

Undergraduate Researchers 2010 – 2011

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Laura Anzaldi, SURF Scholar

Developing Root-Based Semantic Vocabulary

Information related to medicine, biology and chemistry is stored by a number of different sources, each of which uses a different vocabulary. This makes combining or sharing information very difficult, as for literal, pattern-matching computers, different vocabularies are completely different languages. Therefore it is necessary to develop a root-based vocabulary (mirroring Latin) to act as a standard. This is advantageous, as once a common set of roots has been established, the meanings of compound words become intuitive. Adding vocabulary, which is essential for the exponentially growing field of biology, could not be easier. New vocabulary can be formed by combining different root words, or if need be, creating new ones.

In order to form this new vocabulary, specialists in biology selected a diverse, extensive and representative collection of ontologies. I parsed these ontologies and entered them into database tables, in order to facilitate extracting and querying information. By using parent-child relationships between the terms, I wrote a program to recreate trees showing the hierarchical nature of words in the ontologies.

The final stage of my project was to create a user interface, a website, so that biologists and chemists would be able to easily query the database to collect information. These experts will be able to do what computers cannot...judge how suited a word is to serve as a root. Proper root words are easily concatenated, easy to say, and usable in a wide variety of contexts. A standard root-based vocabulary will streamline communication and encourage unity in information between different scientific companies and organizations.

How did you find out about SURF (Summer Undergraduate Research Fellowship)?

I saw a flier in the Honors College lounge and thought it sounded like a wonderful opportunity.

How did you know this was the laboratory you wanted to work in?

I worked in the Chemical Sciences lab this summer, which I applied for because I was interested in gaining some experience with lab work. However, I was placed in a bioinformatics position, which gave me the unique opportunity to use computer science to solve problems in biology.

Is this your first independent research project?

Yes, before this I had never done research.

How much time do you put into it?

SURF is full time for 11 weeks.

What academic background did you have before you started?

I had just completed my freshman year of college at UMBC, so nothing more than introductory computer science classes.

Was the application difficult to do?

No, and I really liked how you applied for a lab rather than for a specific project.

What is your advice to other students about getting involved in research?

Be open minded in selecting where/to what projects you apply. You might be surprised at what you stumble across.

What has been the hardest part about your research?

I dealt with a lot of technical difficulties and struggled a bit with overall inexperience.

What was the most unexpected thing?

I was surprised how long the project took me. When I heard an initial description at the beginning of the summer, I did not expect it to take 40 hours a week for the full 11 weeks!

How does your research relate to your work in other classes?

My research used all of the introductory level computer science concepts, and I think I will find it relates even more as I continue into more upper level classes. I had to teach myself about databases, Perl, and a little web development.

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Naomi Bier, SURF Scholar

Homogeneity Analysis

Standard Reference Materials (SRMs) are materials that have been thoroughly characterized and certified by NIST for properties such as elemental composition and homogeneity. These materials are used by customers in industry, academia, and other sectors, for a variety of purposes. For example, SRMs can be used for calibrations of instrumentation, validation of in-house methods, and for quality control. It is crucial that SRMs be homogenous in composition, both at the macro- and micro-scale, in order for the material to be valid. Traditionally, X-ray fluorescence spectroscopy (XRF) has been used for the direct elemental analysis and evaluation of homogeneity of solid samples, such as glass, ceramics, and soils. However, XRF does not provide sufficient sensitivity to detect heterogeneity in all the elements of interest it is also unable to measure beryllium, an element of interest in many materials.

A proposed complementary technique to XRF is laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). The LA-ICP-MS technique uses energy from a laser to directly interrogate a solid surface and create a plume of gas-phase particles that has the same composition as the bulk material. The gas-phase particles can then be transported to an ICP-MS for detection and quantification. The primary advantage of ICP-MS compared to XRF detection is sensitivity, which is on the order of $100 \mu\text{g kg}^{-1}$ or better for the majority of elements accessible to ICP-MS. The present SUURF project explored the effects of different experimental parameters, both within the laser and in the ICP-MS, on micro-homogeneity measurements made by LA-ICP-MS. Parameters of interest included laser beam spot size, repetition rate, ablation cell dimensions. The results indicated that optimization of experimental parameters is crucial for the successful assessment of micro-homogeneity in solid samples by LA-ICP-MS.

How did you learn about the summer Undergraduate Research Fellowship (SURF) program at the National Institute of Standards and Technology (NIST)?

I learned about the NIST/SURF program from UMBC webpage for summer research programs: <http://ur.umbc.edu/summer-research/>; this page links to hundreds of paid summer research programs and NIST/SURF was the first one on the list.

How does the program work?

NIST is typically looking for undergraduate students majoring in the sciences or engineering. Students look into the different work being done at the NIST <http://www.nist.gov/surfgaithersburg/resprograms.cfm> and decided what areas interest them and which labs they would like to work in.

What academic background did you have before you applied for this summer program?

I was finishing my junior year when I applied for the SURF program. I have friends from the program that had just finished their freshman and sophomore years. Before starting the summer fellowship I had taken classes in Biology, Chemistry, Organic Chemistry, and Physics which gave me a foundation that facilitated my understanding of the work.

Was the application difficult to do?

The application for SURF was really simple compared to other applications I have filled out in the past. It was easy and straightforward, all the directions were given to me on one page which helped me keep track of what I completed and still needed to do.

What is your advice to other students about getting involved in research?

If you have any interest in learning about research I say DO IT! Working in a lab is different than sitting in a classroom and it can help clarify questions you may have about research. Before I started working in a lab I was wary of pursuing a career in research for a number of reasons. The biggest concern I had was that the work would become boring and mundane after a short time. Working on projects over the past academic year and this past summer showed me that there is always more to learn no matter what area of research you choose.

What are your career goals?

I plan to pursue a Ph.D. in Biochemistry or Microbiology and Immunology in hopes to work at a government agency researching infectious diseases.

What has been the hardest part about your research?

One common hardship many students face in performing research is not getting discouraged when things go wrong. The thing about research is that you're looking into something that has yet to be discovered or determined; sometimes there is no immediate answer. This can be difficult, especially when you are used to taking classes in which the right answer can ultimately be found by looking in a text book or asking a professor.

What was the most unexpected thing?

The most unexpected thing about my research this summer was how much I enjoyed my work. My area of interest lies in Organic Chemistry and Microbiology; my project this summer concerned neither of these disciplines. My project was in the field of inorganic analytical chemistry, and even though it was not my area of academic interest, I invested a great time and energy into the work and ultimately enjoyed the experience immensely.

Will you work with NIST more, now that the summer is over?

Yes, I have been selected for a fellowship at NIST for this fall 2010 semester. I will be working with my group and continuing my project from this summer.

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Abigail Bratcher, History and Russian

Reclaiming Maryland: Confederate Nationalism in Popular Print Culture

Faculty Mentor: Dr. Anne Rubin

During the Civil War, Maryland occupied a unique position as a divided state in a divided nation. President Lincoln needed to keep Maryland in the Union because otherwise Washington, D.C. would have been surrounded, and the industrial powerhouse of Baltimore would have fallen to the South. At the same time, Confederates claimed Maryland as their own, using Maryland's plight as a powerful symbol of national aspiration. This research will focus particularly on the Southern reaction to Maryland's position as seen in popular print culture of the time: broadsides, editorials, political cartoons, and other manifestations. Rather than conducting a literary analysis of these artifacts on the micro-level, I will research how these broadsides reflected Confederate nationalist propaganda on the macro-level. An analysis of popular print media contributes to an understanding of the civil culture of nationalism in the Confederacy, and how Confederate ideals permeated beyond military or political actions. I will also investigate the relationship between Southern identity and Confederate Nationalism as

manifested by pulp writers during the Civil War. Understanding how these broadsides functioned in Confederate states reveals how nineteenth-century Americans consciously viewed their powers of persuasion.

How did you find your mentor for this project?

Dr. Rubin is one of my professors for my Humanities seminar on Abraham Lincoln's America. I researched a smaller version of my topic for the term paper in the class, and she suggested that I could expand it and apply for an Undergraduate Research Award.

How did you know this was the project you wanted to do?

For the Humanities seminar, we could write our term paper on anything relating to Abraham Lincoln or nineteenth century America. I knew I wanted to do something on Maryland during the Civil War, but historians have thoroughly documented the politics behind the secession crisis in Maryland. I talked with Dr. Rubin about other viable options for the term paper, and she directed me to a particular collection of broadsides that she used during the research for her book. When I investigated the Wake Forest Confederate Broadside Collection, I noticed that so many of dealt with Maryland, so I focused particularly on those 58. This project is the perfect fusion of politics and culture.

Is this your first independent research project?

Yes.

Do you get course credit for this work?

I got credit for the portion of my research that has to do with broadsides.

How much time do you put into it?

I have spent a considerable amount of time in the library reading. This summer, I plan on spending a week in Richmond in the archives researching. I think the most time-consuming process will be writing and rewriting an article, though.

How did you hear about the Undergraduate Research Award program?

I heard about the Undergraduate Research Award program when I was applying for the Humanities Scholar program as a high school senior. I remember older students describing their research grants in the humanities, but I never seriously considered a

URA until this semester.

What academic background did you have before you started?

I researched the Pratt Street Riots for a high school Maryland History Day project.

Was the application difficult to do?

Not particularly. The hardest part was balancing specificity with brevity.

How much did your mentor help you with this?

Dr. Rubin was especially helpful in estimating the amount of time and money I would need in Richmond. She did a lot of the research for her book in the Virginia Historical Society and Library of Virginia, so she was familiar with the logistics of conducting research there. She also reviewed my application and helped me set a realistic goal for the culmination of my research (submitting an article for publication in the Maryland Historical Magazine).

What is your advice to other students about getting involved in research?

Just do it! This is a wonderful opportunity for undergraduates to experience researching as a professional academic. Other universities don't have the money or faculty support for this kind of program. Start off by simply talking to other professors in your field.

What are your career goals?

I am torn between being a Russian spy, history professor, fashion designer, and housewife.

What has been the hardest part about your research?

The 24-hour-a-day system the world is running on.

What was the most unexpected thing?

Abraham Lincoln only received 2.1percent of Marylanders' popular vote in the presidential election of 1861.

How does your research relate to your work in other classes?

I think the broader questions of my research can be applied to any nation and any time period, and that is what's so great about history? How do ordinary people express themselves politically and form an identity? What is the relationship between identity and nationalism, culture and politics? Specifically, a lot of the broadsides use the spirit of the American Revolution to illustrate Maryland's virtue during the Civil War. I am currently in a class on the Revolutionary generation, and many of the broadside poets that I studied use the same rhetoric of the American Revolution.

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Priyanka Bushana, URCAD Presenter

Small Molecule Inhibitor of Anti-Apoptotic Proteins, ABT-737, in Glioblastoma Multiforme Stem Cells

Faculty Mentor: Gary Gallia, Avadhut Joshi

Glioblastoma Multiforme (GBM) is the most common and aggressive form of intracranial malignancies. Median patient survival remains at less than 15 months despite aggressive surgical, chemotherapeutic, and radiotherapeutic treatments. In this study, we hypothesized that part of GBMs' resistance to chemotherapeutics can be attributed to their high expression of anti-apoptotic proteins of the Bcl-2 family; therefore, targeting Bcl-2 would increase sensitivity of GBM cells to chemotherapy. To follow up on this hypothesis, we assessed the levels of Bcl-2 family proteins in GBM cell lines. We were able to conclude that Bcl-2 family proteins were significantly increased in GBMs grown as oncospheres as opposed to adherent serum-grown cell lines. Following these trials, we measured the efficacy of ABT-737, a small molecule inhibitor of these proteins. In addition, we tested the effects of ABT-737 in combination with receptor tyrosine kinase (RTK) inhibitors. The results were in accordance with our observations, as the ABT-737 treatment inhibited the GBM stem cells, but had little effect on the adherent cell lines. Furthermore, combination therapy demonstrated that sunitinib and ABT-737 synergistically inhibited GBM stem cells. These observations suggest that Bcl-2 can be targeted in GBM stem cells and warrants further investigation of ABT-737 in preclinical animal models.

How did you find your mentor for this project?

We met through a family friend. I worked during the summer of 2009.

How did you know this was the project you wanted to do?

I learned about the components involved in my project in genetics class and thought that the mechanisms were very interesting. Genetics was my first Biology class in college, so I was excited that the things that I had learned could already come into use only a month after I had finished the class.

How much time did you put into it?

It was a full-time job for the summer, but the work was very flexible. It depended on the stage of work that I was in and the amount of preparation that it took. There were some days when I would leave home at 8AM, and not be back until 9PM; and there were other days when I was done by lunch, and had extra time to look around downtown.

What academic background did you have before you started?

I had my first year of college behind me. As far as biology goes, I only had high-school and advanced placement biology completed, as well as Genetics at UMBC.

How did you hear about Undergraduate Research and Creative Achievement Day? Was the application difficult?

I heard about it when looking for grants so that I could continue my work in the coming years. The application was fairly easy because I had summarized my work already for presentation at my lab.

Were you nervous about presenting your work to a large audience? How did it go?

I was more nervous about having to generalize the specifics of the work I had done without overlooking things that were very important. It went pretty well, and everyone seemed very receptive.

How much did your mentor help you with this?

The adviser my mentor assigned to me was my go-to when I needed help. A lot of people in the lab also gave me advice and let me practice with them.

What is your advice to other students about getting involved in research?

Don't be afraid to ask. The worst thing that can happen is not getting a response back, or getting a "no" outright. If you're interested enough to ask about something, chances are that you should be able to find another lab that catches your eye anyway.

What are your career goals?

I would like to study medicine, and go into surgery.

What has been the hardest part about your research?

The hardest part was understanding what I was actually doing. The literature was very dense, and everyone working in the lab was at least five or 10 years older than me. They didn't expect me to understand everything I was doing, but I wanted to study and understand everything.

What was the most unexpected thing?

I didn't expect to have finished with such good results. The project seemed very daunting at the beginning of summer, and I did not expect to have finished it by the end of summer.

How does your research relate to your work in other classes?

My research has illustrated things I've learned in nearly every biology class I've ever taken, and some chemistry classes.

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Geoffrey Clapp, Mathematics and Computer Science

Modeling Sensory Input to the Lamprey Spinal Cord

Faculty Mentor: Dr. Kathleen Hoffman

NEW - Winner of the [National Science Foundation Graduate Research Fellowship](#)

We will develop a mathematical model of the central pattern generator (CPG) of the lamprey spinal cord in order to better understand the effects of sensory input on vertebrate locomotion. The lamprey, a relative of the eel, is a model system for studying vertebrate locomotion because its spinal cord contains the same types of neurons as its human counterpart, except in smaller quantities. Biological experiments have revealed that the lamprey's swimming behavior is modulated by input to the spinal cord from edge cells, sensory organs that measure the body's curvature. A mathematical model has become essential to advancing our knowledge on this topic because of the degree of complexity and precision required to obtain accurate experimental data. We will consider both neural and phase models of the CPG. In both cases, the CPG is represented as a chain of connected oscillators. However, a neural model provides representation for multiple groups of neurons within each oscillator, making it more biologically detailed than a phase model, which represents each oscillator by only one variable. Previous work has compared results from our neural model to results from an unrelated phase model. The goal of our project is to derive a phase model from our neural model using phase reduction techniques, which will allow us to make direct comparisons between the models. Our results will help us to determine the appropriate degree of biological detail for a model used to study the role of edge cells in the lamprey swimming behavior.

How did you find your mentor for this project?

I took Calculus III and a first year math-biology seminar with my mentor, Dr. Hoffman. During the seminar, she presented some of her research.

How did you know this was the project you wanted to do?

The seminar course really sparked my interest in applied math, specifically applications of math in biology. The project was a great opportunity to explore this field.

How much time do you put into it?

It really depends on what needs to be done, but I meet with my mentor weekly to provide a status report and to figure out what needs to be done next.

How did you hear about the Undergraduate Research Award program?

My mentor noticed it on the UMBC website and suggested that I apply.

What academic background did you have before you started?

I had completed courses in math-biology and differential equations. I had also learned Java, C, and Matlab through my coursework, which are important tools for mathematical modeling.

Was the application difficult to do?

No, it wasn't bad at all. Actually, completing the application helped me plan for next year's research.

How much did your mentor help you with this?

She provided me with resources on mathematical modeling and the important biology concepts and answered any questions I had.

What is your advice to other students about getting involved in research?

Definitely do it if you can; it's a great opportunity to immediately apply what you're learning in class.

What are your career goals?

I plan to get my Ph.D. in applied mathematics and to become a professor at the university level.

What has been the hardest part about your research?

The hardest part about my research is debugging the code. Sometimes we find a one character mistake that means that we have to redo months of work.

What was the most unexpected thing?

The most unexpected part of my research has been that five different universities are working together on this project. Our part of the project is modeling input to the spinal cord, and the other groups are working on fluid dynamics and muscle activity

involved in swimming.

How does your research relate to your work in other classes?

Almost all of my math and computer science courses have helped me to better understand various concepts in my research.

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Emily Doughty, Bioinformatics and Computational Biology

Improvement on Automatic Method for Mutation Extraction and Disease-Relationship Annotation for Mutations for the Biomedical Community

Faculty Mentor: Dr. Maricel Kann

Associating mutations with disease phenotypes is fundamental for developing novel tools for diagnosis and prognosis of cancer. Most of the mutation-phenotype relationships are buried in large biomedical literature databases such as PubMed. This [research](#) has two focuses. One is to improve the specificity of the automatic text-mining method Extractor of MUtations (EMU) which was created in Dr. Maricel Kann's lab to find disease-associated mutations. The second part is to use EMU for a semi-automatic evaluation of five diseases and categorize mutations that are not yet in the manual databases OMIM and SWISS-PROT. I will be working to increase EMU's precision of finding the correct gene per mutation (currently .75 precision) by associating genes to mutations based on proximity. For the second part of this work, I will be manually curating five diseases for mutational information and disease-association. The information gained from curation will be used to evaluate EMU's gene finding methods and

will be made available online for visualization for use for the biomedical community.

When and how did you find out about the URA program?

I found out about the URA program through my mentor about six months prior to the deadline. She mentioned it as a future possibility for fall research work especially since I had just completed a project in my lab.

Was the application difficult to complete? How much did your mentor help you with the application?

The application was very easy, you just need to make sure you have a clear focus, a definite goal and plan to achieve that goal. Basically, you just have to clearly state what you want to do, how you want to accomplish it, and so forth. It's especially important to have thought out your project thoroughly beforehand so your application is not vague and contains no ambiguity. My mentor reviewed my application when I completed it and offered any suggestions as needed. The whole process only took me a few days to complete.

How much time do you put into it?

I worked on the application over the course of a few days. I knew what I wanted to do, made a short list of points to include, and wrote the proposal. I found the process straightforward, quick, and simple.

What have you gained from being a URA scholar?

From working on my URA, I've gained research experience relating to the process of writing proposals, following that proposal, and staying on a deadline. I've also gained a multitude of information during the monthly URA meetings.

What is your most interesting research activity?

My most interesting research activity has been being first author on a paper that was just accepted into the journal Bioinformatics. On that project, we developed an automatic method that extracts disease-related mutations from the biomedical literature. I've been working on that project since June 2009 and to see it finally out there in the community is a major relief.

How did you know this was the project you wanted to do?

The work I'm doing is a problem that has bothered me since I started working on the EMU project in my lab. Being able to address it in some way has been a goal of mine for some time.

What academic background did you have before you started?

I am a bioinformatics major with minors in both computer science and statistics. I've worked in Dr. Maricel Kann's bioinformatics lab since June 2009. My URA work is my own continuation of a project I've been working on in my lab and was just published in Bioinformatics.

What has been the hardest part about your research? The most unexpected thing?

The hardest part (but should have been expected) was that when you get more into your work, your focus will shift slightly. It is very hard sticking exactly to the proposal you write since science (at least for my work, and I assume it is similar in other disciplines) can be unpredictable. Time lines change, you encounter lengthy problems and so forth. You should expect these problems to arise but this does not fully prepare you for when it does.

What is your advice to other students about getting involved in research?

Talk to students in research, ask your advisor about possible research opportunities in your department, and get in contact with the appropriate people. Also, make sure you have the time and commitment for a project - you can't start in September for example and then decide to stop coming in to the lab (or where ever your work is set up) and not contact any one.

What are your career goals?

I plan to continue on to graduate school towards a doctorate in bioinformatics. I'm not sure at this time what my specific focus will be. From there, I can continue in a research environment or be a resident bioinformatician for a lab.

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Meredith Donaho, Music and English

"Music for All:" After-School Private Education in Carroll County, MD

Faculty Mentor: Dr. Joseph Morin

Music is traditionally underfunded within the Carroll County, Maryland, school system and as a county-sponsored after-school activity. The recent economic downturn has only exacerbated this situation. In addition, many students, especially those living in the most rural and impoverished areas of Carroll County, lack the finances and access to private music instruction needed to reach their fullest potential and achieve life-long enrichment. This research project seeks to explore the creation and development of a volunteer program dedicated to providing individual music lessons to high school and middle school age youth in the Carroll County, Maryland region who cannot afford music lessons but who express a desire to learn an instrument. This research project will lay the groundwork for the development of this program and is divided into three related endeavors: (1) to carry out a needs assessment survey to convey the necessity for such a program, (2) to research similar programs dedicated to music instruction to gain insights and knowledge on how to operate an arts education program, and (3) to conduct research centered on the acquisition of non-profit status for this program, which will be vital for fund raising.

What have you gained from being a URA scholar? What is your most recent (or most interesting) research activity?

Right now I am in the process of creating a volunteer program to provide disadvantaged youth with the opportunity to start involvement learning a musical instrument by providing them with one or two free half hour lessons. I have found many people

within the community who are helping me out, including church members who are allowing me to use churches as sites for the volunteer program. Many parents who I have come into contact with and and spoken to about my project have helped me get the word out about the volunteer program; so far I have been met with a lot of positive feedback from parents and kids who want to learn music but who lack the financial means to do so which has encouraged me to work harder and go farther.

I have gained a lot of insight into the long process of creating a nonprofit, including the forms and paperwork that must be submitted and approved by the IRS. I have also made contacts in the community with others who have created nonprofits.

How much time do you put into it?

During the fall semester I didn't have a lot of time to spend working on the project, but I am making up for it now during the winter break. During the fall, I still continued researching existing nonprofits and contacting directors, spending about an hour a week or less doing so.

When and how did you find out about the URA program?

I found out about the program through my music professor Dr. Morin, who advised many other music students who have been past URA scholars. He encouraged me to apply for the URA, helped me with the proposal writing process and is my mentor for my research.

Was the application difficult to complete? How much did your mentor help you with the application?

The application was not difficult at all. Writing the proposal took some time, I started writing it about two months prior to submitting it. Dr. Morin, my mentor, helped me to revise and edit what I would write which helped me to explain my plan as concisely as I possibly could.

What is your advice to other students about getting involved in research?

Find a professor who will be your mentor for your research early on, and explain your ideas to them, they can also help you expand your ideas. Also, start writing your proposal early because the process of editing, deleting some ideas, and getting your proposal to the point where it will be accepted can take some time. If you have a great idea for research don't be afraid to pursue it; you never know how far your idea can take you.

What are your career goals?

I would like to work in the nonprofit sector, particularly in the arts, either as a grant writer or director for an organization in addition to teaching guitar.

What academic background did you have before you started?

I am a senior majoring in English and Music, I had no prior experience working with or knowing anything about nonprofits. My research has enabled me to learn how nonprofits, particularly for the arts, work, operate, and benefit the community with hands-on experience and involvement in the community.

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Sabah Ghulamali, Gender and Women's Studies

Reexamining Burden: Describing Children Living with HIV Positive Adults in Kenya

Faculty Mentors: Dr. Susan Short and Dr. Nancy Luke

In 2003, 6.7% of Kenyan adults were HIV positive. With antiretroviral therapy, HIV positive adults are likely to survive longer than previous generations, but will still experience compromised health due to disease progression. Yet, the prevalence of children living with an HIV positive adult has not yet been described. This project analyzed the prevalence of children in Kenya residing in a household with an HIV positive adult across several household covariates, including residential area, wealth percentile, and number of household residents. The data used was from the 2003 Kenyan Demographic and Health Survey (DHS), and the sample consisted of children ages 0-14 who lived in households where adults were voluntarily tested for HIV/AIDS. We found that 6.8% of children live with an HIV positive mother, 6.0% of children live with an HIV positive father, and 9.3% of children live with any HIV positive adult. Children in HIV-affected households are significantly more likely to be wealthy, live in urban areas, and

live with fewer people. Overall, this research highlights the importance of altering perspectives to describe youth, particularly children who may be burdened with care-giving responsibilities.

How did you find your research program and project?

I found the Leadership Alliance website through the Office of Undergraduate Education's website on summer research opportunities. I applied and was accepted for a Summer 2010 program with the Population Studies and Training Center at Brown University in Providence, RI. The program was like a full-time job for nine weeks of summer. I got into the computer lab at nine a.m. and left around five or six p.m.

Was the Leadership Alliance application difficult to do?

It was not difficult per se, but it was very long. I had to explain all my college experiences thus far, clearly illustrate my research interests, and pick my internship site.

Did you have a choice about the project you worked on at Brown? How did you decide?

After reviewing a number of possible projects with my mentors, I decided on this specific research topic for a number of reasons. Firstly, it was a really exciting project to work on. I really felt like we were breaking new ground by describing who these children were. Secondly, it was a feasible project in the amount of time I had (nine weeks). Thirdly, would be able to challenge myself. I do not normally do quantitative research, so I was learning something new every day.

What was the hardest part about your research? The most unexpected?

The hardest part was learning how to use statistical analysis software! It was definitely a challenge. I was surprised and extremely happy when I realized that the Leadership Alliance was going to provide its interns with so much insight into graduate school. We received practice GRE exams, heard lectures from professors and grad students, and visited other campuses, including Harvard.

Is this your first independent research project?

No. I was a third year Gender and Women's Studies major at the time of application. I had received an Undergraduate Research Award for a mixed-methods project on student response to UMBC's resources for sexual assault.

Do you get course credit for the summer research?

No, though I did receive a notation on my transcript.

What was your mentor's role in your summer research?

I was given the rare opportunity to have two amazing mentors for my summer project. They reviewed my day-to-day work, constructively critiqued my presentation, and offered advice on applying for graduate school. I had space to take my research in the direction I wanted, but they were always there to guide me along.

What is your advice to other students about getting involved in research?

I think some of the most successful student researchers I met are those who believed in their project 100%. It does help to have your heart and soul invested in the issue.

What are your career goals?

I don't know if I will teach at a university or work only out in the field.

How does your research relate to your work in other classes?

My specific topic—children living with an HIV-positive adult in Kenya—does not directly inform my other classes. However, it provides a global setting in which to contextualize new knowledge. Also, conducting this research project from start to finish meant writing a proposal, getting data, running analyses, conferring with others, making a PowerPoint, and presenting in a conference. All of those skills will come in handy in my other classes.

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Neeti Goel, SURF Scholar

Detection and Differentiation of Bacillus Endospores using Fluorescence Spectroscopy

The threat of bacterial pathogens, such as the anthrax-causing *Bacillus anthracis*, as biological weapons has made it more urgent to understand the mechanism and properties of bacterial endospores. In harsh conditions the bacterium transforms into endospores which can remain dormant for many years and then germinate in favorable conditions, such as a human host. A detailed understanding of certain spore characteristics can help improve the methodology and instruments used by first responders in a biohazard emergency to ensure rapid, accurate, and non-invasive detection. This study attempts to use the characteristic of intrinsic fluorescence to differentiate molecular species by their unique spectra. The effects of certain germinant nutrients and temperature on the growth and germination of the *Bacillus* spores were also characterized. A comparative analysis was done of the spectra of different strains of *Bacillus thuringiensis* and *Bacillus cereus* (both simulants for *Bacillus anthracis*) grown in three different growth media. After several calibration curves of Dipicolinic acid (DPA) and DPA complexes were created, the samples were scanned for these endogenous fluorescent molecules. Measurements of the concentration of the fluorescent DPA complexes were used to follow the germination of the spores.

How did you find out about SURF (Summer Undergraduate Research Fellowship)?

This was my second summer at NIST, I first found out about NIST through online research.

How did you know this was the laboratory you wanted to work in?

I read about all the labs on the NIST web site until I found the right lab. I was interested in biochemical research having done it in the past.

Is this your first independent research project?

I was a part of the SURF program last summer and have worked in a drug design laboratory at the Emory University School of Medicine.

How much time do you put into it?

SURF is an eleven-week summer program, 40 hours per week.

What academic background did you have before you started?

I had completed two years toward my degree, a B.S. in Biological Sciences before going to NIST for Summer 2010.

Was the application difficult to do?

The application was very user-friendly.

What is your advice to other students about getting involved in research?

For summer internships, start the process the fall semester before. Ask your professors for a recommendation letter well in advance and have your resume and cover letters reviewed by someone before you submit them.

What has been the hardest part about your research?

Data analysis and designing further experiments to test or narrow conclusions made from current experiments.

What was the most unexpected thing?

I was surprised at how much I enjoyed working in the lab. I didn't mind working late into the afternoon because I really enjoyed what I was doing.

How does your research relate to your work in other classes?

My science classes definitely gave me a background to help me further learn and understand the advanced concepts required to do this independent project. In particular I used material I had learned from organic chemistry, physics, and cell biology.

[\(Top\)](#)



Casey Gray, English and Secondary Education

"Americanized Pedagogy: Journey to El Salvador"

Faculty Mentor: Dr. Jean Fernandez, Dr. Lucille McCarthy

English as a Second Language and Bilingualism are relatively virgin fields of study to applied linguists, language acquisitionists, and educators alike. Due to the growing emphasis on multicultural education in primary and secondary classrooms in North America, it has become my goal to teach and attain from first-hand experience, contemporary techniques for English language and literacy development in multicultural settings with an emphasis on social justice and solidarity. I am interested in uncovering how and in what ways my teaching pedagogy has become Americanized and the positive and or negative implications that cultural background could have on the language learning of students from the Salvadoran cultural background. It will then be my task to take what I have learned and apply it at home. It is my belief that some of the best works of informative literature as related to teaching are not merely scholastic and technical in form, but are also uniquely written in a free and creative style. Therefore, I will weave together my experience and research with daily Salvadoran life into a travel narrative as I take on the role of volunteer teacher of English at The Melida Anaya Montes Language School of the Centro de Intercambio y Solidaridad (Center for Exchange and Solidarity) for nine weeks. I will also participate in Spanish language classes which will allow me to experience and evaluate the role-reversal that will take place when I become the American student in a Hispanic cultural setting instead of the teacher. This will serve as a great balance of perspectives. In my study and experience, I will take a social constructionist perspective with an emphasis on transformation pedagogies and education as a practice of freedom.

When and how did you find out about the URA program?

I first learned about the URA program through the Shriver Center in the spring of 2010, which marked the first semester of my senior year.

What have you gained from being a URA scholar? What is your most recent (or most interesting) research activity?

Being a URA scholar has grown me as an individual in a few different ways. It was a new experience to conduct broad-scale, intense, or experiential research as did while teaching English as a Foreign Language in El Salvador. Undertaking and successfully completing this task through all the long hours and language barriers has built so much more confidence in me. I have completed a task that a few times I wanted to give up. It has given me a sense of pride, well-roundedness, and tangibility of the future.

How did you find your mentor for this project?

I chose a mentor who I knew to be committed to high achievement, who I respected, and who I already had a relationship with. As I progressed with my research, I asked for the opinions and research expertise of a second professor whom I also valued. Both mentors took the time to review my work repeatedly to help me achieve my best.

How much time do you put into it?

In some respects, this project was like a part time job. If you want to produce quality, you can't forget the quantity.

What academic background did you have before you started?

Before beginning the project, I had a few years of experience teaching teens and children, but I had never taught English as a Second Language before.

What has been the hardest part about your research? The most unexpected thing?

The hardest and most unexpected part of my research was accepting and adjusting when things did not go quite as planned.

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Krystyna Horn, Biological Sciences

Sexual Signaling With Colored Pigments: Are Eastern Meadowlarks Hiding Costly Carotenoids?

Faculty Mentor: Dr. Kevin Omland

My goal is to examine the evolution of coloration with a specific interest in sexual signals. Eastern Meadowlarks express yellow pigments in the feathers of the breast, but a small area - in the shape of a V - is black. Two possible hypotheses explain this: (1) Carotenoid expression has been lost from an ancestral state or (2) Carotenoid expression has been retained "under" black pigments. If carotenoid expression has been lost, then this would suggest that depositing carotenoids in feathers is costly. Birds and animals are unable to synthesize carotenoids de novo, so they must be obtained from a dietary source. As previous studies have indicated that the expression of carotenoids is a costly sexual signal (McGraw 2006), then it would also be costly to deposit carotenoids that are masked in certain areas of the body. In a related species, the Bullock's Oriole, black feathers from the nape were found to have underlying orange coloration when bleached (Butcher & Rohwer 1989). This suggests that the Eastern

Meadowlark may be masking carotenoids with its black breast feathers. This research will determine the presence or absence of carotenoids in the black breast feathers to better understand the evolution of sexual signals and the costliness of expressing them. This might help explain the variety of colors and patterns we see in birds.

When and how did you find out about the URA program?

I attended URCAD last year on the suggestion of one of my professors. I heard about the URA program this year from my lab mentor who suggested I submit a proposal.

Was the application difficult to complete? How much did your mentor help you with the application?

The application is very straightforward and not difficult to complete. Aside from providing guidance with my research prior to applying, my mentor assisted me with the application by guiding me in writing an abstract and proofreading the application before submission. Overall, I did not require a great deal of help to complete the application.

What have you gained from being a URA scholar? What is your most recent (or most interesting) research activity?

How did you find your mentor for this project?

I have definitely learned how important it is to be organized and methodical regarding research. I worked in my mentor's lab for a semester assisting a graduate student before he suggested that I apply to be a URA scholar. Most recently I have been completing the last stages of my research, organizing my results, and putting together all of the information for review by my mentor.

How did you know this was the project you wanted to do?

I had worked with a graduate student in a similar area (carotenoid coloration) and found that I was quite interested in the subject. My mentor suggested a direction for my research that would complement or confirm the data that the graduate student I had worked with had found and once I started working on it I knew it would be interesting to look at the overall results.

How much time do you put into it?

The majority of my research took place over the Summer and the beginning of the Fall semester.

What academic background did you have before you started?

I have been studying biology at UMBC since 2008, but I had little experience in Ornithology (aside from what I learned in Ecology & Evolution) until I started working in Dr. Omland's lab in 2009.

What has been the hardest part about your research? The most unexpected thing?

The hardest part about my research has been maintaining a high level of organization in my data.

How does your research relate to your work in other classes?

My research related quite well to the work I did in BIO 483 (Genes to Genomes) regarding the skills I needed to research and answer questions.

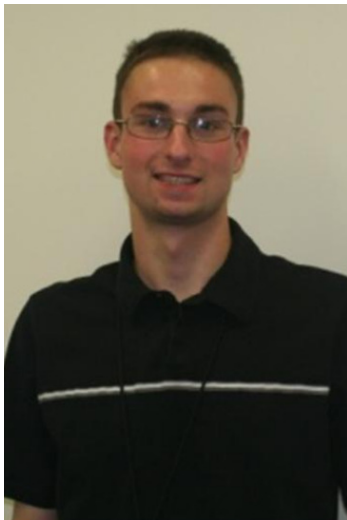
What is your advice to other students about getting involved in research?

Definitely go for it! There is nothing more rewarding than taking control of research in an area of your interest.

What are your career goals?

I hope to take a different route and research Linguistics at graduate school.

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Christopher Iglehart, Mechanical Engineering

Residential Appliance Energy Research

Location: NIST (National Institute of Standards and Technology) Gaithersburg, MD

Program: [SURF \(Summer Undergraduate Research Fellowship\)](#)

Laboratory: Building and Fire Research

Consumer appliances account for a significant portion of home energy use. NIST develops testing and rating procedures for residential appliances. Manufacturers use these procedures to determine values such as estimated yearly electricity use and operating cost for appliances. These values are printed on the yellow EnergyGuide labels and enable consumers to compare the efficiency of appliances. The development of new appliance technologies in recent years has created the need to revise test procedures for dishwashers, clothes washers and clothes dryers.

My work this summer (2010) was divided into two phases. The first involved an assessment of publically available survey data on the usage of consumer appliances. I contacted companies and organizations to obtain relevant data. The data was then analyzed to acquire information that will assist in the revision of the procedures to accurately reflect current consumer appliance usage habits.

The second phase of my summer research involved the design of a new residential appliance test facility at NIST. The test facility will include a number of representative appliance models, as well as data monitoring equipment. A future goal is to implement automation of the test facility, and the requirements for this task were investigated. The test facility will enable NIST engineers to analyze and verify proposed test procedure modifications before they are published.

How did you find out about SURF (Summer Undergraduate Research Fellowship)?

I received an email from the Mechanical Engineering department. I was interested in working at NIST over the summer, and this seemed like a good opportunity to pursue that goal.

How did you know this was the laboratory you wanted to work in?

I was looking for a research opportunity that would be relevant to my degree. Building and Fire Research seemed like the best fit for my skill set.

Is this your first independent research project?

No. I worked on a four-year science project in high school regarding aerodynamics and hydrodynamics.

How much time do you put into it?

The summer SURF fellowship is full time for 11 weeks.

What academic background did you have before you started?

I had completed my third year of school when I began this research.

Was the application difficult to do?

No. The application process was very easy and straightforward.

What is your advice to other students about getting involved in research?

Take the time to find out about the opportunities available to you. There is a lot out there. I would suggest blocking out time during the fall to gather information on different summer programs and to read any information available on the kind of work that is performed at a given location.

What has been the hardest part about your research?

Locating and chasing down sources of information was a frustrating process. Many times, the information was private or simply unavailable.

What was the most unexpected thing?

I was surprised at how much progress I was able to make. Early on in the process, I was getting very discouraged at some of the difficulties that I was running into. With enough effort, those problems worked themselves out.

How does your research relate to your work in other classes?

I utilized knowledge from a number of my classes to perform my work. In particular, I was able to apply knowledge from statistics, thermodynamics, and engineering design. I also anticipate that knowledge from future classes would be useful if I were to continue this work.

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Megha Jacob, Music Education/Pre-Physical Therapy

The Incorporation of Music Therapy into Physical Therapy Sessions for Physically Disabled Children

Faculty Mentor: Dr. Airi Yoshioka

This research will assess the effects of introducing music therapy (MT) into physical therapy (PT) sessions. Physical illness due to genetic and/or environmental factors (such as Down syndrome or car accident injuries, respectively) can be traumatizing. This is especially true with children because they are expected to cope with so much at a young age. Therapy sessions can be intense and draining for patients and can take a toll on their psychological state. MT, which promotes wellness in individuals by offering therapeutic benefits to the mind through the use of musical involvements, can help offset the psychological fatigue associated with PT. I plan on researching the specific types of physical disabilities for the children at the schools/institutions, so I can better understand the limitations and hazards of each disability. I also plan on attending educational workshops based on music, education, and therapy so that I may work under licensed therapists with both clinical and work experience. I wish to create innovative therapy techniques to incorporate music into therapy sessions by utilizing kinesthetic techniques to respond to sounds, creating group exercises to heighten social skills, and encouraging patients to compose and perform songs to help relieve stress and stimulate their minds. The goal of my research is to examine whether or not the combined use of PT and MT in therapy sessions is positively correlated with the patient's mental and physical well-being.

How did you find your mentor for this project?

I thought Dr. Yoshioka would be the best person to be my mentor because she is in charge of the education emphasis in the music department at UMBC. I have had the opportunity to sit in her classes and hear of her teaching from other students. She uses a variety of innovative teaching techniques in classroom settings and any help from her will be valuable.

How did you know this was the project you wanted to do?

Since my undergraduate career at UMBC, I have always wanted to pursue my passion in the sciences and arts. Upon completing two internships at Kennedy Krieger, I wanted to incorporate music therapy and physical therapy in a clinical setting. After hearing about the URA program, I realized that this was a best time to begin my exploration of these two fields of study.

Do you get course credit for this work?

I do not earn credits that go towards my graduation, however this research offers opportunity for me to earn credits in graduate school.

How much time do you put into it?

I have only started the first phase of my research which involves attending workshops, reading books related to physical therapy and music therapy. So far I am spending about four to six hours a week. Once I begin the clinical research in the fall, I am certain I will spend more than double the hours.

How did you hear about the Undergraduate Research Award program?

I have attended the URCAD presentations for the past few years, and I met a few student presenters who were also in the URA program and they introduced me to it.

What academic background did you have before you started?

I am majoring in Music Education and Pre-physical therapy and minoring in Biology and Psychology. My academic background in each of these subjects allows me to combine not only biology and music but also psychology and education.

Was the application difficult to do?

Not at all.

How much did your mentor help you with this?

Very much. She has mentored other URA applicants in the past so she knew what to expect in the application process. Whenever I needed help with any aspect of the research, she would always make time to answer my questions and guide me.

What is your advice to other students about getting involved in research?

My advice to other students is that if you have any creative ideas, you should definitely get involved in research. Although the URA program is a well-known and acclaimed program, it should not intimidate anyone from sharing his/her ideas. It is a remarkable opportunity for the students to have their research funded by the school. This program is a great way to begin and/or continue one's research and I say if you have an idea or plan . . . work towards making that dream a reality.

What are your career goals?

Upon completing my undergraduate studies, I plan on attending graduate school for the doctoral program in physical therapy. Then, I want to pursue my masters in music therapy. After attaining my education in physical and music therapy, I want to open a clinic in which innovative therapeutic techniques are offered to patients. I wish to use a combination of music, physical, and various other therapies for the patients.

What has been the hardest part about your research?

So far, the hardest part has been trying to understand different disabilities and create various therapies which involve both music and exercise. I think one of the hardest parts will be assessing the effects of each therapy session and improving it to yield better results.

What was the most unexpected thing?

So far I have not been faced with any surprises. Part of the excitement is that I do not exactly know what to expect.

How does your research relate to your work in other classes?

My research will be very much related to my music education classes, because I am taught to make lesson plans and also improvise in a classroom setting. During clinical research, I know that therapies may not work the way I imagined or planned it. And when that time comes, I will have to improvise on the spot and find a more effective technique. I will use my knowledge from my human anatomy classes to plan the exercise therapies accordingly with the physical disabilities in mind.

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Natee Johnson, Mechanical Engineering

X-Ray Study of Nano-Scale Superlattice Materials

Faculty Mentor: Dr. Fow-Sen Choa

Nano-scale superlattice (SL) based devices, such as quantum cascade lasers QCLs, have recently become very important due to their capability to identify toxic and explosive chemicals. In manufacturing these Mid-IR photonic devices, atomic-level scanning tunneling microscopes (STM) and transmission electron microscopes (TEM) have been used to characterize the growth quality of superlattice wafers. However, these methods yield observations that are localized and cannot view the entire structure and even now we have not been able to correlate these measured crystal lattice images with device performance. The x-ray scanning technique has greater likelihood of success given that it can observe not only the localized but also the entire superlattice structure. By extracting special features and key parameters in x-ray diffraction patterns, the epitaxial quality of QCL superlattices can be evaluated and correlated to the performance of fabricated QCL devices. We can then differentiate and classify different grades of wafers before starting device fabrication and testing. In this work, we use X-ray diffraction techniques and Fourier analysis as tools to study and compare grown SL wafer quality. The aim is to provide immediate feedback to QCL growers in order to improve their successive growth runs without waiting 3-4 weeks for device processing and testing, given that poor wafers will be immediately eliminated, and performance for all other wafers can be anticipated prior to fabrication.

How did you find your mentor for this project?

In class, one of my engineering professors offered to help interested students apply for the award and have him as a mentor on projects he was prepared to move forward.

How did you know this was the project you wanted to do?

It was outside of my current field of study, but I knew that it would strengthen my skill set and knowledge of this area in preparation for graduate school studies.

Is this your first independent research project?

No, I've completed several other research internships during my summers where I was given something to investigate and was able to take the research as far as I could.

Do you get course credit for this work?

Yes, I asked my professor if he could register me for an independent study so that the credit would show on my transcript and I would have time in my schedule allotted specifically for research.

How much time do you put into it?

The project is not in full blossom at the moment because I am participating in another program for the summer. I anticipate putting in at least 10 hours a week during the semester, but realistically, it will be whatever is demanded to complete the work in a timely fashion.

How did you hear about the [Undergraduate Research Award](#) program?

I had seen advertisements for it on myUMBC and around campus. I also have friends that participate who told me about it.

What academic background did you have before you started?

I started in the second semester of my fourth year. I am a mechanical engineering student, but the focus of my study is materials science under the mentorship of a Computer Science and Electrical Engineering professor. I have taken material science courses and circuits, but the advanced courses that will help me with this work will be taken in the semesters to come.

Was the application difficult to do?

No, I feel the application process was great because it helped me attain a greater understanding of the project and practice communicating the idea to others. The questions were excellent, straightforward, and not overly demanding.

How much did your mentor help you with this?

My mentor helped a significant amount because he formulated the idea and helped me groom it into a proposal. I don't believe I would have been as successful without his patience and superior understanding of the material.

What is your advice to other students about getting involved in research?

I would encourage involvement in research because it is a great way to sharpen your critical thinking skills, as well as see coursework as a means to expand knowledge and not solely validate oneself with high scores. It's also great for getting to know professors and vice versa. At some point, everyone will need letters of recommendation and having extensively worked with a professor beyond the classroom is a wonderful way to strengthen it. Also, keep an open mind. Many opportunities are overlooked because the right buzzwords were not attached. Do yourself the service of really looking into something you think you aren't interested in, if only to confirm that you aren't, but possibly to discover a perspective you may not have otherwise considered.

What are your career goals?

Ultimately, I would like to be a professor and really have a hand in education of young people in STEM fields. Prior to that, I would love to travel the world to learn other cultures and languages and somehow incorporate that into my teaching experiences.

What has been the hardest part about your research?

The hardest thing is trying not to learn everything at once, meaning keeping a healthy pace when taking on a new topic. It can be frustrating, but an even stride is more fruitful than a rushed one. It's also difficult to accept the fact that "science" is a living thing that requires time like anything else. Rushing through experiments and simulations isn't possible if you actually want to conduct them well.

What was the most unexpected thing?

Setbacks are always unexpected. If that weren't the case, we would never have them. Things break, ideas don't work, people really can forget to move the decimal point, and technology isn't flawless. Given that, the most important thing is to stay flexible and encouraged. It's a great quality to be resourceful and it really helps when things don't go as expected.

How does your research relate to your work in other classes?

It's an interesting place for me to be in when I say to myself "I wish I took Orgo Chem." (I would never wish that for myself without just cause.) The very basics of what you learn in class are the foundation of research. A lot of times you're taking fundamental concepts and trying to create new ones. I say with bitter sweetness that I have used all my classes in the course of my research. The bitter part is that I wish I would have known that before I took the class. All the classes, from chemistry to statistics, psychology to phys ed, have helped in some way. Either in performing molar conversions, analyzing data, dealing

with people, or simply maintaining one's health as to remain a functional member of the team, I have called upon lessons from these courses.

[\(Top\)](#)



Achsah Joseph, Interdisciplinary Studies

The Effectiveness of Aid Organization in Northern Uganda

Faculty Mentor: Dr. Devin Hagerty

The decades-long conflict in northern Uganda has negatively impacted the Acholi people. Their children have been kidnapped, their villages have been destroyed and their farms have been razed. Most of the people now live in Internally Displaced People camps. Many non-profit organizations have responded to this crisis, providing aid to the Acholi people and homes for former child soldiers. However, the effectiveness, sustainability and impact of these aid organizations have not been researched. Looking at the impact of these aid organizations will identify what strategies and aid are most helpful to the people in northern Uganda, which can improve the amount and type of aid provided. Improving the aid that the Acholi people receive, and ensuring that it is sustainable, will help reconstruct society and structure in the war torn regions of northern Uganda.

How did you find your mentor for this project?

I took International Relations and a First-Year Seminar on the U.S. and Iran with Dr. Hagerty. My project has to do with international relations and political science so I thought Dr. Hagerty would be the perfect mentor.

How did you know this was the project you wanted to do?

I have been interested in the conflict in northern Uganda for several years now and work with several non-profit organizations that serve in the area. Since I want to go into the non-profit sector, I wanted to research the effectiveness of non-profits in this area.

Is this your first independent research project?

No, I have researched human rights in Iran and food scarcity issues in Darfur, Sudan before.

Do you get course credit for this work?

Yes, I will be doing this project in conjunction with my study abroad program in Uganda.

How much time do you put into it?

I will be spending four months in Uganda and Rwanda, and expect to prepare beforehand.

How did you hear about the [Undergraduate Research Award \(URA\)](#) program?

I've heard about it from the Honors College and several professors.

What academic background did you have before you started?

I've taken classes that look at human rights issues and organizations that work in different communities.

Was the application difficult to do?

The hardest part was turning it in on time!

How much did your mentor help you with this?

Dr. Hagerty gave great feedback on my proposal and helped me brainstorm ways to improve it.

What is your advice to other students about getting involved in research?

The URA is a great way to get started, so do it!

What are your career goals?

I want to work for an international non-profit organization as an advocate for victims of civil war and genocide. I also plan on getting my master's degree in International Affairs.

What has been the hardest part about your research?

I expect the hardest part of my research will probably be finding people to interview in Uganda.

What was the most unexpected thing?

That I get to go to Uganda! I've wanted to go for a really long time so I'm excited that it's actually happening.

How does your research relate to your work in other classes?

Most of my classes relate to international relations, human rights or intercultural communication in some way, which is integral to my research.

[\(Top\)](#)

**Rima Kikani, English***Genetic Pathways Involved in Retinal Degeneration***Faculty Mentor:** Sally Shivnan and Rivka Rachel

Retinal degeneration affects over 1.5 million people each year worldwide. Although we have mapped the genetic causes of the condition, the underlying cellular mechanisms behind photoreceptor cell death are not well understood. Homologous genes that trigger retinal degeneration have been identified in mice, allowing us to examine the biological changes that occur in a non-human species. We studied and grouped all the mutants according to rate and severity of photoreceptor function loss. This project analyzed tissue loss through cell morphology and histology, localization of phototransduction proteins by immunohistochemistry, and altered photoreceptor function by electroretinography. Our results indicate that mutants associated with rapid degeneration (rd1, rd4, rd10, rd16) control phototransduction and ciliogenesis. They generate missense mutations without terminating DNA translation and are linked to autosomal dominant retinitis pigmentosa in humans. On the contrary, mutants tied to intermediate (rd2, rd3, rd5, rd8) and slow (rd6, rd7, rd9, rd12) degeneration monitor general cell growth and development. They create base-pair deletions and substitutions that do cause premature termination of the polypeptide chain and result in autosomal recessive retinitis pigmentosa in humans. The goal is to identify mechanisms that we can apply to treat human retinal degeneration.

When and how did you find out that you could do independent research or creative work as a UMBC undergraduate?

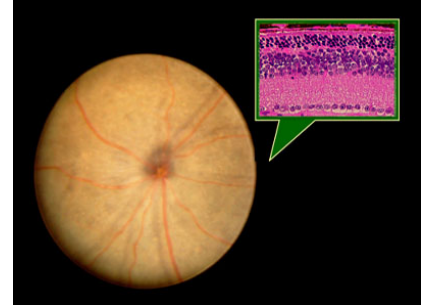
Before I even entered UMBC. It was one of the things that drew me here; I've been doing research since before I came to UMBC.

Who is your research mentor?

My primary mentor is my supervisor at the National Institutes of Health (NIH). My project is actually the work I'm doing at NIH. My on-campus mentor Sally Shivnan (English Department) advised me while I was working on my manuscript.

Can you describe your research?

I'm researching the genetics of retinal degeneration. Researchers have found 16 mutants that degenerate the retina. While there is a lot of research done on the individual mutants, up until now, no one had combined the data and analyzed everything as a whole. The purpose of my project was to piece the segments together and see what insight that would provide into human retinal degeneration.



How much time did you put into this research? Did you have a background in this area?

I have worked on this project for the past two years. The 25 biology and chemistry credits I took built a nice foundation for me.

How does your research/creative work relate to your work in other classes?

It doesn't. I'm an English major and I've finished my science credits. Science writing is poles apart from drafting English papers.

What has been the hardest part about your research/creative work? The most unexpected thing?

Being patient is the hardest part about research. Most unexpected: after I completed my project, the lab's senior scientists asked me to write a manuscript (as first author) of a scientific paper that would be published in an international journal focusing on ophthalmology.

What is your advice to other students about getting involved in research?

Go for it. It's more rewarding than you would think, and the experience sticks with you for the rest of your life.

What are your career goals?

I'm an English major and a double-minor in Political Science and Rhetoric & Communication. I'm going to start law school this fall.

How did you decide to present your work at URCAD this year?

I presented my manuscript at NIH last summer and my mentors encouraged me to present it here as well.

Was the application difficult to complete?

No!

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Nathaniel Kim, Chemistry and Political Science

Tricyclic Carbonucleosides as Medicinal Agents for HCV Polymerase

Faculty Mentor: Dr. Katherine Seley-Radtke

One of the major public health risks in the world today is the Hepatitis C Virus (HCV). The current standard therapy for HCV infection, co-treatment with interferon-a-2b and ribavirin, has shown low efficacy and side effects, pointing to the need for new and more efficacious treatments. In order to develop novel candidates against HCV that exhibit greater inhibition than current treatments while minimizing cytotoxicity and side effects, we have designed and synthesized a series of tricyclic nucleoside analogues that have strategically designed features that should prove highly beneficial. These tricyclic purines nucleosides feature a carbocyclic ring in place of the ribose moiety. This structural modification increases both the nucleoside's stability towards cellular repair enzymes and its ability to cross membranes, both of which are problems associated with ribose analogues. A second modification has been incorporated into the tricyclic base; replacement of the N-7 nitrogen provides a 7-deaza pyrrole moiety. A number of 7-deaza compounds have been shown to be potent inhibitors of HCV while maintaining low cytotoxicity. Thus, combining these two structural attributes with that of known tricyclic nucleoside HCV inhibitors should synergistically result in increased anti-HCV activity.

How did you find your mentor for this project?

I e-mailed professors whose research interested me. Dr. Seley invited me into her lab as an undergraduate researcher. I have worked with her on research since the start of sophomore year.

How did you know this was the project you wanted to do?

I learned during a summer internship at NIDDK/NIH that synthetic chemistry was something I might want to pursue. My research in the Seley lab is, now, primarily synthetic chemistry.

Do you get course credit for this work?

I got three credits for CHEM 499 for the fall and spring semester.

How much time do you put into it?

I spend about 15 hours in the lab every week. With any type of research, and even more so with undergraduate research, the research project goes as far as the time you're willing to put into it. Plus, I enjoy being in the lab and doing what I do.

You have a \$1,500 [Undergraduate Research Award](#) from UMBC for your work. How did you hear about this program?

Dr. Seley and a couple of my friends who previously won a URA encouraged me to apply.

Was the application difficult to do?

The application itself was a good experience to go through. It helped me to fine tune my thoughts and proposals on a possible research topic in a coherent manner. This ability becomes very important if you go on to further research, especially when you're applying for other scholarships and research grants.

How much did your mentor help you with this?

My mentor facilitated my research, the research project I worked on, and made sure I was not overwhelmed. The research itself is primarily my own.

What is your advice to other students about getting involved in research?

You can't get into a research group as an undergraduate if professors don't know who you are. If you're at all interested in conducting research, find what research topics might interest you and e-mail professors who you feel fit you best.

What has been the hardest part about your research?

Time management. I have a lot of other responsibilities as a Desk Staffer and SGA member. Being able to balance my time is something I've had to learn.

What was the most unexpected thing?

Everyone will hit the proverbial wall when they conduct research, where everything seems to come to a screeching halt. This wasn't unexpected but it was something that I had to push through and stay dedicated to.

How does your research relate to your work in other classes?

I've used several techniques from Organic Lab and Biochemistry and built upon other research techniques that I already knew. You're not expected to know everything when you enter a research group, but it's good to know the basics.

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Emily Kimak, Interdisciplinary Studies

Dance, Sustainability, and Ecology Research at the SEEDS Festival

Faculty Mentor: Ms. Carol Hess

This research will include a literature review of environmental art and dance and a 10-day conference called SEEDS: Somatic Experiments in Ecology, Dance and Science, in Plainfield, Massachusetts in July 2010. Upon my return from the SEEDS festival I will draw from my research of experimental dance-making, Body-Mind Centering, improvisation, ecology, environmental sustainability, and environmental art to compose my Interdisciplinary Studies capstone project consisting of a research paper and site-specific performance. I will explore an environmental issue using choreographic and improvisational methodologies learned at the SEEDS festival, and the entire performance process will establish an environmentally sustainable model, unlike traditional modes of dance performance. I will document my creative research process and final artistic product through photography, video and a dedicated public blog.

How did you find your mentor for this project?

As an Interdisciplinary Studies major, I have three advisors. Because I take many dance courses, one of my advisors is Carol Hess. I have taken many dance courses with her since I entered UMBC as a transfer student and she has continued to provide great support and inspiration.

How did you know this was the project you wanted to do?

I was sure from the beginning that my project was meaningful in the present, and that I will use what I learn throughout my future career. In addition, the concept formed as a result of several courses I have recently completed, in which my perspective on art, society and the natural world has shifted significantly. Projects in these classes inspired me to pursue research that is more substantial.

Is this your first independent research project?

Yes.

Do you get course credit for this work?

Yes. This research constitutes my Interdisciplinary Studies Capstone project.

How much time do you put into it?

Much time throughout Summer & Fall 2010, including a 10-day conference experience and literary research.

How did you hear about the [Undergraduate Research Award](#) program?

I first heard about the Undergraduate Research Award program from my advisors, and later from fellow students.

What academic background did you have before you started?

I have completed courses in dance, visual art and various social issues. The most related courses are Dance Improvisation and a seminar in Sustainable Design.

Was the application difficult to do?

It is often difficult to predict what direction an art-related project will go, so it was a bit challenging at first. However, I received wonderful guidance on this process and found a way to explain my concept. The layout of the application helped me to clarify my purpose and plan my research process.

How much did your mentor help you with this?

I met with her many times to review my proposal to make sure it was clear and concise.

What is your advice to other students about getting involved in research?

Don't hesitate to seek guidance from mentors. Take this wonderful opportunity of a URA and run with it!

What are your career goals?

To use my knowledge of art within education or research to approach social issues. I would like to dance professionally and work with nonprofits focused on environmental sustainability or community art.

What has been the hardest part about your research?

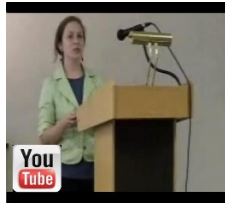
Maintaining focus on only what is necessary. Many disciplines and resources are related to my topic, so I must make sure not to branch out into too many directions at once, but rather integrate my new knowledge. It is common to look at environmental sustainability from a scientist's point of view, but less common from artist's stance. But, this makes my project all the more intriguing.

What was the most unexpected thing?

Making great friendships with people at the SEEDS festival, which I attended in July 2010. A dance and video project developed organically throughout the festival amongst myself and a diverse group of strangers. This mini project serves as an experience that I can draw from to complete my own research at UMBC. I expected to learn much from experience, but the SEEDS festival was a total learning experience in sustainability and dance, from living on their land for the week to collaborating and improvising with participants from various backgrounds and stages of life.

How does your research relate to your work in other classes?

My research incorporates what I have learned in previous dance and art courses, and an INDS seminar on Sustainable Design, which contributed most to my concept for the project. My current classes are all about interactions, such as group dance composition, interactions between humans and technology, and the line between art and life. The research I have completed so far has changed my perspective on these interactions, and these classes influence my research.



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Kevin Lin, Biochemistry and Molecular Biology

Association between Parenting Goals and Parenting Practices among Chinese Immigrants

Faculty Mentor: Dr. Charissa Cheah

Culture plays a significant role in shaping parental values regarding desirable and undesirable long-term socializations goals and child behaviors, as well as optimal parenting practices. However, there is limited research on Chinese American parents' long-term parenting goals for their children's development and their parenting practices. Thus, the present study aims to examine: (1) the major themes and the content of the long-term parenting goals for their preschool children reported by immigrant Chinese mothers, (2) mothers' endorsement of Chinese indigenous parenting practices, (3) and the associations between the parenting goals and parenting practices of these mothers. Seventy immigrant Chinese mothers will be interviewed regarding their long-term socialization goals and asked to complete questionnaires about their parenting practices. The findings from this study will enhance our understanding of how these mothers achieve their long-term socialization goals for their children in the U.S. and contribute to our promotion of the successful development of these families.

How did you find your mentor for this project?

I volunteered in Dr. Cheah's Psychology child development research lab since my sophomore year. She's the perfect mentor for my project.

How did you know this was the project you wanted to do?

I volunteered in the lab for the past two years. I really enjoy working in the lab. Then when this opportunity came, I knew right away this is something I want to research.

How much time do you put into it?

It is really hard to say exactly how much time I put into this project. I started in the summer doing background research and reading journals. Then as the semester starts, I'll probably have to spend 8-10 hours per week. I'll put in as much time as needed to finish this project.

How did you hear about the Undergraduate Research Award program?

Dr. Cheah mentioned the URA program and encouraged me to apply.

What academic background did you have before you started?

I took some psychology courses and also volunteered in the Child Development Lab.

Was the application difficult to do?

The application itself is not really difficult to do; you just need to give yourself enough time and start early. This application is a little different than other applications I have done in the past. You really need to know what your research is about.

How much did your mentor help you with this?

She helped me a lot; especially during the application process. She went through the project with me and providing tips and suggestions along the way. She also edited my application before final submission.

What is your advice to other students about getting involved in research?

I think everyone should apply for it if you can. This is a great opportunity and awesome experience to do a project on your own. Make sure you pick a topic that really interests you and go for it.

What are your career goals?

At this point I would like to go to Pharmacy School and become a pharmacist in the near future.

What has been the hardest part about your research?

The hardest part has to be the time management. This project requires me to put a lot of time in and I have to balance it with classes, jobs, and clubs.

How does your research relate to your work in other classes?

Some of the psychology courses I took before provided background information on my project.

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David Mason, SURF Scholar

Working Towards a NIST- Certified Phantom for Computer Tomography

This summer, I worked with a medical physicist at the Natl. Inst. of Standards and Technology (NIST) to help develop a precise reference standard for use in Computed Tomography (CT) imaging systems. Having quantitative results from a CT scan are vital for making accurate diagnoses, but it has been found that there can be significant variation in results between systems due to hardware and software differences. To help standardize results, it is desirable to have a material that can be used to calibrate each scan. Our goal this summer was quantitatively studying the x-ray properties of a material that will be used to simulate lung tissue. Once these characteristics are fully understood, NIST can certify the material as a standard reference material, which will in turn offer more accuracy to medical professionals when diagnosing lung disease.

How did I know about SURF?

I knew friends who had worked at NIST, and professors in the Physics department always promoted the program.

How did you know this was the laboratory you wanted to work in?

When applying to NIST, I knew that I wanted to explore the field of medical physics, and so I mentioned this in my application. NIST does a great job of placing students in their area of interest.

Is this your first independent research project?

No. In 2009, I began working at NASA Goddard Space Flight Center as a summer research intern. During this time, I worked with a team of astrophysicists on developing a compact, portable x-ray diffractometer for doing mineral analysis. The final product should be a device small enough to have applications in rover-based planetary science missions. During the summer of 2009 I worked on hardware development for this project, and then continued doing software work during the next academic year.

How much time did you put into it?

Both my internships at NASA and NIST were full 40-hr work weeks. The NIST SURF program is a 10-11 week program. My initial NASA work was 10 weeks, but I later continued my work during the semester.

What academic background did you have before you started?

I began working at NASA after my sophomore year and NIST after my junior year. While my physics/math coursework was useful in both internships, undergraduate research often involves immersing yourself in a subject you've never seen before. It's a fantastic learning experience, particularly if one is considering graduate school.

Was the application easy to do?

The NIST SURF application (like all internship applications) is simply a matter of watching deadlines and completing a few simple forms and questions. Applications aren't hard, but it is easy to forget about deadlines.

What is your advice to other students about getting involved in research?

Start now. It's never too late and never too early to try getting involved in undergraduate research. If you're a freshman with only limited experience, it may take more perseverance, but the opportunities are out there. Professors can be a huge asset. See what internship programs you can find on your own, but also try just talking to professors to see if they have room or know someone who does. I ended up at NASA by simply asking my advisor to pass my name around the physics department. As it turned out, one of my previous professors knew a research at NASA Goddard who had funding and was looking for help. All it takes is a few e-mails to get the process started, and you'll be surprised how easy it can be.

How does your research relate to your work in other classes?

My physics courses provided a solid foundation on which I could rely as I explored new fields via research. All the research I've done has involved x-ray physics, so my Modern Physics course sophomore year was quite valuable.

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Stefanie Mavronis, Political Science and MCS

Indigenous Media in Bolivia: Audiovisual Democracy in a Globalized World

Faculty Mentor: Dr. Jason Loviglio

This research will explore the ways that indigenous populations in Bolivia utilize new media technology to foster a de facto form of democracy and to build community, especially in the midst of the hyper-mediated world of the twenty-first century. Scholars have written extensively about the effects of globalization on less-developed nations, focusing largely on the benefits of the spread of information and the detriments of exploitative and unequal power relations. However, few have focused on the ability of nations like Bolivia to create alternate political spheres, especially through the production of audiovisual media. Two-thirds of the country's population is classified as indigenous, a subset of the population that is highly illiterate. Furthermore, the state and Catholic Church largely control mainstream media, failing to meet the needs of these indigenous populations. Through conducting interviews and analyzing the media culture of indigenous populations in Bolivia, I hope to better understand this audiovisual resistance to globalization at large and connect its media production with the

larger political question of democracy.

How did you find your mentor for this project?

I took a class with Dr. Loviglio last spring and loved it. After adding my MCS major, I knew that he would be a great person to do this type of research with, especially since he's not only an expert in the media field, but also knowledgeable about politics and globalization.

How did you know this was the project you wanted to do?

I knew that I wanted to visit Latin America because of its amazing culture and history. I've always been very interested in displays of resistance throughout the world, so once I discovered the interesting ways media was being used to foster a form of resistance in Bolivia, I was attracted to the idea of learning more about it. Plus, this project will really allow me to bridge my Media and Communication Studies major with my Political Science major.

Is this your first independent research project?

This is my first big independent research project, but I conducted research last school year in Baltimore on the city's drug culture and its impact on the educational achievements of urban youth. From that, I've definitely gained a lot of experience with interviewing and writing questions, not to mention the good techniques for finding relevant scholarly articles.

Do you get course credit for this work?

This should count for an applied experience for at least one of my majors.

How much time do you put into it?

It's hard to anticipate how much time it will take until I actually travel to Bolivia, but I'm planning on spending a lot of time throughout the summer and fall semester doing the background research so I can ensure my work is original and I waste little time once abroad.

How did you hear about the Undergraduate Research Award program?

A lot of my fellow Sondheim Scholar peers have won URAs. I've always been interested in the research my close friends were doing, something that encouraged me to apply.

What academic background did you have before you started?

I have a strong background in new media and applied communication, in which I have experience in film, audio, web, and graphic production. This, paired with my understanding of politics and media theory, should provide a good frame of reference and foundation for starting my research next year.

Was the application difficult to do?

The application was a bit intimidating, but I got a lot of advice from my mentors and friends who won Undergraduate Research Awards. I wasn't sure of the best way to start, but I started with a very, very rough draft of my general ideas. Then, I went back and edited it to make it a bit more formal and to add in some of the scholarly research I did. It was an ongoing process that became more defined and specific as time went on.

How much did your mentor help you with this?

Despite my starting the application process relatively late, Dr. Loviglio was extremely supportive and helped me refine my idea to something that was workable. The conversations we had about the significance of what I was doing and how it would relate to MCS helped me tailor my ideas and produce a final edit of my application. I'm really looking forward to having Dr. Loviglio as a resource when I'm abroad. He can keep me focused and on the track that I'm establishing for myself.

What is your advice to other students about getting involved in research?

I really encourage everyone to get involved in research. I think there are a lot of negative feelings towards research initially because of the way research projects worked in high school, but doing research on this level is totally different. Not only does UMBC provide a staff that's extremely dedicated, but it also provides a wide range of opportunities. Research doesn't have to be math and science based or historical; the humanities and social sciences have huge potential for new research, especially since there is a lot of significance in the things that are happening around the world in the present.

What are your career goals?

It's difficult to say what I'd like to do as a career, but I've been considering programs in public policy, law, media studies, and political communication. We'll see!

What has been the hardest part about your research?

While I've not really started, I'm anticipating the most difficult part of my research to be tapping into an aspect of media studies in Bolivia that's completely original. A decent amount of research exists on this topic generally, and I'm going to have to spend some time finding my niche within it.

How does your research relate to your work in other classes?

As I said, this research bridges the coursework I'm doing across my two majors. I hope to use my experience from my public policy, international relations, comparative politics, economics, women's studies, and media theory coursework to enhance my final research product.

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Kevin O'Malley, Biochemistry and Molecular Biology

Synthesis of New Heterocyclic Inhibitors of the Helicase of the Hepatitis C Virus

Faculty Mentor: Dr. Paul Smith

The natural product UK-1 is known to catalytically inhibit the enzyme DNA topoisomerase II (topo II) and is also known to kill cancer cells in culture. Our goal is to identify where UK-1 binds to topo II using photoaffinity labeling. We will synthesize a photochemically reactive analog of UK-1 which will covalently attach to the enzyme binding site when irradiated with light. Protein digestion followed by liquid chromatography and mass spectrometry will identify the protein residues attached to UK-1. The results will provide an understanding of the mechanism of inhibition as well as guide the synthesis of better inhibitors related to UK-1 with the long-term goal of identifying clinically useful anti-cancer drugs.



Where are they now?

How did you find your mentor for this project?

I was taking Dr. Smith's Mechanisms of Organic Reactions class and really enjoyed it. I looked forward to class and got excited about doing the homework. One day I asked Dr. Smith if he had room in the lab, and after a week or so, he said yes.

What academic background did you have before you started this research? Did your mentor help you?

I was a junior biochemistry and molecular biology major and had taken both biochemistry, and organic chemistry classes. I wanted to do biomedical research and liked organic chemistry. The research required few afternoons each week in the lab and an occasional Friday morning. Dr. Smith worked one-on-one with me. I did the work and he was there for guidance and the occasional helping hand. He also helped me interpret a lot of the spectral data and troubleshoot when experiments didn't go as perfectly as we had hoped.

You did a different project for the summer of 2010. What was that?

I worked full-time for 10 weeks on a project at the Johns Hopkins Malaria Institute. A representative from the Institute came to UMBC in the spring to give a short presentation of his research. He is a protein X-ray crystallography who does rational drug design from a structural biology perspective. I really liked how visual his work was and thought his strategy was really exciting. I showed my interest by asking questions during and after the presentation and through a follow up e-mail.

How did you know this was the project you wanted to do?

Malaria is one of the most socioeconomically crippling diseases. In recent years it has been making a comeback due to drug resistant strains. There are many factors that keep people in the developing world from living a good life; malaria is a serious one, and it is one we can fix. I really wanted to work with someone who was doing Malaria work. Dr. Bosch's project stood out because it involved some things I knew as well as some new things and some things I thought were cool, and it was on a topic I cared about. I knew about rational drug design, but had never experienced it from a structural biology perspective. I think protein 3D structure is endlessly fascinating, and malaria concerns me greatly.

How did you hear about the summer opportunity?

Dean Rous got me excited about malaria research which motivated me to apply when the internship was posted on *UMBCWorks*. Kevin, how does this related to the answer to the first malaria question? Can we combine the two into one question and answer?

How much did your mentor help you with the work this summer?

He worked one-on-one with me while I was learning the basic procedures and after that he was always near if I had a question. I was following his plan but he gave me a lot of freedom to design experiments. Often times the data were really confusing, but I could count on him to help me figure things out and give moral support when experiments didn't work.

What is your advice to other students about getting involved in research?

Start talking to researchers. Professors are a great place to start because you already have a reason to see them in class. Ask them about their research and what they do. If it sounds interesting than ask if you can work with them. Even if they don't have room or the time they can certainly connect you with another researcher who does.

What are your career goals?

I am very interested in medicine and biomedical science, specifically nutrition from a biochemical perspective, and rational drug design. I may pursue a dual degree like an MD/PhD or an MD/MPH or just an MD. I am torn between being a primary care doctor or a physician scientist.

What has been the hardest part about your research?

Failed experiments and unsatisfactory results. They can be pretty disheartening. However, as annoying as they are, they are actually the best part of research. They are like lighthouses that tell you when you're going in the wrong direction. When you're lucky, the sometimes even provide a clue for what you should do next.

What was the most unexpected thing?

How long it can take to do things. I'm the kind of person who likes things now! Research can be a good lesson in patience.

How does your research relate to your work in other classes?

Obviously my classes provided the theoretical basis for the research. Interestingly enough, I have found that the relationship works both ways. More often than not my work in lab helps cement and expand on concepts that I learned in class.

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David K. Pourshoushtari, Political Science

Justice Sotomayor and the Legitimacy of the Supreme Court

Faculty Mentor: Dr. Tyson King-Meadows

This paper examines public perceptions of Supreme Court Justice Sonia Sotomayor after the first series of oral arguments of the 2009-2010 term, *Citizens United v. Federal Election Commission*. Using national survey data to examine public attitudes toward Justice Sotomayor, we examined affect, perception of her impact, and attentiveness to her inaugural activities. The data revealed that not only did conservative respondents generally hold unfavorable views of Sotomayor, but that they also had a tendency to believe she would likely have a more liberal impact on the Supreme Court. The study also revealed that conservative respondents paid less attention to Sotomayor's performance than did liberal respondents. These findings suggest that effect towards Sotomayor among conservatives remains relatively low, and that conservatives still believe Sotomayor will shift the court in a more liberal direction, despite her succeeding a liberal judge in David Souter. As a result, Justice Sotomayor may indeed weaken the otherwise consistent

legitimacy the overall public affords the Supreme Court.

How did you find your mentor for this project?

I met Dr. King-Meadows at the UMBC on-campus job fair in the Fall of 2009. I had never taken classes with him, but he was seeking undergraduate research assistants, with a preference for Political Science majors. I got the job and I aided him with the research he is currently working on.

How did you know this was the project you wanted to do?

My goal after I graduate from UMBC is to attend law school, so I have always had a particular interest in law and in the Supreme Court in particular. Never having undertaken this kind of a project, it was an exciting opportunity for me to expand skill set and learn more about the academic field of Political Science.

How much time did you put in?

I began working on this project in December of 2009, and made a conscious effort to devote five to ten hours per week while trying to balance the other six classes I was taking in Spring 2010.

You had a research travel grant from the school, how did you hear about this?

Dr. King-Meadows encouraged me to apply to present my research to the Midwest Political Science Association National Conference. When my work was accepted he informed me about the travel funds and how to apply for them. He impressed upon me how important it would be to travel to Chicago for this conference. He was right. I learned a great deal from the presentations of other political scientists.

Was the application difficult to do?

The hardest part was trying to write a clear, concise proposal to convince the committee that the work I was working on was important enough to justify school funding.

How much did your mentor help you with this?

He helped me a lot, since he has so much experience with requests for research grants.

What is your advice to other students about getting involved with research?

Make sure to get to know many professors from your discipline, since there may be professors looking for assistants who will be willing to take you on, even if you haven't taken any classes with them. Otherwise, work hard in all of your classes and maintain a good relationship with your professors, you never know when one may notice your hard work and take a chance on you.

What was the most unexpected thing about this research?

How much of a commitment this project was. It essentially felt like I was taking a seventh class. If you undertake a research project, be ready to work your tail off.

How does your research relate to your work in other classes?

There are many classes here at UMBC that specialize in teaching students about our judicial system and the topic of identity politics. There are also classes that include institution legitimacy within their curriculum. In addition to this, my research called for me to make heavy use of the SPSS program so that I could study my data. The POLI 300 class gave me the proper background knowledge I needed so that I could navigate my way through this extensive program.

[\(Top\)](#)



David P. Stonko, Mathematics and Statistics

Building a Mathematical Model to Understand the Molecular Interpretations of Spatial Gradients of Biological Activators

Faculty Mentor: Dr. Bradford E. Peercy and Dr. Michelle Starz-Gaiano

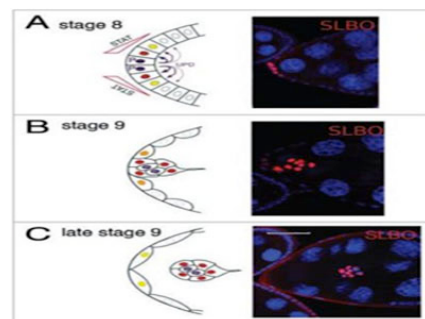
Small alterations in biochemical signaling can be transformed into major differences in cellular decisions. Our interdisciplinary project revolved around the conserved Signal Transduction and Activator of Transcription (STAT) signaling pathway and the regulation of cell decisions. The STAT pathway is essential in stem cells, immune function, and some cancer progression. We took advantage of a simple system in *Drosophila* ovaries to identify the mechanism that determines STAT activation and results in the transition of stationary cells to migratory ones. STAT activation is initiated by diffusible molecules radiating from a localized source, generating graded activation in neighboring cells. Cells closest to the source robustly activate downstream signaling, and become mobile cells; distant cells downregulate signaling and are stationary. A heuristic model of the molecular interactions can capture how graded signal is converted to activation of motile cells. We analyzed this model to determine the critical parameters and determined its underlying mathematical structure and relationship to the biology. We began to construct a biophysical model to inform new testable hypotheses. We will continue to polish this biophysical model and conduct genetic and cell biological experiments to understand how epithelial cells can convert analog information into the binary activation of a molecular pathway.

When and how did you find out that you could do independent research or creative work as a UMBC undergraduate?

UMBC always says that undergraduates can get involved in research so I approached a few professors to see if I could lend a hand.

How did you find a mentor and decide on a project?

After talking to a few professors it was recommended that I apply to UBM (Undergraduates in Biology and Mathematics). So I did. I applied to work with Dr. Peercy on the Math side and Dr. Starz-Gaiano on the Biology side and eventually I was selected. The project that we are looking at is an extension of a project that Dr. Starz-Gaiano has been working on for several years.



How did you know this was the project you wanted to do?

All of the projects in [UBM](#) are at the interface of Biology and Mathematics and I have had an interest in both fields so it fit perfectly.

What academic background did you have before you started?

I was at the beginning of my second year when I applied and was chosen. I had finished most of the core requirements for my B.S. in Math and had taken a few biology courses. If you were like me (or you have done more) then apply!

What has been the hardest part about your research/creative work? The most unexpected thing?

It's fun! Any undergraduate who likes to see their work or ideas come into fruition should get into a lab. It's a lot of fun learning new things and getting insight into how research works.

How does your research/creative work relate to your work in other classes?

Since I am a math and biology double major my work fits right into what I am learning. In fact, my genetics professor talked about a gene that we work on today.

What is your advice to other students about getting involved in research?

Everyone should talk to a professor in their department and see who is doing research on topics that interest them. Here at UMBC there are plenty of opportunities to get involved.

What are your career goals?

I want to go to medical school and do research similar to what I am doing now. I am hoping that this work could provide the initial stepping stones to get there.

How did you decide to present your work at URCAD this year?

My UBM team which includes myself, Xuan Ge, Dr. Peercy, and Dr. Starz-Gaiano decided that we would like to present the topic we are working on.

Was the application difficult to complete? How much did your mentor help you with the application?

The application was pretty straightforward. Our mentors helped us with all of the sections that we did not know the answers to.

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Franki Trout, Dance

Investigating the Technique and Legacy of José Limón

Faculty Mentor: Mr. Doug Hamby

José Limón was a leading founder of American modern dance and a major influence in the dance world during his lifetime. Even after his death in 1972, his legacy continues in the bodies of the dancers in the José Limón Dance Company who perform his choreography and continue to teach his technique. The only way to learn this technique is to go to the source and learn from the people who practice and live it every day. The ideas and principles of Limón technique are passed down from generation to generation and would be lost without dancers willing to learn and share this knowledge. My research involves learning this specific technique and the principles of fall and recovery, breath, suspension, and musicality that are characteristic of it. I plan to apply these ideas to my own artistic vision and create a dance performance work that uses the principles of Limón technique in a new and exciting way.

Through the creation of this work I will share my new knowledge of Limón's choreographic and technical methods with my UMBC dance peers. My new dance will demonstrate that the

blending of dance ideas and practices from artists of the past is valuable to a dance world that is constantly evolving and changing.

How did you find your mentor for this project?

Doug Hamby is a prominent figure in the UMBC Dance Department and although I have never had him as a teacher, I have gotten to know him through various performance and dance opportunities. He has also been a mentor for other dance students granted Undergraduate Research Awards in the past and I knew he would be an experienced mentor.

How did you know this was the project you wanted to do?

I took a modern dance class in Limón technique with Carol Hess during my first semester at UMBC and found it really exciting. I knew I wanted to keep learning about and dancing this technique and the URA has given me the opportunity to do that.

Is this your first independent research project?

Yes, this is my first independent research project.

Do you get course credit for this work?

I will be enrolled in a course designed for independent study for dance in the fall, where I will be continuing work on this project.

How much time do you put into it?

After the two-week-long program this summer, I will be working with my dancers for two to three hours each week during the semester to develop choreography and apply the principles I learned.

How did you hear about the Undergraduate Research Award program?

I was a dancer in another student's project for URCAD last year and learned a lot about the program through that experience.

What academic background did you have before you started?

My academic course work in dance involved a great deal of ballet and modern technique classes, as well as classes in dance composition, improvisation, performance and dance history.

Was the application difficult to do?

I found the application to be very straight forward and concise. The two page limit made me really consider what the bottom line of my project was going to be and gave me a more clear focus for my research.

How much did your mentor help you with this?

I had a meeting with my mentor even before I began filling out the application to discuss what I wanted to do and how to best represent that on the application. He then helped me edit the final proposal before I submitted it.

What is your advice to other students about getting involved in research and independent creative work?

That the possibilities are endless! There are research opportunities in every academic major so find what you are passionate about and go for it!

What are your career goals?

After college, I hope to keep dancing on a professional level, but eventually I want to teach dance in public high schools.

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Maria D. Vitery, Biochemistry and Molecular Biology

Crotamine, the Protein from the Venom of the South American Rattlesnake, and its Binding to DNA

Faculty Mentor: Dr. Richard Karpel

Crotamine is a protein from the venom of the South American rattlesnake (*Crotalus durissus terrificus*). This 42-residue polypeptide is a nucleic acid binding protein that is capable of penetrating cells and targeting chromosomes. It has the ability to carry plasmid DNA into cells that are actively proliferating. Cell penetration is believed to follow interaction of crotamine with cell surface heparan sulfate proteoglycans. This quality makes crotamine a potential candidate for drug transport. The goal in the lab is to quantify salt dependence, binding site size and affinities of crotamine for DNA. Our experiments focus on studying the binding of crotamine to single- and double-stranded DNA over different ionic conditions. In these experiments, the fluorimeter is used to determine light scattering, which is a measure of particle size. In parallel, we perform experiments that include the usage of a DNA-intercalating dye, ethidium bromide. Ethidium bromide intercalates within DNA and absorbs light at 600nm, and becomes fluorescent when bound to DNA. In these experiments, the interruption of DNA and ethidium bromide fluorescence by crotamine

and its reversal by heparin is being quantified.



When and how did you find out that you could do independent research or creative work as a UMBC undergraduate?

I found out about the independent research at UMBC during my first semester after I transferred from Montgomery College.

How did you find a mentor and decide on a project?

I have worked on protein (molecular chaperones) at the NIH, therefore when I transferred to UMBC I wanted to keep doing research on proteins. I went on the Department of Chemistry and Biochemistry website and read about the different Principal Investigators and the research they perform. I really liked the research of Dr. Karpel so I decided to request an interview with him.

How did you know this was the project you wanted to do?

Crotamine was discovered fairly recently, and there is not much information about its properties and chemical characteristic yet. Having the chance of working on a "new" protein and finding that it's binding affinities to DNA and RNA in different conditions, made me realize that this was the project for me. All the findings that I would obtain would help the characterization of crotamine and in future use as a drug-delivery vehicle against actively proliferating cells.

How much time did you put into it?

I try to take the research I do at the lab very seriously. Normally, I go four to five times a week for 4 to 5 hours. Characterizing a new protein is very interesting and fascinating since you do not have old data or previous information about it. The downside to this is that setting up the experiments is very time consuming and sometimes you do not obtain any results after you repeat the experiment several times. Therefore, it is required to spend a lot of time working on each experiment.

What academic background did you have before you started?

As I mentioned before, I have work at the NIH National Cancer Institute for two summers. There I also worked on proteins, so I had background on protein purification and characterization. Also, I have taken several upper level biochemistry and molecular biology courses that made me capable of performing this independent research.

What has been the hardest part about your research/creative work? The most unexpected thing?

The most unexpected thing was spending more the three months on only repeating one experiment. Recently I have been working on quantifying the decrease in fluorescence of crotamine upon addition of plasmid DNA. At first when I set up this experiment it seemed pretty straight forward, but this was not easy. It has taken me more than three months to perfect the protocol for this experiment and to be able to get reproducible data.

How does your research/creative work relate to your work in other classes?

As a Biochemistry and Molecular Biology major, I learn about different major proteins in most of my upper level courses. This project helps me to put all the knowledge and theory learned in my classes into practice.

What is your advice to other students about getting involved in research?

My best advice is do not be afraid to get involved in a independent research project. Even if you do not get the outcomes that you expected, I am pretty sure that at the end you will still have learned something very valuable.

What are your career goals?

I am planning on going into an M.D/Ph.D after I graduate, and do research in neuroscience.

How did you decide to present your work at URCAD this year?

URCAD is a great way to get to know people that work in the same area that you do and learn from their exeripences. Also, I think it is a good way to show my fellow classmates what I have achieved after a year of independent research.

Was the application difficult to complete? How much did your mentor help you with the application?

The application was not difficult, but it was time consuming. Writing a good abstract requires a lot of time and dedication. Dr. Karpel, was always willing to write my rough draft and give me as much feedback as possible.

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Salma M. Warshanna, English

The Past That is Always Present: The Role of Memoir in Identity

Faculty Mentor: Robin Farabaugh

Memoir writing is the gold rush of the twenty-first century. While memoir is certainly a mode of self-expression, it is largely crafted for the reader's understanding. My analytical essay focuses on how the combination of the first-person perspective and a rich description of memories allows memoir to connect to a reader's sense of self in ways that no other genre can. A quiet dialogue occurs, where the reader is invited to live moments of another life and, more importantly, understand how the past is always present in identity. My research includes an annotated bibliography of a handful of memoirs. For the creative component of the project, I traveled to Egypt, where my parents grew up and the majority of my relatives still reside. Based on my experiences, I wrote a series of creative nonfiction essays that explore my parents' emigration from Egypt, my relationship with each of them, and how being raised between two cultures has shaped my identity. My semester abroad in the United Kingdom played a crucial role in how I understand my parents and their immigrant experiences, and those explorations are woven into the overarching story of identity.

When and how did you find out that you could do independent research or creative work as a UMBC undergraduate?

I have been a UMBC Writing Center tutor since fall 2008. At the beginning of every semester, the Learning Resource Center had a meeting with all the LRC tutors. Janet McGlynn was always there to talk to us about Undergraduate Research. She emphasized the fact that research isn't just for the science students, and that there are opportunities for students from the humanities to participate as well.



How did you find a mentor and decide on a project?

As early as my freshman year, while taking English 291: Intro to Writing Creative Essays, discovered that my favorite genre to write in is creative nonfiction. The next year, I took English 303: The Art of the Essay with Professor Robin Farabaugh. For my project, I chose a topic that I wanted to explore and could write about endlessly: identity. Because Professor Farabaugh knew my work and always challenged me to grow as a writer, I chose her to be my mentor for my project.

What did you do to make your project a reality?

I applied for the Undergraduate Research Award (URA), which helped fund my two-week trip to Egypt in summer 2010. I took a ton of notes, voice recordings, and pictures. Starting in August, I began meeting with my mentor once a week to discuss my writing and the progress of my project. So far, I have produced about 50 pages of creative writing, plus a research paper about memoir and the relationship between the reader and writer. I also read 8 memoirs and wrote an annotated bibliography.

What has been the hardest part about your research/creative work?

To focus on the process of writing instead of the potential product - a set of high-quality essays and seeing them published one day.

What is your advice to other students about getting involved in research?

Just do it! It's great experience, a great resume booster, and a great way to show potential employers that you are self-motivated and can work independently on a project that you are passionate about.

How did you decide to present your work at URCAD this year?

Because the majority of my project is creative writing, I decided that was what I wanted to share with the audience through an oral presentation. I pieced together segments of my essays to give an overview of my experiences in Egypt and what I wrote about, and chose some of my photographs to complement the story.

Update on Salma:

As a URA Scholar, Salma wrote a series of four creative nonfiction essays titled *The Past That Is Always Present*. The fourth essay, "What Egypt Has," won an Honorable Mention in the North Colorado Writers 2011 Writing Contest. In December 2011, it will be published in the winner's anthology *Pooled Ink*. The first essay, "The Landscapes Within," was accepted for publication by the *Susquehanna Review*, the nationally distributed literary magazine of Susquehanna University in Pennsylvania. The essay will be available online and in print.

After graduating Magna Cum Laude, Salma is spending her first summer after UMBC working as a Program Assistant with People to People Ambassador Programs in Arlington, Virginia.

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John Winder, Computer Science

A Digital Skeleton Key to Art: Symbolism of Light and Dark in European Oil Painting from 1500 to 1900

Faculty Mentor: Dr. Preminda Jacob

Painters of the High Renaissance through Romanticism periods (1500-1900) used chiaroscuro (contrast of light and dark) not only as a stylistic, compositional tool but also to impart symbolic meaning to aspects of their work. I will devise an algorithm that will allow me to abstract the varying values of light and dark in a digital copy of a painting, providing an analysis based on both quantitative and qualitative methods. The purpose of such an analysis is to reveal facets of a painting, primarily focusing on composition and content, so as to illuminate the artist's intentions, to compare different artists' use of chiaroscuro when portraying the same subject, and perhaps confirm or refute conventional assumptions about a work. For each painting I will provide a contextual "vignette" to explain the artist use of chiaroscuro, its significance and symbolism to the work and compare this to other paintings of

the same theme. Such a vignette would address thematic questions covered in numerous paintings. Example vignettes would include: Is Christ portrayed as the lightest figure in a scene? Do artists convey the sublime in dark or light landscapes? What we think to be the case might or might not be.

How did you find your mentor for this project?

I took an art history class with Dr. Jacob in the fall of 2009, and routinely spoke to her after class about my passion for the subject. Dr. Jacob encouraged me to develop a topic of research and offered me guidance as I formulated one.

How did you know this was the project you wanted to do?

My main goal, before I knew specifically what I wanted to do, was to pioneer a connection between math and art. I knew I wanted to do art historical research with a focus on painting. I also wanted to analyze critically the spatial and symbolic composition of paintings. The key inspiration came from a remark in a math textbook about the structure of a digital image. From that, I synthesized my research topic.

Is this your first independent research project?

Yes. I was one of the few freshman who were awarded a URA, and I hope that this current project might serve as a basis for future research.

How much time do you put into it?

Several hours per day during the summer, and it will continue to a lesser degree during the semester. It is a good policy to think of independent research as a full-time summer internship or employment.

How did you hear about the Undergraduate Research Award program?

I had seen information about the URA on the UMBC website, but I was unsure who could apply. My mentor, Dr. Jacob, actually gave a presentation about the URA to her class in the fall. When I spoke to her, she encouraged me to pursue it.

What academic background did you have before you started?

I have a keen passion for art and its history. During high school I educated myself extensively on the history of painting, and since coming to UMBC I have taken art history classes.

Was the application difficult to do?

The application was straightforward, but I devoted considerable time to it. My main difficulty was describing my topic, though it was clear in my mind, concisely and effectively without excising anything necessary to its explanation.

How much did your mentor help you with this?

My mentor provided me with books, inspiration, direction, and encouragement.

What is your advice to other students about getting involved in research?

Do not be afraid of your professors (talk with them after class or visit their office!), do not be afraid of your own ideas, and do not limit yourself (my major is computer science but I am doing art historical work). This is a rare opportunity for undergraduates, take advantage of it!

What are your career goals?

I plan to go to graduate school for computer science. Research (on the technical side) for this project has revealed intriguing avenues of study in CS such as image processing, computational photography, and computer vision.

What has been the hardest part about your research?

The challenge of this project is uniting all of the disparate but necessary topics of research, such as digital images, mathematical manipulations of images, themes in European oil painting, and the significance of chiaroscuro and the shadow in art. Their synthesis is my success.

What was the most unexpected thing?

Seeing how, when using my algorithm, successive levels of abstraction remove detail from a painting but retain its overall form and composition.

How does your research relate to your work in other classes?

The project is really independent from any class, but a lot of the principles I applied to it came from math or computer science classes. I truly believe greater understanding comes by viewing matters with an unconventional eye.

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