize students with optical system (lasers, optical fibers) electronics, vacuum technologies and computer control of instruments and computerized data acquisition. **Requirements:** Detail oriented and desire to learn new things. Sophomore-level Physics & Math useful but not essential. Prior experience in LabView programming is highly desirable.

Optical Tweezers.

Faculty contact: Professor Pasad Kulatunga, Department of Physics (Kulatunga@hws.edu)

Build and characterize an optical tweezers to manipulate microscopic particles. This project's goal is to build a system to trap quantum dots that are used as biological markers. We will first build the optical system to trap and image microscopic fluorescent beads and characterize the trap parameters. Work involved is in the area of optics, microscopy, electronics and image analysis.

Requirements: Detail-oriented and a desire to learn new things. Sophomore-level Physics; chemistry useful but not essential. Some microscopy experience preferred.

Psychology

Implicit and Explicit Forms of Bias and the Tendency to Minimize One's Racial, Gender, and Class Privilege

Faculty Contact: Jonathan Iuzzini, Assistant Professor of Psychology

Brief Description of Project: This summer science research experience includes two related projects. One is a theoretical review, which will integrate and synthesize the existing literature on privilege and power. We will draw on traditional social psychological theories as well as sources from sociology, behavioral economics, and other fields. The second project is an experimental study that will examine the relation between implicit (i.e., automatic, unconscious) and explicit forms of bias and one's acknowledgment of the privilege we typically associate with membership in high status racial, gender, and socioeconomic class groups.

Brief Job Description: The student who fills this position will work with Professor Iuzzini on the two projects described above. On the review project, the student will further develop her/his skills in conducting literature searches and will learn how to code existing studies for a variety of variables. On the experimental project, the student will collaborate with Professor Iuzzini in recruiting members of the HWS and Geneva campus communities for participation in the experiment, running experimental sessions, and analyzing data using SAS and/or SPSS.

Requirements: The student who fills this position should have some experience conducting literature searches, some experience with SAS and/or SPSS, and a strong interest in learning more about the research process in experimental social psychology.

Examining Associations between Adolescents' Peer Experiences and their Social, Emotional, and Academic Adjustment

Faculty Contact: Julie Newman Kingery, Ph.D., Assistant Professor of Psychology

Description of Project: This summer science research opportunity will focus on several projects. The first project is a review paper that will summarize and evaluate current empirical research on friendship and anxiety with children and adolescents. The summer student who collaborates with Professor Kingery on this paper will be listed as a co-author on the final publication. The second project involves analyzing data from a study exploring the relationship between college students' friendships and their academic, emotional, and social adjustment. After analyzing this data, we will submit a poster abstract to the Society for Research on Adolescence conference, which will be held in Philadelphia during March of 2010.

Job Description: The summer student who works with Professor Kingery will assist with a variety of research tasks, including conducting literature searches, summarizing and critically evaluating published research, analyzing data with SPSS, and writing a section of the literature review paper. For the poster submission, the student will generate a research question that is of interest to him/her and complete the analyses and poster abstract with the assistance of Professor Kingery. There will also be opportunities to learn about community research collaborations by attending meetings with organizations that serve youth and families in Geneva.

Requirements: Students who apply for this position should have some prior experience conducting literature searches with PsycINFO, familiarity with SPSS, excellent writing and organizational skills, and a strong interest in gaining applied research experience in the fields of developmental and clinical psychology.

Positive Mood, Sociability, and Other-focused Attention

Faculty Contact: Portia Dyrenforth, Assistant Professor of Psychology

Brief Description of Project: This summer science project will focus on a series of studies examining the associations between positive emotion (happiness) and social outcomes. Specifically, it will include coding videos and analyzing data from an experiment that tested whether being in a good mood led participants to be friendlier and more social when interacting with a stranger. In addition, throughout the summer the student will help to design and prepare additional studies regarding the influences of positive emotion on social success and attention directed toward other people.

Brief Job Description: The student will work with Professor Dyrenforth on a variety of tasks related to the research program described above. Daily tasks will include conducting literature searches for relevant articles and study measures, coding of videotaped interactions, and collecting and designing materials for additional studies. Depending on the student interests, there may also be opportunities to explore additional questions regarding well-being and happiness using existing data resources. The position offers an opportunity to gain experience in several steps of the research process, including literature reviews, behavioral coding, and designing new measures and research protocols for studies of positive emotion.

Requirements: Strong interest in research (both experimental and literature reviews), creativity, and attention to detail. Some experience with SPSS is preferred.