Summer Undergraduate Research Fellowship 2014

Faculty Member: **Clyde Barlow**
Project Title: **Optical Methods to Measure Oxygen, pH, and P_{CO2}**

(Project could support up to 3 students)

Measuring physical and chemical properties of aqueous systems is key to understanding the behavior of natural waters and the interactions of living systems that reside in these waters. Such systems include marine waters, lakes, streams, and ground water. Electronic devices have been developed and are available commercially to measure parameters such as temperature, oxygen, depth (pressure), pH, turbidity, and conductivity. These devices are relatively expensive, however, limiting their availability among researchers. I would like to spend the summer adapting optical approaches to the development of inexpensive water monitoring systems that could be constructed and maintained by students at institutions like Evergreen.

The basic system would function by using fluorescent and phosphorescent dyes that respond to pH and oxygen (1-3). Preliminary studies have been carried out in our laboratory at Evergreen with fluorescent and phosphorescent dyes incorporated into 15-µm diameter polystyrene microspheres using microfluidic methods. For the proposed research developing aqueous system sensing the challenges are less demanding and we may use a simple polymer membrane. A membrane will be exposed to water on one side. Luminescent excitation and emission will take place on the back side eliminating any environmental perturbations of excitation and emission intensities. When we produce the membranes we will incorporate titanium dioxide, a very white pigment, to produce high light scattering and limit optical interference from changes on the front side of the membrane. Luminescent excitation will be produced by appropriate laser diodes and detection by silicon photodiodes using single-fiber optics to couple optical elements on the circuit board to the sensing surface at the front of the device. The phosphorescence emission intensity follows Stern-Volmer behavior, $I_0/I = K*P_{O2}$, where I is the phosphorescence intensity at a given oxygen partial pressure, P_{O2}, and I_0 is the intensity in the absence of oxygen. pH will be measured in a similar manner using a fluorescent dye such as pyridylmethyl-4-amino-1,8-naphthalimide which has a fluorescence emission around 510 nm and a pK_a close to 7.0. Both the oxygen and pH sensing dyes are excited with blue light and emit in the far red and green regions respectively. These properties should allow development of a combination sensor for oxygen and pH using a single LED light source and two or three silicon diode detectors.

References

1. Barlow, C. H., Rorvik, D. A., & Kelly, J. J. (1998). Imaging epicardial oxygen. Annals of biomedical engineering, 26(1), 76-85.
2. Tian, Y., Shumway, B. R., Cody Youngbull, A., Li, Y., Jen, A. K. Y., Johnson, R. H., & Meldrum, D. R. (2010). Dually fluorescent sensing of pH and dissolved oxygen using a membrane made from polymerizable sensing monomers. Sensors and Actuators B: Chemical, 147(2), 714-722.
3. Lu, H., Jin, Y., Tian, Y., Zhang, W., Holl, M. R., & Meldrum, D. R. (2011). New ratiometric optical oxygen and pH dual sensors with three emission colors for measuring photosynthetic activity in cyanobacteria. Journal of materials chemistry, 21(48), 19293-19301.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Abir Biswas** (Biogeochemistry, Geological Sciences)
Project Title: **Biogeochemical cycling in Pacific Northwest forest ecosystems**

(Project intended for 2-3 sophomore-senior students)

This project seeks students working on aligned studies investigating nutrient and trace metal cycling in lowland and higher elevation forest ecosystems in the Pacific Northwest. Students will have a significant responsibility in conducting fieldwork to collect soils and potentially other ecosystem compartments (eg. wood, rocks, lichens). Analytical experience, particularly a driver's license to use the ICP-MS, is preferred though experience using other analytical instruments or SEM could also be relevant. Student(s), who are interested in developing biogeochemical sampling and analysis skills over this summer (and hopefully into the future), could also develop laboratory skills while focusing on studies of mercury (a bio-accumulating toxin), to quantify its distribution in different ecosystem compartments in these regions, toward studies assessing its potential for uptake into local food webs.

Field work for these projects will be conducted at long-term research plots in the Evergreen Ecosystem Observation Network (EEON), which includes sites near the Evergreen campus, as well as at Mt. St. Helens. The research conducted at Mt. St. Helens will likely require extended field time away from the Evergreen campus, especially later in the season. Students should expect to camp during these field excursions, and be prepared for all weather conditions, mosquitoes, and work in both exposed high elevation sites and remote old-growth-sites. Following each field excursion however, students should also expect extended laboratory time processing samples and analyzing results. The schedule will likely include intensive weeks where a large amount of time is required, followed by "down weeks" where research activities will be minimal or not scheduled. Ideally, students should have access to their own transportation or be able to drive a manual transmission.

Potential researchers should have lab or field experience (hopefully both), strong skills in scientific writing and working with primary literature, and be able to commit 20-40 hrs/week to this project. Interested students are strongly encouraged to contact the faculty (Biswas) directly to discuss how their academic backgrounds and/or previous research experience fit with these studies and would allow them to be successful in this research framework.

Faculty support:
The faculty on this project will work side-by side with the student(s) on these projects, provide all necessary training for the research projects, and will meet with the student(s) weekly to reevaluate project design and progress. Meetings early in the season will be particularly important as they will set up the research designs, schedules, and appropriate use and access to equipment.

External support:
No external funding is required for these projects.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Clarissa Dirks**
Project Title: **The Distribution, Biodiversity and Ecology of Tardigrades (Water Bears)**

Tardigrades are found in most terrestrial, freshwater and marine habitats, including remote places of the deep sea and Antarctic. They make up their own phylum, Tardigrada, and are most closely related to arthropods. These organisms are part of the meiofauna community of animals (tardigrades, nematodes, rotifers, ciliophora, and mites). This community plays an important role in food webs and nutrient cycling within aquatic and terrestrial ecosystems.

Tardigrades are unique in that they have the ability to survive harsh environments by entering cryptobiosis – a reversible dormant state induced by several harsh conditions. They can survive desiccation, extreme cold, heat, low oxygen levels, and even ionizing radiation. Therefore it is important to better understand this woefully understudied group of organisms.

The limno-terrestrial tardigrade fauna of the Southwestern United States has not been well surveyed and nothing has been published about tardigrades from the Grand Canyon National Park (GNCP). The Grand Canyon has many suitable habitats for tardigrades, inclusive of unique springs and seeps where new species might be found. Given their importance in a variety of ecosystems and the fact that they can serve as climate change indicators, the Dirks' lab is studying how abiotic factors, such as elevation, moisture, and bedrock composition, effect species distribution throughout the Grand Canyon National Park and nearby mountain ecosystems. This work will contribute to a better understanding of the biodiversity and biogeography of tardigrades in North America, particularly in the Southwest, and provide the foundation for future studies of tardigrades in the Grand Canyon.

The Dirks' lab has completed a comprehensive survey of moss and lichen species along elevational transects in the GCNP and the San Francisco Peaks, which is a nearby mountain range containing the highest peak in Arizona. We invite enthusiastic undergraduates at all levels to join the project and evaluate the GCNP samples for meiofauna and to characterize the tardigrades from these samples both morphologically and genetically. Students at different levels in their education can participate in the research and will be trained in microscopy, molecular biology, genetics, and bioinformatics.

Students will learn to do collaborative work and engage in the process of science through conducting research, reading primary literature, analyzing data, and communicating their work in oral presentations to the lab members. Students will work as a team with other students and the faculty to methodically evaluate the samples we have to build a comprehensive model of tardigrade distribution and diversity in the Grand Canyon National Park.

The Dirks' lab has the ability to support three students who can join the ongoing work and each focus on samples from different regions of the GCNP. Each student can analyze samples from a specific region thereby contributing a significant piece of data to the collective work. It is possible that any member of the research team could identify and describe a new species of Tardigrada as these organisms are diverse, and incredibly understudied in desert ecosystems. Every member of the team will make meaningful contributions to the research.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Anne Fischel**
Project Title: **"No Borders: Communities Living and Working with Asarco"**
Position(s): Political Economy & Public Health of the Mining/Smelting Industry

The Student Research Fellow(s) will work with faculty members Anne Fischel (and Lin Nelson, who will retire mid-June), on their long-term project examining one complex corporation, the American Smelting and Mining Company, and its impact on selected communities. The project involves extensive fieldwork, community-based research, policy analysis, document analysis, film and photography, and interviews with a wide array of officials. The project has been shaped around the emerging story of one major corporation -- its operations, closures, Superfund hazardous waste sites and transport of hazardous materials with a particular focus on its 2005 bankruptcy filing and the fiscal and health fallout that followed. These developments impacted 90 sites in 22 states. Washington State is one of the most affected by the public health risks and financial burdens. The outcome of the bankruptcy also set a precedent for other corporations seeking to divest themselves from a century or more of liabilities from the closures of toxic sites.

The student or students will help develop a company timeline, building on our previous project work. Students will help shape a contextual history and analysis of mining and smelting as foundational industries in developed/developing economies. This will involve substantial library and on-line research, consulting regional resources, and consultation and interviews with public health advocates and corporate researchers. The student will be contributing to the project website, articles, community outreach materials, and a full-length book.

The Research Fellow(s) will do the following:
(1) learn about the No Borders project by studying project documents and the website;
(2) attend meetings with public health officials and community members;
(3) contribute to a detailed corporate history of Asarco;
(4) help develop an overview of public health risks associated with mining and smelting as an industry (including creating factsheets and guides);
(5) draft a guide to the mining/smelting industry, with profiles of key companies, their holdings nationally and globally, public health impacts, and relevant public policy;
(6) help profile the impact of the Asarco bankruptcy on the policies of other companies;
(7) collect and organize photographs, films and infographics as they relate to mining/smelting as an elemental factor in development;
(8) identify and profile materials about "more ecologically sound" mining and smelting.

The Research Fellow should be an Advanced Student (junior or senior) with a strong background and interest in political economy and/or public health. The student(s) will develop research skills, experience in translating complex information into accessible form; and understanding of corporate research and public health education. This will be a full-time position in the summer sessions. We can accommodate two students, if there is interest. We will work closely with the students and meet with them regularly at the Evergreen ASARCO office in Seminar 2.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Dylan Fischer**
Project Title: **Plant Ecosystem Ecology Research in Northwest Forests**

Intended for 1-2 junior-senior students ready for advanced work in field and lab plant science

In this project, students will evaluate responses of plants to variation in forest structure and disturbance. We will conduct research at two field sites, the Evergreen Ecological Observation Network (EEON), and long-term forest monitoring plots at Mount St. Helens, WA. On the Evergreen State College campus forest, students will measure carbon flux in soils to determine if carbon flux is associated with variation in plant communities. This work will require experience with taxonomy and use of dichotomous keys, and statistical approaches to community analysis. The project will also require a willingness to learn how to use advanced equipment for measuring root growth and soil CO_2 flux (including a minirhizotron digital root scanner, and a field-based infra-red gas analyzer). Students will also measure soil carbon and nitrogen differences in forest soils using a new elemental analyzer purchased for the college in 2012.

Applicants should have some experience in both field and laboratory techniques. Later in the season, students in this project will work on a project at Mount St. Helens (WA) comparing recovery of vegetation in old growth forests versus clear cuts following the 1980 eruption. They will answer questions about how clear cuts and old growth sites differ in their responses to volcanic debris over the past 30 years. This project will require extended field time away from the Evergreen campus, especially later in the season. Students should expect to camp during these field excursions, and be prepared for all weather conditions, mosquitoes, and work in both exposed high elevation sites and remote old-growth-sites. Following each field excursion however, students should also expect extended laboratory time processing samples and analyzing results. Students should have access to their own transportation or be able to drive a manual transmission. They should expect to work an average of 20-40 hours per week on the projects, with a schedule that includes intensive weeks where a large amount of time is required, followed by “down weeks” where research activities will not be scheduled.

The faculty on this project will work side-by side with the student(s) on aspects of both of these projects, provide all training for the research projects, and will be meeting with the student(s) weekly to reevaluate project design and progress. Frequent meetings early in the season will be especially important as they will set up the research designs, schedules, and appropriate use and access to equipment.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Heather Heying**
Project Title: **Sympatric roosting and interspecific communication in two *Myotis* bats**

This project will examine the behavioral adaptations that allow temperate vespertilionid bats to survive in the Pacific Northwest. Interspecific associations are known in other bat species, but the extent of the relationship between *Myotis lucifugus* (little brown bat) and *Myotis yumanensis* (yuma bat) in northern coastal forests is unknown. While the two species share many aspects of their biology and life history, including size, diet, and reproductive timing, they do not appear to compete directly over roost sites, as evidenced by the identification of several little-studied colonies containing both species across the region. All known colonies containing these two species are maternity colonies, in which females birth and raise their young; one such colony lives on Evergreen's Organic Farmhouse.

Using a combination of telemetry, remote temperature monitoring, and acoustic recording and analysis (required because individuals cannot be identified to species by morphology alone—their echolocation calls are required to identify them), we will work towards a more complete explanation of how and why mixed-species maternity colonies exist, and what their particular environmental requirements are, in light of one such colony living in the siding of an Evergreen building. Data will be collected on bat activity throughout Thurston County.

Students who wish to work on this project must have considerable experience in behavioral field research, and be able to generate compelling hypotheses, then see them through experimental design, data collection, and analysis. Bats have evolved to sense, fly, and hunt in the dark. While human researchers do not share these adaptations, those who wish to study bats must be willing to put in long hours at night, and let the activity patterns of bats determine their schedule.

This research could incorporate one to two upper division science students with a theoretical background in evolutionary biology and ecology. Additionally, students should have the following experience or skills:

- Understanding of biological statistics, and experience employing them
- Field experience with the capture of live animals, including mist netting
- Field experience with radio telemetry
- Proficiency in operating acoustic recording devices for wildlife
- Experience with Sonobat (software program)
- Familiarity with placing, removing, and taking data from remote sensors
- Access to a motor vehicle (car or truck)
- Ability to work odd hours, including many hours in the evening and night

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Grace Huerta**
Project Title: **Education & Empowerment—Examining the Academic Achievement of Diverse Learners in K-12 Settings**

Research Description: This K-12 educational research project examines the implementation of critical pedagogy in the Shelton and Olympia School Districts. Critical pedagogy (CP), grounded by critical race theory (CRT), provides a framework for undergraduates to examine how educators address the academic needs of diverse learners while teachers strive to meet standardized testing benchmarks. Building upon our participatory research conducted in 2012-14 at Evergreen Elementary (a bilingual school), Shelton and CHOICE high schools, our undergraduates examined how dominant ways of knowing were presented with limited attention to curriculum and instruction that addresses culture, language, gender, class and ableism. This research also helps scaffolds our continuing outreach and mentoring efforts with under-represented Latino/a students who may consider attending TESC in the future.

This summer, three TESC students plan to continue this research. By collaborating with educators in Olympia and Shelton, our students will create an action research plan which generates strategies to implement critical pedagogy and culturally relevant practices. The ultimate goal of our action research is support the academic achievement of diverse learners while meeting Common Core curriculum standards.

General Expertise—Intermediate and advanced undergraduate education students will use qualitative research methods such as participant observation, field journaling, interviews, literature and document analysis to answer essential questions regarding the Common Core standards. Given their background knowledge in CP and CRT, they will research how these standards interface with critical pedagogical approaches to Language Arts, Social Studies, Math and/or Science curriculum design and assessment.

Research Responsibilities—Each team member will identify a school and an educator to examine the nature of critical pedagogy, culturally relevant curriculum design and its relationship to the Common Core. An elementary school, middle level and high school in Shelton and Olympia will be our target research sites. Research fellows will conduct a document, curriculum and literature analysis of the Common Core, test outcomes, and their relationship to CP. Students will interview and collaborate with such stakeholders as teachers and administrators to analyze the relationship between standardized testing and collaboratively create a CP curriculum model for implementation in the fall. Lastly, the research team will compile their findings in a preliminary report by the end of summer. Through the completion of this action research project, the knowledge the students will garner establishes how educators can align critical pedagogy (i.e. inclusive instructional approaches) to the Common Core curriculum.

Number of Fellows—This project will accommodate three fellows. Each member (representing an elementary school, middle level and secondary site) will: 1) further solidify our ongoing undergraduate education student entrée and commitment to service (i.e. tutoring and mentoring) in the Shelton and Olympia school districts; 2) continue their participatory, qualitative research in their respective school sites; 3) complete a literature and data analysis specific to CP and districts' Common Core test outcomes; 4) generate an action research CP plan in collaboration with participating educators (who we have been already been working with since 2012) for implementation and assessment in the fall.

Additional Information—This undergraduate participatory research initiative also includes media production and collaboration with Latino/a students in the Shelton community with the support of the 2012-13 *Local Knowledge* program (w/Dr. Anne Fischel), the 2013-14 *Education and Empowerment* Program (w/Dr. Leslie Flemmer) and the CCBLA. We have already completed three short films that demonstrate TESC undergraduate collaborations with Latino/a students at Evergreen Elementary School, CHOICE High School and Shelton High School located in the Shelton School District. This preliminary undergraduate research was also submitted for consideration at the American Educational Research Conference in 2013. Our work was also presented at the National Association of Chicana and Chicano Studies, Pacific Northwest Regional Conference, as well as the 2013 Latino/a Youth Summit at South Puget Sound College last November.

Summer Undergraduate Research Fellowship 2014

Faculty Members: **Carri J. LeRoy and Erin Martin**
Project Title: **Ecological Research in Fluvial Systems**

This research experience will be focused on learning techniques used to understand the structure and functioning of stream and river ecosystems in Washington State. A major focus of the fellows' research on this project will be the surveying, monitoring and exploration of the five streams on Evergreen's forested campus. We have just over 1,000 acres of forest on campus and there is a developed terrestrial monitoring network (EEON – Evergreen Ecological Observation Network). As part of EEON, we have identified long-term stream monitoring sites, yet data have been infrequently collected at these sites. Fellows will collect data that will serve as the basis for future long-term monitoring. In addition, to provide students with knowledge of ecological techniques used to study larger rivers, fellows will collaborate on several ongoing research projects around the state.

This proposal can support two students. Students should be at the intermediate level, having completed at least one year of college biology and chemistry. Additional experience in ecology and/or analytical chemistry is preferred, but not required.

Both fellows will be involved with the following tasks and research opportunities central to stream ecology: measuring in-stream primary production and community respiration rates (bottle incubations), assessing algal production (chlorophyll-a analysis), enumerating bacteria (DAPI staining), and identifying and surveying for aquatic macroinvertebrates. In conjunction, students will make measurements central to riverine biogeochemistry, including analysis of nutrients (nitrate and phosphate), dissolved carbon dioxide content (pCO_2), quantifying the amount of coarse and fine particulate organic matter, and determining the composition of this material (lignin content and C:N ratios). Students will also measure basic hydrological variables in streams (slope, sinuosity, substrate type, depth, discharge). Although both fellows will conduct the field and laboratory techniques mentioned above, we anticipate that one fellow will take the lead on analyzing the biological and hydrological data, and the other the biogeochemical data. Awarding two fellows will ensure that both the biological and chemical analyses (both are needed to holistically understand stream ecosystem functioning) are conducted.

In addition to the work described above, both fellows will have opportunities to collaborate on other field projects around the state, including the Queets River. Students will gain experience in advanced organic geochemical techniques, including radiocarbon analysis of biomarkers specific to leaves. Previous research suggests that such measurements provide insights into the rate at which carbon is stored and processed in terrestrial ecosystems. Students may have the opportunity to collaborate with laboratories at the University of Washington to learn the techniques required to make these measurements.

Lastly, the SURF fellows will have opportunities to learn about experimental design, data collection and archiving, statistical analysis and scientific writing through workshops and interactions with faculty members and other fellows. Successful research projects may be written and/or presented to diverse audiences at conferences.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **David McAvity**
Project Title: **Undergraduate Research in Evolutionary Dynamics**

This research involves agent based modeling of the evolution of cooperation. The work is interdisciplinary in nature. It incorporates mathematics, biology and computer science. The particular project for this summer involves the effect of variable investment in cooperation due to spatial and temporal variations in the amount individuals are able to donate. The cooperation rate for individuals who live in an environment with uneven distribution of resources is expected to be enhanced in certain cases, and reduced in others, depending on the nature of the distribution. For example, vampire bats are known to live in cooperative clusters, where sharing of food among unrelated individuals happens in circumstances where some individuals are successful in collecting food and other are not.

Students should have skills in computer programming and applied mathematics. Background knowledge in evolutionary biology is desirable but not essential. Students will have responsibility for creating evolutionary models, running simulations, collecting data, and creating visual representations of the observations. They will also be expected to develop analytical models to understand the results. There is more than enough work to occupy two students for 20 hours a week.

The project will progress fine with a single well motivated student. A pair of students working together would be ideal. Students will be given a fair amount of independence to take initiative to move the project along in a way that is interesting to them. They will gain important knowledge and understanding of what extended research projects in mathematical modeling are like.

I have been working successfully on projects of this kind with students doing Undergraduate Research. I have published one paper with students and have another paper in preparation. The current project is new, and offers some very interesting possibilities for new results. The opportunity to have students working in a focused way for 20 hours a week during the summer should help move the work along in a substantial way.

Summer Undergraduate Research Fellowship 2014

Faculty member: **Paul R. McCreary**
Project Title: **Interactive Computer Animations for Learning about Groups in Abstract Algebra**

The topic of groups in abstract algebra currently helps physicists to understand how the cosmos is put together. Algebraic groups are also the first truly "abstract" topic that undergraduates meet in mathematics courses. Interactive computer animations can help introduce the topic and give a genuinely intuitive grasp of the ideas. The summer project is to devise and produce interactive animations that can be used to experience the actions that group elements have on a space. The student participants will gain experience with mathematical group theory, computer graphics coding, and experience in explaining mathematical ideas.

Applying students should have a deep interest in mathematics and a willingness to learn how elementary computer code can run interactive animations on a personal computer. In addition to mathematical interest, the students should have prior experience with calculus. No prior experience will be necessary in computer coding. Participating students will gain a deeper insight into the structure of algebraic groups and an introduction to very elementary computer coding for interactive animations. They will be expected to attend meetings, consult with faculty, and collaborate with all other project participants. These activities will take place at the facilities for the Tacoma program (in Tacoma, Washington).

With one student fellow, the project will develop several interactive animations that facilitate deeper learning of algebraic structures. With a second student fellow, we would be in a position to develop a publication draft by summer's end.

Note that a file with a number of examples of interactive animations can be obtained from the following web link.

http://academic.evergreen.edu/m/mccrearp/dynamicHyp/modGrpExamplesWebCopy.cdf

Further note that in order to view these examples a free software is necessary and available at the following site.

http://www.wolfram.com/cdf-player/

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Greg Mullins**
Project Title: **History and Culture of Human Rights**

I'm working on a book-length research project that advances scholarship on the culture of human rights by taking up the United States as a case study and analyzing the deployment of rights language in key sites of cultural/political production. In summer 2014 new research will focus on Malcolm X, Dr. Martin Luther King, Jr., and especially Harvey Milk as "figures" of human rights. The research is interdisciplinary in character, and draws on historical sources while employing cultural studies methods.

I'm currently working with a student researcher on another chapter of this project, and his work is illustrative of the summer work. For example, he is 1) organizing and annotating text and image files from research I've completed in the archives of Amnesty International; 2) conducting biographical research on key figures; 3) pursing new leads on sources as they come to our attention; 4) compiling and maintaining bibliographies; and 5) reading scholarship that provides the foundation for my project. I draw attention to this latter area of work because it is likely to be of interest to applicants for the SURF fellowship. To the greatest extent possible, I wish to structure the working relationship so that the fellow is doing intellectual work alongside the more clerical work of text-based research.

I can work with up to two fellows. Ideally, they will have a background in one or more of: human rights theory, history, cultural studies/theory, visual and textual analysis, African American studies, or queer studies. The fellow(s) should be working toward an Evergreen degree in the humanities or social sciences in which library/text-based research has figured prominently. Advanced students preferred. Intermediate students would pursue the more clerical and less analytical portion of the work. Crucial are: excellent organizational skills, time management skills, persistence, ingenuity, and curiosity. Fellows will learn: 1) how to locate and interpret historical evidence; 2) how portions of research feed into a developing argument; and 3) how to situate original research in relation to published scholarship.

In Summer 2014 I will visit the archives of the San Francisco Lesbian and Gay Historical Society, which holds personal papers, photographs, newspapers, gay liberation ephemera, and the records of the Harvey Milk Democratic Club. This organization also helpfully streams 400 hours of gay and lesbian radio programs from the 1970s and 1980s. Depending on what I find there, I would ask one or two SURF fellows to organize and annotate the records I collect. A fellow with relatively fewer research skills would spend more time listening to the radio streams and helping organize my notes. A fellow with relatively greater research skills would read scholarship in the area, find additional published or non-published sources, and annotate a bibliography.

Another portion of the project would welcome a SURF fellow: the turn toward human rights in the work of both Malcolm X and Dr. King in the 1960s. This research will largely focus on published sources (scholarship) and on streamed files (their speeches). Published sources include scholarship both on black liberation movements in the United States and the deployment of human rights language in anti-colonial struggles. An intermediate student would read sufficiently widely and deeply to compile the sources in an annotated bibliography. An advanced student would analyze these sources along with me, and pursue new leads as they arise.

In short, I could work with one or two SURF fellows on the Harvey Milk/LGBT politics material from the 1960s, 70s, and 80s. Or I could work with one SURF fellow on the turn toward human rights discourse in black liberation movements in the 1960s. Or I could work with on fellow in the first area and one fellow in the second area. (I don't wish to overcommit to mentoring three fellows in one summer.)

The work of one fellow would result in a strong bibliographical foundation in one of the two subprojects; the work of two fellows in the Harvey Milk/SF Archives portion would result in specific analysis of sources (at the very least, the radio broadcasts, and also, most likely, print material I find in the archive).

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Mike Paros**
Project Title: **Bovine Mastitis Bacteriophage Lab**

Bovine mastitis is one of the most common forms of disease in dairy cows worldwide. Gram negative coliform bacteria are typically associated with severe clinical mastitis and *Escherichia coli* is often isolated from acutely affected cows while also playing a role in recurring subclinical intramammary infections. The widespread and routine prophylactic use of intramammary antibiotics on dairies is now under public scrutiny due to concerns over the transfer of antibiotic resistant genes to human pathogens. Bacteriophages are viruses that can infect bacteria and suppress their growth. A number of animal studies have demonstrated the safe and efficacious use of phages against *E. coli* infections. Utilizing a grant from the Washington State Dairy Products Commission, we have successfully isolated bacteriophages against mastitis causing *E. coli* strains, measured host range specificity, and have generated a cocktail of phages that could infect a variety of clinical coliform mastitis strains. We plan to test the ability of phage cocktails to suppress *E. coli* growth in raw milk with a number of different carrier agents, as a necessary pre-cursor to clinical trials that would examine the use of bacteriophages to prevent *E. coli* mastitis. Finally, our lab will be using a bovine mammary cell culture line to observe bacteriophage inhibition of intracellular invasion by mastitis pathogens.

Over the past four years, our laboratory has helped over a dozen Evergreen undergraduate students gain important research and laboratory skills in microbiology. A number of them are now doing graduate research in the biological sciences. A summer student research intern would be expected to work approximately forty hours a week where he or she would help design and execute experiments. Our laboratory can accommodate up to two fellows. Priority will be given to students with some basic laboratory skills in microbiology, and completed course work in upper level biology and chemistry courses.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Alison Styring**
Project Title: **Summer Research in Field Ornithology**

I am looking 1-3 qualified students to work on the following summer research projects.

Monitoring Avian Productivity and Survivorship (MAPS)
In collaboration with the Center for Natural Lands Management (CNLM), the ornithology lab has recently established a MAPS station at Glacial Heritage Preserve: a remnant native prairie site 23 miles south of campus. MAPS is a network of bird banding stations across North America that collect standardized data on key indicators of avian health and survival. I am looking for students to participate in station activities and collect the second season of data. Work will include conducting habitat assessments; setting mist-nets; banding birds; collecting information on body condition, sex, breeding status, molt, and age; entering data into spreadsheets/databases; running analyses; and preparing/submitting reports to the Institute for Bird Populations and state/federal wildlife agencies.

Acoustic monitoring of birds in the Evergreen Forest
In collaboration with the ongoing ecological research in The Evergreen State College Forest (http://academic.evergreen.edu/projects/EEON/), the ornithology lab is conducting an acoustic survey of birds in the campus forest. Work involves conducting acoustic surveys, downloading and archiving recordings, identifying vocalizations, entering data into spreadsheets/databases, and running analyses.

Determining bird locations using microphone arrays
The ornithology lab is working on a new area of research in the field of avian monitoring and wildlife acoustics: localizing birds using microphone arrays. Subtle differences in the arrival times of songs and calls can be used to determine the position of an animal when it made the sound. Currently, research on this topic has focused on two-dimensional (map) locations. This project will focus on determining two-dimensional, and potentially three-dimensional locations of birds in the campus forest. Work involves setting up microphone arrays, testing array efficacy, downloading, analyzing, and archiving recordings, entering location estimates and relevant habitat information into spreadsheets/databases, and running analyses.

Successful applicants will be expected to work on all projects. Desired qualifications: experience/training in MAPS protocol, proficiency with field recording, prior coursework in data analysis (upper division statistics), and experience with canopy access methods. Successful applicants must commit to conducting field work from 4:45 am to as late as 4 pm on field days. The faculty will work with students in the field and lab during the first weeks of the projects and will meet weekly throughout summer. Interested students should contact Alison Styring (styringa@evergreen.edu) for more information on the projects, qualifications, and expectations.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Erik V. Thuesen**
Project Title: **Ecological Physiology of Marine Invertebrates**

Description
Organisms that live in estuaries experience a wide range of environmental parameters, and these fluctuating conditions of temperature, salinity, oxygen concentration, etc. pose physiological challenges that need to be overcome. This project will examine the response of whole animal metabolism to changes in various environmental parameters. Working with one or two specific species commonly encountered in Puget Sound, this project will establish the environmental parameters that the species can tolerate. Appropriate species will be chosen based on mutual interests of the student/faculty and on the availability of specimens. Past research in this lab has focused on crustaceans, cnidarians, ctenophores, nemerteans, polychaetes, chaetognaths and molluscs.

Student Requirements and Responsibilities
This project is appropriate for 1-3 students. Students will need to have completed course work in marine sciences and/or zoology and possess a working knowledge of lab chemistry and microscopy. This project contains both lab and field components, and students should feel comfortable carrying out investigations in both situations. Students will collect animals in southern Puget Sound, maintain them in seawater aquaria and measure metabolism of target species in the lab. A final report will be written describing the results. The student Involved with this project will benefit through gaining experience in marine fieldwork, learning to identify marine invertebrates, learning to use a sophisticated oxygen fiber optic oxygen sensor, carrying out precise in vivo oxygen measurements, analyzing data and preparing figures using statistical and graphing software.

Related Possibilities
Fieldwork to measure oxygen stratification and development of hypoxia in southern Puget Sound may be carried out to target organisms living in low oxygen. Typically, hypoxia (less than 25% oxygen saturation) develops in Olympia Harbor by the middle of July, and working on species that live in this low oxygen area will be possible.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Richard Weiss**
Project Title: **EDURange: Creating Educational Cybersecurity Games (A SURF Proposal)**

EDURange is an ongoing project with the goal of building Cloud-based, interactive computer security exercises (games). Games are an effective tool for active learning. The desired outcome will be the creation of a suite of exercises for faculty and students that will be engaging and will teach computer security skills and concepts, most significantly the security mindset. Having the security mindset implies that one can understand a system both from the standpoint of a builder and an attacker. Thus, the security mindset provides the conceptual underpinnings for a student to reason in both defensive and offensive situations. Exercises will focus on highly interactive, competitive, and dynamic scenarios.

Imagine that you are given a URL for Citizens Against Zombies, and you are told that there are vulnerabilities in the site but not what they are. Your mission is to exploit the vulnerabilities to post a message on the site that Zombies are endangered and in need of help. At the same time the defending team is trying to patch the vulnerabilities and prevent you from getting access. Students will be developing games such as this one. They are designed to require users to collaborate and form learning communities to solve complex problems and develop quantitative and analytical reasoning skills. The exercises will be assessed on how well they teach content as well as result in collaboration. The exercises produced will be created and hosted on Amazon's EC2 and demonstrated in workshops at national conferences.

Students who apply should have good programming skills and some understanding of computer networking and security. The level of study is intermediate to advanced. Students will learn advanced techniques in security, including penetration testing, intrusion detection and prevention, and data loss prevention. Since we learn best by teaching, students will be able to achieve a deep understanding of the skills and concepts taught by the games that they develop. They will also learn the skills needed to configure virtual machines and networks using the latest tools on EC2. They will need to install and configure the software on these virtual machines to create the vulnerabilities that make the games instructive and interesting. Each student will be responsible for designing a new game and implementing it in EC2, but the process will be collaborative. There will be discussions and design reviews with students and faculty from Evergreen and other schools, including Lewis & Clark College, The University of Calgary and Wellesley College. There will be a two-day hackathon at the beginning of the summer to form working groups. The EDURange project has had eight refereed publications in the last year. Students will be expected to participate in writing scientific papers on their work suitable for publication. This is a collaborative project supported by a grant from the National Science Foundation and an educational grant from Amazon. More information can be found at http://blogs.evergreen.edu/edurange.

This project can accommodate two fellows, each one working on a different game but using and contributing to a common framework for creating games. Thus, with one student, we would be able to create one new game and a simple user interface for setting up the game. With two students, we would create two new games and a more extensive graphical interface for setting up and configuring the games. Automated scoring is also part of the project and each of the fellows would contribute to that infrastructure.

Summer Undergraduate Research Fellowship 2014

Faculty Member: **Elizabeth Williamson**
Project Title: **Martyrs in American Culture**

I propose a summer fellowship that would draw on Evergreen students' facility with critical theory and film analysis in order to support my current research on Shakespeare and martyrdom. This book-length project deals with Shakespearean representations of martyrdom, including recent American film adaptations of Shakespeare's plays. My working hypothesis is that American directors faced with interpreting texts like *Titus* and *Coriolanus* inevitably do so in light of other American film representations of self-sacrifice, which are themselves influenced by imperialist ideologies. In order to ground my argument about the conventions of American film, I am seeking undergraduate research fellows who can 1) screen and analyze a number of films that deal with self-sacrifice 2) read and seminar with me on crucial pieces of secondary literature that provide necessary vocabulary for analyzing themes of imperialism within the films.

Required: Intermediate research and analysis skills in the humanities (i.e. ability to search journal databases by subject, read and analyze journal articles, and produce detailed formal analyses of narrative films)

Desired: Previous experience with film theory, post-colonialism, and/or queer studies

Responsibilities will include researching and viewing selected films as well as seminaring on and providing written summaries of primary and secondary texts. Knowledge gained will include increased competency in research and analytical writing, broader exposure to secondary literature and insight into the process of designing a book-length research project.

One student could research, view, and report on a wide variety of American films as well as secondary texts related directly to the films. This work would contribute directly to my analysis in chapter 3 of the book.

Two students could cover a broader range of theoretical material relating the figure of the martyr to other key tropes—specifically the soldier and the terrorist. They could also seminar together in addition to their seminars with me. This work would contribute to chapter 4 of the book as well as to chapter 3.

Book overview:
Shakespeare's plays are notoriously cagey about the subject of religion, but contemporary scholars continue to be interested in his take on the phenomenon of martyrdom—in part because of the significance of the martyr figure in contemporary Western culture. This book examines the politics of martyrdom in Shakespeare's plays from several angles. Chapter 1 considers the traditional narrative elements that were foundational to early modern understandings of martyrdom, including some of the more radical aspects of early Christian martyrology. Chapter 2 provides readings of several Shakespeare plays that deal directly with the politics of Christian martyrdom. Chapter 3 considers two recent film adaptations of these plays that reflect contemporary Western understandings of martyrdom. Chapter 4 reviews some of the recent scholarly literature that has sought to make sense of Shakespeare's ambivalent relationship to martyrdom, and interrogates the use of analogies that link early modern martyrs to contemporary "terrorists."

Chapters 1 and 2 of the book (which are closest to my primary area of expertise) are nearing completion; this proposal seeks fellowship support to augment my knowledge of American film and critical theory, which will expand my analysis in Chapters 3 and 4 and thus enhance the relevance of the project.