The Science for Life Program Strives to Provide Enriching Research Opportunities for Early Undergraduates

We have continued to provide high-quality laboratory research experiences to our target student population of freshman and sophomores throughout the duration of our fourth year. In an effort to attract talented early undergraduates with an interest in the life sciences, we have increased our efforts to introduce both the Science for Life program and seminar class to entering freshmen. One of the main ways this has been achieved is through the University of Florida “Preview” orientation sessions, which all incoming freshmen are required to attend with a parent. Approximately twenty-five of these orientation sessions are held during the summer months in order to acquaint new students to university life and various campus-wide opportunities. During each of Preview’s two optional afternoon sessions, we have been committed to providing twenty-minute overviews of our program, as well as allotting ten minutes for questions. These summer presentations have been influential in attracting students in both science and non-science disciplines to enroll in the Science for Life seminar class. The foremost goal of this course is to expose early undergraduate students to the leading-edge research that is currently taking place in faculty laboratories across campus. This has been accomplished by allowing 40-42 professors each semester give fifteen-minute overview presentations on their research interests. The seminar class has been instrumental in providing a direct line of communication between inquisitive students and mentors with active and funded laboratories. Accordingly, enrollment during the fall and spring semesters peaked at over 420 undergraduates, and of those, more than 50 applied for our research award and subsequently entered into the year-long program.

The UF-HHMI Undergraduate Core Laboratory (UCL) Provides a Strong Natural Science and Engineering Background Necessary for Early Undergraduate Research

The primary goal of the Undergraduate Core Laboratory (UCL) is to provide early undergraduate students in the natural sciences and engineering disciplines with a strong foundation of biology, chemistry, and physics in order for them to actively engage in life sciences research. This is accomplished by providing freshman and sophomores with strong content knowledge in the aforementioned areas, emphasizing the cross-disciplinary nature of modern research in the life sciences, and also providing former UCL students with opportunities to serve as teaching assistants in order to solidify their knowledge. This past year, over 600 students were impacted by the efforts of the UCL. In the coming years, many new initiatives have been set into motion such as offering a new undergraduate major in Biomedical Engineering starting in Fall 2011, creating an upper-division course in Cell and Tissue Engineering, as well as working with the Department of Biology to create an upper-division laboratory course in Cellular and Systems Physiology, which will be taught in the Undergraduate Core Laboratory.
The Science for Life Outreach Efforts Motivate High School Students From Economically-Underserved Areas to Pursue Undergraduate Majors and Ultimately Careers in the Life Sciences

Our commitment to outreach has continued to serve as an approach to motivate and prepare high school students from economically underserved areas to pursue undergraduate majors and ultimately careers in the life sciences. The UF-HHMI Science for Life Award has provided the means by which the University of Florida has been able to work closely with science teachers from six high-poverty, low-performing urban high schools from Dade, Duval, and Orange counties, as well as several in Puerto Rico. Such interactions with instructors from these “UF Alliance” schools through the UF Summer Science Institutes (UF SSI) for Teachers have enhanced the professional development of 39 teachers (29 females and 16 minority) who can increase knowledge and resources to share with their peers and over 3900 economically underserved and minority students each year. Our goals over the next year include increasing meaningful post-SSI collaborations and continuing to strengthen relationships with teachers from economically underserved schools. These aims will be accomplished in hopes of “leveling the playing field” and enhancing opportunities for disadvantaged students so they can gain meaningful research experiences and explore science and health care careers.

The Science for Life Assessment Team Continues its Efforts to Collect Data in Order to Improve Upon Our Program

Assessment of our program is an on-going process as we are continually striving to improve upon both our successes and failures from the previous years. Our assessment team works painstakingly hard to evaluate our program both quantitatively through surveys, as well as qualitatively through conducting interviews with participants. These studies evaluate differences and changes in perception between the genders and across various ethnic groups. Results from this year’s student surveys indicated that a majority of the students (~80%) reported their highest laboratory learning gains as learning laboratory techniques, and having a deeper understanding of the research process and how scientists solve real world problems. However, smaller gains were made in student self-confidence and effective science writing and oral presentation skills. Therefore, in the coming year we will work towards increasing opportunities for students to present their research projects to peers and research faculty. This will be accomplished through student-organized evening seminars where Science for Life students can present their work and also overcome some of the isolation they experience in their individual laboratories. We hope this will further enhance the sense of community among our students and also increase their self-confidence in presenting their work and discussing unfamiliar research topics.

Science for Life Activities Allow Students to Establish Collaborative Relationships with Other Disciplines, Gain Confidence in Conducting and Presenting Research, and Also Highlight Their Achievements

The annual Creativity in the Arts and Sciences Event represents an opportunity for our students to gain experience presenting their work in poster format, to learn about the leading-edge research their peers are engaged in, as well as provide a foundation upon which collaborations can occur across both the arts and scientific disciplines. In order to facilitate an exchange of creative thoughts among the disciplines and provide the foundation for exciting, new collaborative projects, we held various pizza parties in order for the science and art students to meet and discuss their interests and current projects. Next year, we plan to introduce an exciting new award category, which will allow science and art students to collaborate creatively in order to produce a new joint poster and art exhibit. Another annual event that students enjoy is our Spring Undergraduate Research Awards Reception, held at the President’s House on campus. The annual reception provides a platform upon which we can present awards for the exceptional work of mentors, graduate students, and Science for Life Awardees.
The Science for Life Executive Committee:

Ben Dunn, Distinguished Professor of Biochemistry and Molecular Biology and Science for Life Program Director

Kirby Barrick, Professor, Agricultural Education and Communication and Associate Director

Richard B. Dickinson, Professor and Chair, Department of Chemical Engineering and Associate Director

Catherine Emihovich, Dean, College of Education and Associate Director

David Julian, Associate Professor of Biology and Associate Director

Mary Jo Koroly, Director UF-HHMI Precollege Program and Associate Director
Undergraduate Research

The primary mission of the Science for Life program remains a concerted effort to provide the tools whereby early undergraduates can actively seek and contribute to meaningful, leading-edge research projects. One of the chief ways in which we stimulate interest and provide high-quality research opportunities for early undergraduates is through the Science for Life seminar course offering. The seminar allows prominent research faculty with funded and active laboratories to present their research interests to a group of intellectually curious undergraduates (typically freshmen in their second semester). The seminar class also provides an environment in which students can set up appointments to speak one-on-one with research faculty their research interests align with in hopes of starting enriching conversations that may lead to future mentorship and an eventual independent research project.

By the close of its fourth year, the Science for Life program has provided a total of nearly 250 awards to early undergraduates in our intramural program and more than 60 awards in our extramural program. It is important to highlight that we have a fairly balanced distribution of men and women in our programs, as well as a significant number of minority students among our awardees.

We are pleased that over the past year, several students have contributed data to papers that were accepted and subsequently published in the scientific literature. We strongly believe that encouraging students to join laboratories early in their undergraduate careers fosters an environment whereby they can ultimately contribute data to the scientific community that is on par with experts in their field.

Intramural Program

During the 2010 academic year, 52 students received first-time HHMI support from the intramural program to work with research faculty mentors at the University of Florida. These awardees did their research in nearly 20 different academic departments. Consistent with our program’s mission to focus our efforts on early undergraduates, 13 of the intramural awardees were freshman, 35 were sophomores, 3 were juniors, and 1 was a senior. Our program is now deeply entrenched in the culture of the university and as a result, we have seen increased enrollment in the Science for Life seminar, which introduces new students to our program.

Extramural Program

Over the past year, eleven students were awarded support for conducting summer research projects away from the University of Florida campus. These talented extramural students conducted research at Harvard University, Cornell University, University of Michigan, Northern Illinois University, Yale University, Emory University, Max Planck Institute for Chemical Ecology, California Institute of Technology, Princeton University, Brigham and Women’s Hospital, and the University of Minnesota.

These collaborative activities with other institutions have increased awareness of our program among our partners both nationally and internationally.

Abstracts

The following pages present 87 intramural and 11 extramural abstracts from undergraduate participants in the Science for Life program over the past year. The year students entered into the Science for Life program is indicated on their abstract.
Research is the foundation to scientific discoveries. The many smaller discoveries that occur behind the scenes through research eventually lead to the major scientific breakthroughs that change the way we live our lives. An understanding of the basic methods of research is important to all who seek to attain an extensive knowledge of science. During the past twenty years, there has been a revolution in the biological sciences. The complete sequencing of the human genome, as well as the genomes of many animals and plants, has opened up new possibilities in genetic research. These advancements have led to a new scientific field of genetic engineering, with boundless possibilities, especially in the field of medicine. I hope to become a leader in this budding field of genetic engineering and help bring to an end gene defects and bacteria caused diseases.

My aspirations have driven me towards research as the first step in reaching my goals. I have contacted Dr. Melanie Correll from my department, Agricultural and Biological Engineering, and have constructed a research plan with her to help me develop laboratory and research skills and further my knowledge in the field of genetics. Her research deals with the effects of the environment on gene expression patterns of plants and the integration of these into larger-scale plant models. My research topic will focus on red-light effects on growth and development and gene expression of Arabidopsis.

The HHMI Undergraduate Research Award provides me with the opportunity to gain work experience in the laboratory while also completing courses related to my chosen field, Biological Engineering. The knowledge and concepts I learn in lecture halls will be applied directly to research that I will perform in the laboratory. I believe in this sense that the research and the coursework will complement and enhance each other and help me further succeed in both. Dividing my time between both would not be an issue as both build on each other. I have already successfully achieved such a balance by volunteering at Shands Medical Center and maintaining a 3.90 grade point average academically.

If I am the recipient of the HHMI Undergraduate Research Award, I look forward to demonstrating my aptitude for research and developing a close collaboration with my faculty mentor. I am already involved in the research with Dr. Correll as a volunteer and hope to continue this for at least another 1.5 years. The HHMI will help me to continue to collect data and begin a research project that will lead to a co-authorship on a publication. Previous undergraduate students in Dr. Correll’s lab have published in a peer-reviewed journal and were able to contribute significantly during this timeframe. I am confident that with assistance and direction, I will be a co-author on a publication. I am very enthusiastic about the opportunity to present a poster at either a regional or national meeting such as the South East section of the American Society of Plant Biologists as well as at the Science Day at the Museum event. I also hope to visit with collaborators at other universities during my research.

Performing research throughout my undergraduate studies will only strengthen my conviction in my career choice and will provide me with a stepping stone into future career opportunities. Armed with prior laboratory experience under the supervision of an accomplished university professor, research opportunities such as that in graduate school will be more readily available. I intend to enroll in graduate school and enter into the biomedical field after completing my studies and view this unique opportunity to get involved with research as a great jumpstart to my career. I believe genetic engineering is the future and I look forward to helping advance the science and becoming a leader in the field. The world is on the brink of the most exciting step into human evolution ever, and through knowledge, exploration, and laboratory research, I hope to be at the front of the new waves of scientific discoveries.

Abstract

Characterizing the role of PIN4 in the red-light inhibition of root elongation.

Acosta WA, Kiss JZ, Correll MJ

The identification of key genes involved in red-light-signaling pathway in plants will suggest mechanisms that plants use to adjust their growth in response to light. Roots have been shown to display positive phototropism and a reduced rate of elongation when exposed to periods of red light. The role of auxin transporters in these responses is unknown. Microarray data suggests that gene expression of an auxin transporter, PINOID4 (PIN4), is involved in the red-light inhibition of root elongation. Gene expression studies using microarrays were performed with the roots of phytochrome mutants phyA, phyB, and phyAB and wild-type (Ler) exposed to 1h red light and compared to dark controls. Interestingly, only six genes were commonly upregulated in all plants and none were commonly downregulated for all. The common upregulated genes include ATROPGEF12/MEE64/ROPGEF12 (MATERNAL EFFECT EMBRYO ARREST 64; AT1G79860); LHB1B1 (Photosystem II light harvesting complex gene 1.4; AT2G34430); LHCb4.2 (LIGHT HARVESTING COMPLEX PSII; AT3G08940), UGT84A2 (UDP-glycosyltransferase/ sinapate 1-glucosyltransferase; AT3G21560), ELIP1 (EARLY LIGHT-INDUCIBLE PROTEIN; AT3G22840), and ELIP2 (EARLY LIGHT-INDUCIBLE PROTEIN 2; AT4G14690). These genes are primarily associated with chlorophyll development which is known to occur for root grown in red light. As for auxin transporters, PIN4 expression was primarily controlled by phyA in roots exposed to red light since the expression levels were upregulated in Ler and phyB but not in phyAB compared to dark controls. Studies on the elongation rates of PIN4 roots in red light and confirmation of the microarray data with qRT-PCR are currently being performed. Taken together, it appears that red light induces the expression of PIN4 through phytochrome A and this may result in altered translocation of auxin thus decreased elongation of roots in red light.
Personal Statement Before Starting Science For Life Award

As a junior, I am attracted to the Science for Life Program, to prepare for Graduate school. I feel I can benefit highly from the experience, and regret that I was unaware of the opportunities provided within Science for Life, prior to this year. After receiving my Bachelor of Science degree, I am interested in a thesis based program, either the Master of Science degree within the Department of Animal Sciences or the Master of Public Health, in relation to Veterinary Science. My aspirations also include matriculation at a Veterinary Medicine school, following completion of an advanced degree program.

I am looking forward to working with Dr. Maureen Long, because of our shared passion for equine science. Through volunteering at the Equine Neonatal Intensive Care in the Large Animal Hospital, I have not witnessed Eastern Equine Encephalitis Virus, but have been seen many deleterious infections, thus stemming my interest in EEEV. Dr. Maureen Long and I met, as a result of my interaction with Dr. Charles Courtney, and I am grateful to Dr. Duran for suggesting I meet with Dr. Courtney, in order to find an eligible faculty member to serve as my research mentor.

For my career goals, I am interested in combining my passion for science and animals, with my desire to help people and leave a significant impact on today's society. I would like to accomplish each of the following at some point: serve aspiring veterinarian students as a professor, remain active in the science community through ongoing research projects, hold appointments as an active practicing veterinarian, and create a program that brings middle and high school students to animal shelters to become involved in animal welfare and more interested in science.

As an African-American and first generation college student, I can attest to the fact that many people in my situation do not know about the resources available at the University of Florida, one untapped resource being research funding programs such as this. In addition to the knowledge I will gain while working with Dr. Maureen Long, I plan to incorporate my experience with Science for Life into my role as Coordinator of the OASIS Transition Programs and as a Peer Leader for First Year Florida. Both of these positions allow me to serve first generation and underrepresented college students (as I will be teaching a Florida Opportunity Scholar section of the First Year Florida class). With the contacts I will make as a participant in Science for Life, I will work to bring more diversity to the program through informational workshops and presentations about the benefits of undergraduate research in the life sciences.

I am aware of the time commitment this undertaking will require of me, and am excited about becoming more personally engaged in the laboratory techniques presented to me through lectures, such as the use of PCR. I plan on balancing my schedule, by focusing on completing the majority of the most time-consuming tasks over the course of the summer. During the Fall and Spring semesters, I will also be able to contribute the allotted amount of time, because I am stepping down from my position as a Resident Assistant for the Department of Housing, at the end of this semester. I expect for the laboratory portion of this study to reach until mid Fall Semester. This will allow me to spend Spring 2010 working with Dr. Maureen Long towards journal publications, and presentations at upcoming research symposiums.

Due to the extensive range of data that will be collected about the evolution of the EEEV over the past 30 years, successful completion of this project will provide ample opportunity for me to engage in co-authorship of the following two papers. One paper will focus on the sequencing of 30 years of EEEV genes, and the other will be a descriptive paper on the detection of EEEV in formalin fixed tissues. The primary goal will be to submit these for publication in: The American Journal of Tropical Medicine and Hygiene, and The Journal of Virology.

Abstract
Diagnosis of Eastern Equine Encephalitis Virus (EEEV) in Suspect Clinical Horses
Aytes NC, Glorfelt C, Liu J, Prakoso D, Long MT

Eastern Equine Encephalitis Virus (EEEV) is a mosquito-borne RNA-virus, which leads to inflammation of the brain, affecting both humans and horses. Prevalent in the southeastern region of the United States, the virus' fatality is a well documented 95-100% in both humans and horses. For these reasons, EEEV is the focus of this project. However, EEEV is only one of several neurological diseases which cause clinical signs similar to EEEV and accurate, rapid identification of the causative agent eludes the veterinary and public community. Other important neurologic diseases of the horse which must also be ruled out for surveillance purposes include: West Nile Virus (WNV), Equine Protozoal Myeloencephalitis (EPM), Rabies virus, Halicephalobus deletrix and Equine Herpes Virus (EHV-1). Neurological disease represents approximately 0.3%, depending on age, of all health problems identified by owners in the latest 2005 Equine National Animal Health and Monitoring Study (NAHMS). The true contribution of neurological impairment to the health of US equids overall is actually unknown due to poor diagnostic tools and loss of animals to post-mortem testing. Data from this project represents a collaborative effort to create an electronic database of all UF College of Veterinary Medicine's archived brain tissues reaching back to the year 1995, as well as developing standardized PCR methods for the detection of these neurological viruses in formalin fixed paraffin embedded (FFPE) tissues. Creation of this valuable archive will also allow us to study changes in EEEV over time so that an understanding of what factors lead to EEEV outbreaks can be identified. This study has three primary goals: 1) To create a comprehensive database of all equine neurologic cases examined microscopically at the University of Florida College of Veterinary Medicine (UF CVM) between 1995 and 2009; 2) To expand methods confirmed RNA-sensitive during Summer 2009 to detect nucleic acid detection assays in FFPE tissues and retrospectively confirm clinical findings of suspect cases identified from the database; 3) To determine the validity of genetic sequencing from FFPE brain tissues (archived) by examining the error rate of EEEV sequences obtained from recently confirmed equine cases.

Personal Statement After Starting Science For Life Award

Entering into summer 2010 I had many expectations for myself, including an increased understanding of how to best utilize my time in order to accomplish research objectives. What I did not realize was how much I had grown since last summer, which was my first experience in any laboratory setting outside of the classroom. After a brief hiatus from the lab during Spring 2010 semester, I returned to find that not only had I retained and mastered new skill sets, but I was also more aware of how my actions in the lab related to literature and the mechanisms behind my work. One of the most significant concepts I have come to value is the importance of maintaining detailed, accurate records of data in a well-organized lab notebook. Dr. Long has also helped me to gain confidence in my abilities, which has helped me become more comfortable in my courses, especially when facing material and new techniques that I am not currently familiar with.

Probably the most novel experience of all, was realizing that I now harnessed some lab experience and knowledge that could be passed onto others. With new graduate students and collaborations taking place under Dr. Long, I was given the opportunity to demonstrate and teach all of the following processes that I had learned last year: 1) Cutting scrolls of sample from formalin fixed paraffin embedded blocks; 2) Purification of nucleic acids (RNA and DNA) from formalin-fixed paraffin embedded (FFPE) tissues using three different techniques; 3) Reverse transcription of RNA to cDNA using two different techniques; 4) Setting up reactions and running quantitative Real-Time PCR.

Some new concepts I have learned this summer include: running conventional Reverse Transcription PCR; setting-up, completing, and interpreting results from Gel Electrophoresis; and troubleshooting to avoid contamination. Outside of these lab techniques, I also enrolled in and completed training courses for designing an electronic database through Microsoft Access. I plan to continue learning about this program and use it for my data collection in the future.
Personal Statement Before Starting Science For Life Award

I have always been attracted to the sciences, not just learning material through courses, but the art of science itself, which is conducting research to answer questions, explain mysteries, and develop something which helps mankind. When I came into the University of Florida, I wanted to take on research because I found it to be a more practical approach to learning science, and I wanted it to be in something that would benefit society. I enrolled in the Science for Life Seminars, through which I met Dr. Gower. By that time I had already interviewed a couple of other professors about their research, but after viewing her presentation on biosensors I strongly felt that I found what I was looking for. I chose her as my mentor because I believe that her project, in the long run, has the potential to change the way we detect and diagnose diseases. My goal in life is to pursue a combined M.D. and Ph.D. degree because I want to become a pathologist. My goal is such because it fulfills my dreams and desire to help people, both as a doctor and as a researcher, so this project will benefit my longer term career plans. In this way, I plan to integrate the Research Award activities to my plans beyond undergraduate studies.

I have already worked with the graduate student that coordinates this project in Dr. Gower’s laboratory since the beginning of this semester, so I have already been trained in the methods and techniques specific to this project. The HHMI Undergraduate Research Award would be of great help to me and my mentor as it would allow for us to purchase the expensive sensors necessary to complete the research and especially since the project has not had many major breakthroughs so far. My research is expected to span two years by which then I hope to develop a reusable sensor which would allow me to be a co-author on a peer-reviewed scientific publication. Many of the courses I will be taking in the future enhance my knowledge of my research, such as microbiology. I will be taking a heavy course load next year, but I will take only two major sciences and relatively low-demanding electives so that I can devote most of my free time to advance my research.

If the research goes well and I am able to manage the experiments independently, I would like to travel abroad, perhaps to countries such as France and England, and conduct my research there, which may even lead to forming collaborations with my mentor. Presenting my research at national meetings and competing for other research awards are goals that I definitely look forward to.

Abstract

Biopanning for Inorganic Binding Peptides for Self-cleaning Biosensor Applications

Biopanning is a selection process by which bacteriophages, from a library of phages, can be screened for the strongest binding affinity to a specific inorganic surface or electronic material. Those peptides can then be collected and have their DNA sequenced in order to design peptide linkers to bind the same way to the desired inorganic material. A biosensor is a device for the detection of an analyte using a transducing agent, like antibodies or cell receptors. This is usually designed with associated electronics or signal processors which are primarily responsible for the display of the results in a user-friendly way. Biosensors have many potential applications and can also be used in medical health related targets, the detection of pathogens, the determination of drug residues in food such as antibiotics and growth promoters, and the detection of environmental contaminants such as airborne bacteria. However, because biosensors are very expensive, this is a limiting property. The hypothesis – the basis of conducting this research – is that bound peptide linkers on inorganic surfaces used for biosensors can be released by applying voltage to the surface. This is important to study because if the hypothesis holds true, then electroactive peptide linkers can be developed to have reversible binding affinity which would allow for a triggered, self-cleaning sensor surface, releasing the clogged receptors. The result: continuous sensing from replenished receptors. Biosensors are already feasible and commercially available, and this advancement would make them more efficient and affordable. A significant potential application of these electro-activated peptides includes antifouling of devices prone to biofilm formation; or replenishment of spent, or clogged, bioreceptors.

Personal Statement After Starting Science For Life Award

Participating in this project has taught me more than I initially expected to get out of the experience. My goal is to become a physician, and I know very well the difference between providing care for a patient and finding a cure. I started to do research because I believed in finding a solution to improve an aspect of human life. Working on this project with my peers and mentor allowed me to become a more responsible and dedicated person and has taught me valuable skills as well as to think more like a scientist. I have developed better presentation skills, better lab technique skills, and better group-working skills.

Although I do not intend to make research the main aspect of my profession, I intend to conduct research throughout my years in school and possibly beyond. I participated in the Summer Medical and Dental Education Program for six weeks in Virginia, and I was able to get a glimpse of what my future may be like. I also learned more about the choices I have as a physician, including pursuing the academic side of medicine as opposed to the only the clinical side, which was very interesting to me. I know that my research experience as part of Science for Life has prepared me well for doing any amount of involvement in research later on.
Award
Starting Science For Life

Personal Statement
Before
Starting Science For Life
Award

My interest in research developed during my junior year in high school when I took a research course provided by the Center for Advanced Technologies Magnet Program. One of my proudest moments in high school was when I qualified and placed in the Intel International Science and Engineering Fair. My experience at the school’s research lab, my involvement in various science and engineering competitions, and my relationships with my high school teachers have inspired me to pursue a career in research, specifically in biotechnology. I hope to develop similar relationships with my professors here at UF and gain experience that can serve as a foundation for my future research work. Participating in the HHMI Research Program will prepare me for graduate school.

I have volunteered at the Settles lab since the start of the spring semester and have done PCR, gel electrophoresis, and various laboratory tasks. I have spent up to 12 hours at the lab per week this semester and I intend to spend more time at the lab this summer and the following semesters if I have the opportunity to participate in the HHMI Research Program. I have challenging classes this freshman year such as Genetics and Physiology and Molecular Biology of Plants and my time at the lab has enhanced my understanding of these subjects. It has not been detrimental to my undergraduate studies as one might think.

I learned about Dr. Settles and his research during a Science for Life lecture. His discussion on seed development and maize genetics interested me. I have thought of doing research in genetics since the start of my freshman year. I chose to interview him for my Science for Life assignment and I was fortunate enough to have the opportunity to volunteer at his research lab. I want to get more involved at the lab by working on a project with the other lab members. I chose to work on mapping to learn more about molecular genetics. We are mapping different seed mutants using Simple Sequence Repeat markers to understand the metabolic and developmental relationships between the embryo and the endosperm during seed development. I hope I have the opportunity to work on this project during the summer and until it is completed. This project will take a minimum of one year and could extend to a longer time period depending on funding. If the results are conclusive, then there is a chance that I can be a co-author for this project which can lead to many future possibilities as an undergraduate.

The experience gained from working on this project will give me more opportunities to conduct further research at this lab. The HHMI intramural research program will help me prepare for graduate school and a career dedicated to research and development. Participating in activities such as the Undergraduate Research Forum will give me the opportunity to meet individuals doing research in other fields. I intend to participate in other HHMI programs such as the Extramural Research Program and the Provost Scholar program during my time at the Settles’ lab.

Abstract

Molecular mapping of maize seed mutants to understand metabolic and developmental pathways required for seed development

Bagodon A, Gay B, Martin F, Spielbauer G, Tseung CW, Settles AM

Maize is a staple food crop in both developed and third world countries. It is used in various industrial applications such as biofuel and medications. The endosperm in the seed is rich with starch while the embryo contains oil. Thus, it is imperative to understand the metabolic and developmental pathways primarily between the endosperm and embryo for crop improvement. The identification of target genes is done by using a map-based approach. F2 mapping populations were generated using B73, W22, and Mo17 hybrid reference lines in order to map different seed mutants. The rough endosperm (rgh) mutants have an etched surface indicating profound effects on embryo and endosperm development. An evenly distributed set of 83 Simple Sequence Repeat (SSR) markers were selected in previous research and are used as a primary tool for fine-mapping. (Martin et al., 2010)

Carefully selected SSR markers were scored for genetic linkage using Polymerase Chain Reactions (PCR) under optimum conditions and gel electrophoresis. (See Figure 1) The number of individuals in each mapping population has been expanded from 24 to up to 180. As the physical interval decreases, the number of individuals will increase to provide a more accurate mapping distance. One mapping population has been mapped with one designed SSR marker at approximately 2.36 cM flanking the left side of the mutation. Two possible transposon insertion sites could contribute to the rgh phenotype. Flanking Sequence Tags (FSTs), are genomic sequences next to the transposon insertion sites and can be used to identify the insertion. (Settles et al., 2004) Another SSR marker must be developed flanking the right side of the mutation to confirm mapping distances. If the FSTs are not confirmed, then the physical interval must be flanked to <1cM in order to clone the rgh mutant. This fine-mapping approach is applied on several mapping populations to locate genes that impact embryo and endosperm development.

Figure 1: Gel Image: One panel from 09A-0752 mapping population. The controls are indicated below: H-water, B-B73, W-W22, M- B73/W22, N-Normal pool (16 individuals)

References:

Personal Statement
After
Starting Science For Life
Award

As a recipient of the HHMI Science for Life award, I had the opportunity to gain one-on-one coaching from Dr. Settles in molecular genetics. This past summer has allowed me to practice problem solving, learn important laboratory methods, and understand the dedication needed in academic research. The fellow members at the Settles laboratory made my summer research enjoyable. Participating in the HHMI program has been an extraordinary learning experience that has opened my eyes to possible career opportunities in the science and technological fields.

Learning from a textbook or listening to a lecture is not anywhere near comparable to hands-on research. Over the past few months, my laboratory techniques have significantly improved. Analyzing data from my experiments has enhanced my critical thinking and understanding of fine-mapping. From a larger perspective, I understand how my research can make an impact on society, specifically in the agricultural industry. My summer experience at the Settles lab and further research at this laboratory will benefit my future endeavors in science and will give me an advantage when applying to graduate school.
Personal Statement Before Starting Science For Life Award

Having a natural interest in biological sciences and a deep curiosity of the inner workings of the human body, I find medical research very appealing. I have also admired the scientific process as a model for patience, discovery, and critical thinking. During the summers after my junior and senior years of high school, I volunteered as a research assistant in the prostate cancer laboratory of Professor Carlos Perez-Stable at the University of Miami. I enjoyed the experience so much that I quickly joined a lab studying brain cancer at the start of my second semester at the University of Florida.

My research mentor is Professor Jeffrey Harrison, who studies the role of chemokines (proteins released by cells that signal the immune system) in primary brain cancer. I came upon his research while listening to his presentation last semester in my Science for Life class. I was instantly captivated because I knew quite a bit about cancer research from my past summer experience and it is my favorite topic. I was also really interested in Dr. Harrison’s research because his lab studies the brain, the most complex and fascinating organ in the human body. I was presented with the opportunity to become a pioneer in a relatively unexplored field and gratefully accepted it.

I look forward to continue working under Dr. Harrison throughout my undergraduate years. Besides conducting experiments, I plan to increasingly devote more time to analyzing data, conducting statistical analysis, and charting the course of future experiments. If the research proceeds favorably, I hope to publish results by becoming a co-author of research papers and also present my data at local or national meetings or conferences. My aspirations after completing my undergraduate studies include attending medical school and becoming a physician. In addition, I would like to continue doing research and will consider pursuing a Ph.D. I believe my patients will be able to get better access to new medical therapies from cutting-edge research if I pursue a dual track of patient care and medical research.

I have learned to keep a planner and to manage my time efficiently in order to be successful. In high school, I took mostly AP courses and was still able to participate in many extracurricular activities including the marching band, academic clubs, drama productions, debate, and business marketing competitions. Currently I have all my classes in the mornings. After classes, I go to the Academic Research Building and work in Dr. Harrison's lab for 2-3 hours every day. After that I have ample time left in the day for studying and extracurricular activities. My weekends are wide open and will be used for additional research as needed. This schedule has worked out excellently for me so far and I plan to organize my time similarly next fall.

During the summer term, I will expand my efforts in the lab by doing research full-time.

As outlined in the research proposal, experiments currently scheduled are expected to take at least 6 months. With successful completion of these studies additional experiments will be conducted to extend the research project; these are highlighted in the future directions section of the proposal. I am genuinely excited to engage in this research project and look forward to the challenges this learning experience will offer. I view this opportunity as a chance to further develop my patience, critical thinking skills and most important, a thirst for scientific discovery.

Abstract

Functional characterization of chemokines in malignant glioma

Bhadha CP, Liu C, Harrison JK

Glioblastoma Multiforme (GBM) is the most aggressive type of primary brain tumor in humans. GBM is very difficult to treat because it is very resistant to conventional therapies, which have a high chance of causing permanent damage to the brain. GBM is highly invasive but not metastatic. It is known to affect the glial cells and can grow by suppressing the immune system. Chemokines are a family of small secreted proteins that can induce chemotaxis in nearby responsive cells. They can mediate the migration of immune cells into a tumor and also have direct effects on the cancer cells. The major goal of this research project is to understand the functions of chemokines in biology of malignant glioma. In addition, the mechanisms by which other cytokines or growth factors regulate chemokines and chemokine receptors are also of interest. The first phase of this project involved studying the effect of transforming growth factor b, TGF-, on the expression of chemokines and chemokine receptors. Since gliomas are known to have high levels of TGF- , it was hypothesized that TGF- regulates chemokine and/or chemokine receptor expression. To test this, we treated GL261 mouse glioma cells with TGF- and a TGF- pathway inhibitor for 24 hours and extracted the RNA. Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) was used to measure the expression of all known chemokine receptors and some chemokine ligands. TGF- appeared to down-regulate some chemokine receptors. For instance, CCR3 was consistently down-regulated in cells with TGF-treatment and up-regulated in cells treated with TGF- inhibitor. However, Fluorescence-activated cell sorting (FACS) analysis of CCR3 surface expression showed that the percentage of cells and mean fluorescence of intensity reflecting expression of CCR3 was not affected by TGF- treatment. In summary, the results of these experiments suggest that glioma expressed chemokines and chemokine receptors are not regulated by TGF- pathways in vitro in this murine glioma line. Going forward, we will explore other mechanisms of regulation of chemokines and chemokine receptors. Some possibilities include the STAT3 and MAPK pathways, which have been linked to tumor growth and proliferation. We will also extend our studies to include experiments using patient-derived human glioma cell lines.

Personal Statement After Starting Science For Life Award

Participating in the Science for Life program has proved to be a truly valuable and humbling experience for me. In my short time working in the laboratory of Dr. Harrison, I have learned a great deal about the biology of brain cancer and the methods used to study it. I’ve also had the opportunity to learn and develop new scientific techniques and important research skills.

But above all, I have come to understand and appreciate just how challenging research can be. Failed experiments may seem daunting, but they are a part of the research process and will happen to everybody. I have had more than my share of trials and tribulations in the research lab, but my mentors have helped me learn from these setbacks and get past them. I have developed a vast respect for scientists, who embody the patience and determination so necessary for success in the research field.

As a freshman first coming into undergraduate research, I had a thirst for knowledge and discovery, but no idea how to put that enthusiasm to work. Now, thanks to the Science for Life program and my experience doing research under my mentor, I have confidence in my abilities to design, conduct, and interpret experiments. I look forward to continuing to work in this lab for the remainder of my time as an undergraduate and hope to stay involved in medical research for years to come.
I knew even before entering the University of Florida that I wanted to pursue undergraduate research, having acquired a passion for mathematics and the sciences as well as desire to expose the unknown during my early years of education. To me, research seems the natural path, satisfying my inquisitive personality and challenging me intellectually in ways that textbooks and quizzes simply cannot.

I have been working in Dr. James Cuda’s lab since the beginning of my second semester at UF. I met Dr. Cuda when I decided to interview him as part of the HHMI Science for Life Seminar. His research on invasive exotic plants piqued my interest due its similarity to research I had done in high school in a similar field. Dr. Cuda and I have discussed co-authoring a paper concerning my current and future research assuming meaningful results are reached: research assuming meaningful results are reached.

Following my first semester of college, I knew that I would be able to commit to the time constraints required for serious research. Even among a heavy course load and extracurricular activities, I am able manage my time effectively to complete assignments, study for classes, and even pursue creative endeavors. It seems that the more that I have on my plate, the more productive I tend to be and I believe that this phenomenon will not only help me succeed in my research but will also aid me in my academic pursuits.

Although at present my career plans are still unclear, I cannot see any future possibility that would not involve me in a scientific setting. My interests range from biology and chemistry to mathematics and statistics to computer science. I find that science is most interesting when it combines these (and other) disciplines. Dr. Cuda understands this and has made great efforts to help me develop a project that stimulates my scientific interests. I hope to apply what I learn through my research to other fields, combining disciplines in order to find the area in which I can make a significant or novel contribution.

Abstract

Mathematical and Computational Modeling of exotic Apocnemidophorus pipiti on invasive Schinus terebinthifolius

Bricker JT, Cuda JP, Donahue DA

My project attempts to quantify the interactions of Apocnemidophorus pipiti, a stem-boring weevil native to South America as a potential biological control agent of Schinus terebinthifolius (Brazilian peppertree).

1) The computer simulation is being created through an object-oriented approach using the Java programming language. This model will simulate the life of each weevil from egg to larva to pupae to adult and each plant from seedling to sapling to adult and the interactions among them. The data for this model is taken from the longitudinal studies of John J. Ewel1, et al. and from a series of experiments designed specifically for this project.

2) The mathematical model will be constructed using the data collected by Dr. James Cuda, et al2 as well as additional studies conducted on the Brazilian peppertree3, and experiments designed for the model.

Brazilian peppertree is an exotic, invasive shrub that was introduced into Florida as an ornamental plant, spreading rampantly across central and southern Florida and establishing dominance in over 280,000 hectares of land in South Florida alone4. This plant has been successful in dominating entire ecosystems and replacing native vegetation due to rapid fruit production, seed dispersal by migratory birds, as well as its extraordinary adaptive ability5.

A. pipiti was discovered feeding on Brazilian peppertree in Northern Argentina in 2004. Its current status as a restricted exotic species requires that all experiments be done in quarantine. A model is therefore an important tool that will allow us to predict what will happen upon the release of A. pipiti into the wild.

References:


Personal Statement Before Starting Science For Life Award

Some people, upon leaving their mother’s womb and sometimes even before they have taken their first breath, are born with this innate calling which drives them towards achieving their life goal. I, on the other hand, was born crying. Ever since that first moment it has been a struggle for me to understand who I am as a person and what my purpose in life should be. I can proudly say that, as a college student, I have finally figured out who I am. However, the question that remains unanswered is “what is my role in society?” Nevertheless, after diligently questing for my self-identity, I firmly know that due to my inquisitive nature, I belong to science, and moreover, to research within the sciences. Simply put, I am addicted to dreaming and seeing those dreams come to fruition to the best of my abilities.

I began researching in Dr. Michael Bubb’s lab last summer, and for the past year, research has played an integral role in my educational development. It has led me to explore new concepts and has reaffirmed old ones in a way that I did not think possible. In my experience thus far, I have found that research is not a supplement for my academic classes that I take at UF. In fact, it is exactly the other way around; my classes act as a supplement for my research. The information that I have learned in biology, organic chemistry, and the various other science classes that I have taken is exceedingly pertinent to the biomedical research that I conduct. After spending a large portion of time participating in and observing the dynamics of Dr. Bubb’s lab, I feel reassured that this subject of research has implications to many areas of healthcare—including pathologies such as cancer and AIDS, and will be enduring. As such, there will be many opportunities for publications and presentations of my research in the years to come.

Although I was not born to be a researcher, what I do know, is that as a mature individual I have made the decision to pursue a career in medicine, while maintaining a high focus on academic research.

And while the type of research that I conduct in the future will undoubtedly change as I specialize within the medical field, this project and this lab will act as a perfect starting point for the cultivation of my passion. I hope the HHMI award will facilitate my arduous journey in pursuit of the advancement of scientific and medical research, and moreover will help me to establish my role in society.

Abstract

Actin-remodeling in Human Cells Via Membrane Penetrating Peptide
Chakravarty T, Bubb M

Rheumatoid Arthritis (RA) is a systemic autoimmune disorder that primarily affects joints, but also has the potential to attack many tissues and organs. It is characterized by inducing inflammation of the synovial tissue that often progresses to the destruction of articular cartilage and ankylosis of the joints [1]. Recent studies have shown that tumor necrosis factor (TNF)-α, part of the cytokines family, plays a crucial role in the pathogenesis of RA because its inhibition can mitigate the disease in some patients by triggering a cascade effect which leads to cell apoptosis, thus reducing swelling within the joints and other affected areas [2]. This project aims to regulate gene expression at the post-transcriptional level by observing the use of GW-182 proteins as bio-markers for microRNA (small non-coding RNA molecules) involved in the TNF-α pathway.

GW-182, also known as mammalian P bodies or GWB, are a type of cytoplasmic foci involved in post-transcriptional regulation of eukaryotic gene expression. Studies have shown that GWB can be inserted into cells and be monitored as biomarkers for siRNA and miRNA, which are responsible for negatively regulating gene expression at the post-transcriptional level, activity within the cell [3]. The expression of certain miRNAs are principally due to the stimulation of TNF-α, so based on these data, we can track them using GWB. By observing the specific pathway that the GWB may take will elucidate the intricacies involved with RA studies. Additionally, this research studies the ability of GW-182 to bind to actin filaments (F-actin), which are primarily responsible for cell motility when coupled with depolymerization and polymerization—a process known as treadmilling. This is particularly important when conducting cancer research while studying cell motility. The difference between a malignant tumor and a benign tumor is that the malignant one is capable of movement, consequently spreading to other parts of the body and causing additional damage, which in many cases can be fatal. By manipulating the actin within the cytoskeleton of the particular cells in question, it is possible to immobilize the tumor, thus preventing the dissemination of further damage. The malignant tumor, once restricted, can be removed in the same manner as that of a benign tumor, which as a result will save many lives. So the GW-182 protein can act as a biomarker upon the F-actin, which will then facilitate a better understanding of the micro-mechanics involved with cell motility. This research has numerous implications in multiple areas of health care because TNF-α is believed to be a mediator in various pathologies such as cancer, AIDS, and transplantation rejection.

References:

Personal Statement After Starting Science For Life Award

This past summer has opened up my mind to the universe of biochemistry, and its groundbreaking potential within--but not limited to--the field of medical research. The knowledge that I gathered from my project, and the insight that I gained about myself, has given me the confidence that I need to be successful in the many years of research that lay ahead for me. While I have made much progress (near completion) with my experiment, the many times that I failed along the way have acted as a frustrating yet humbling training, which has yielded a strong learning experience as the final result. Through these failures, I developed how to think analytically, and problem solve. The HHMI Undergraduate Research Award has acted as a pseudo-grant, in that it has taught me how to apply for, receive, and utilize a grant for scientific research. Although future grants may be more tedious to acquire, at least the process will be similar. It is the first of hopefully many that I will have the privilege of receiving, in my ideally long life of medical research and academia.
Personal Statement Before Starting Science For Life Award

Research has been an interest of mine since the start of college. Due my zeal for research, I enrolled in the Science for Life Seminar in hopes to find out more about the many opportunities that are available to me at UF. Through this seminar, I was able to find a faculty mentor, Dr. Weihong Tan, that I was interested in conducting research under. His research on aptamers to treat and target cancer cells using SELEX and other methods excited me. As a prospective oncologist and researcher, I knew that his group would be perfect. I met with Dr. Tan a few days later and he led me to speak to two of his undergraduate students in the lab, Michael Donovan and Michael Mavros—one of whom is a current Science for Life Scholar. From talking to them, I was able to get a better understanding of what undergraduate research entails and the benefits of the Science for Life Awards. Soon, I began training session in each department: molecular biology, chemistry and nanotechnology. Later, Dr. Tan paired me up with Gui Zhi and Meghan O’Donoghue, his graduate students, to get an insight into their research projects. The meetings with graduate students that are very helpful and intelligent reiterated my passion for research and heighten my interest to join Dr. Tan’s group. I hope to use the experiences gained at UF to excel in Professional/graduate School so that I can assist others with the best possible knowledge and skills. I am confident that HHMI Science for Life Award will be a great starting point.

I understand that research takes time, but I am going to balance my classes and activities to make sure that I am devoted to research. As evident through my resume, I am an organized and efficient person—I know that I will be able to juggle extracurricular activities and research while obtaining stellar grades. As an example, I am going to schedule my classes so that I will have at least 4 hours to work on a project each day. For the summer of 2012, I plan to conduct research out of the country in France at the Louis Pasteur Institute or in South Korea at the Seoul National University. As an overall goal, I plan to publish in at least one paper at the end of my career as an undergraduate. All these goals are only possible with the help of Science for Life Program.

The prospects of becoming an HHMI Science for Life Scholar will open doors to many different opportunities at the school and even internationally—many research opportunities and even getting a sense of the world in which we live. I know that this program will build a bridge so that I can successfully become a selfless and recognizable researcher and a clinician of oncology to help others in need. “Only a life lived for others is a life worthwhile.” (Einstein) I look forward to the doors that Science for Life will open for the future.

Abstract

Selection of Internalized Aptamers
Chang YM, O’Donoghue M, Bayrac T, Tan W

Aptamers are nucleic acid or peptide based molecules that bind only to a specific target. Aptamers, in addition to having selectivity and affinities similar to antibodies have a number of other advantages, including, no immunogenicity, low molecular weight allowing for increased tissue penetration, ease of functionalization, and reproducible chemical synthesis. Once optimized, our aptamers will also be investigated for improved drug delivery applications.

We are selecting for aptamers that bind to surface proteins, and then internalizes rapidly. Research has shown that using cell-penetrating peptides (CPP), it is possible to deliver polar, biologically active compounds both in vitro and in vivo. While these proteins are useful in delivering cargo rapidly, they suffer from many problems including toxicity and conjugation issues. We hope to make small nucleic acid probes that can serve a similar function without the drawbacks.

To select aptamers we use a modified cell-SELEX protocol: 1) we incubate the cells at 37°C with a large number of random DNA sequences; this is our pool. 2) after 2 hours we wash unbound sequences off the cell surface, then trypsinise the cells for 20 min at 37°C. This cleaves proteins from the cell surface, and removes any aptamers that have remained on the cell surface. 3) After washing off the trypsin, the cells are then collected and boiled to lye and isolate any aptamers that have managed to internalize. This is our new, enriched pool. We then PCR amplify this pool, in order to make enough DNA to do the next round of selection. ssDNA extracted from the previous iSELEX rounds were used to analyze binding to the cells. To see if we had enriched our pool for aptamers that bind the cells, we performed flow cytometry and tracked the amount of FITC labelled pool was on the target cell surface compared to a random control. Internalization was further examined by using a confocal microscope to detect fluorescence within the cell after 2 hours incubation at 37°C.

Once complete we can use this aptamer for drug delivery or to target intracellular proteins. Many drugs suffer from low membrane permeability, but we can use these aptamers to help improve the permeability of these drugs, increasing their value and effectiveness.

Reference:
Personal Statement Before Starting Science For Life Award

I began my first summer at the University of Florida without much direction. I was enrolled in the Engineering Freshman Transition Program and was excited to learn. The program was rather difficult compared to the average students’ summer, yet it offered me an opportunity next to none. I was introduced to passionate professors who spend their time researching what interests them. I attended engineering lectures about numerous subjects from Aerospace Design to Nano-Technology. This introduction to UF inspired me to look for something I am interested in.

The Universities Honors Research Database was very useful in getting started with a research program. I looked at the many subjects offered and found one which stood out from the rest, “Bio-Mems Manufacturing”, just the title made me want to know more. After meeting with Dr. Hugh Fan and discussing “Bio-Mems,” I knew it was something I wanted to be a part of. I had asked to be a part of his lab my first Fall semester, but I was not chosen. Being persistent I constantly informed Dr. Fan of my interest in his program, but I was not chosen. Being persistent I constantly informed Dr. Fan of my interest in his program, and I gave an interest in his lab starting Spring 07-08. I am proud to say that I am the youngest undergraduate he has hired to date.

I worked under Dr. Fan for two semesters exploring the manufacturing techniques of polycarbonate micro fluid devices. I made the contributions of increased manufacturing rate, quality, and accuracy. I will be published as a co-author with main author Ruba Khnouf for our work on the polycarbonate well-in-well device.

I divided my time between school and lab by attending lab whenever I did not have class. I enjoy doing my work and take pride in the quality of my efforts. I have learned a great deal working with Dr. Fan the past two semesters, and wish to learn more about the engineering field and its applications.

Personal Statement After Starting Science For Life Award

This project has changed the way I see everyday work and how I expect to perform in a working/professional environment. I have been able to expand not only my knowledge of the science in which I am researching but also the importance of cooperation and mutual respect. I was initially very intimidated by my supervisors and older colleagues, but I have learned that when similar goals are shared there is no reason for adversity or intimidation. I feel that I can communicate within my laboratory effectively as well as read articles with a more efficient understanding of the material.

I also had the privilege of preparing a BBQ for the IMG laboratory group. We had a gathering of approximately 25 people with home cooked BBQ accompanying a range of Indian foods. It was a good experience and also made me appreciate what goes into the organization of events.

I think that having this experience will greatly enhance my future endeavors while also improving my self-direction. I have a much more concrete idea of where I want to focus my studies and how I would like to apply them in the future.

Abstract

Toxin Detection by use of CFCF and CECF bioreactors
Chapman BD, Khnouf R, Fan ZH

With the threat of biological warfare and global contamination there is a need for an efficient method to analyze and identify harmful toxins. This study seeks to understand the flow characteristics of micro-devices used for biological reactions. Through the study of fluid flow and membrane properties a novel micro-plate reader capable bioreactor can be developed. The two devices under study are CFCF (continuous flow cell free) and CECF (continuous exchange cell free) bioreactors. CFCF uses a continuous flow of crucial components to feed the reaction and remove waste, while CECF uses diffusion to exchange waste and crucial components. The goal of each device is maximum protein synthesis high signaling capabilities through either luminescence or fluorescence measured by a micro plate analysis device. The sensor array to be studied consists of an arrangement of micro-fluidic wells. Each well is designed to produce a preselected protein through a cell-free synthesis process. When a toxin is present the proteins synthesis is either reduced or halted altogether. Each array will produce a group of proteins; each protein is chosen judiciously so that the production yield of each protein is inhibited or affected differently by a toxin. Toxins are then identified by their characteristic effect on protein production. The geometry of these devices can be optimized to maximize the protein production and in turn increase the signaling capabilities.

Comparison between the protein expression yield in a fluid array device (green) and in a standard microplate (red). The negative controls (black) are for expression yield quantitation. Proteins indicated in the x-axis are green fluorescent protein (GFP), Luciferase, β-glucoronidase (GUS), β-galactosidase (lacZ), β-lactamase (β-lac), and alkaline phosphatase (AP).

Figure 1: Top View CECF – Passive Pumping

Figure 2: Bottom View CFCF – Active Pumping
My personal goal for college is to explore all the opportunities that UF has to offer, to challenge myself mentally and physically in order to see what I can accomplish, and to emerge from the end of four years a better-rounded individual, ready to take on the rigors of medical school. Since I have always been interested in science, I began my first semester by exploring the various research opportunities at UF through the Science for Life seminars. After listening to several speakers and visiting a couple of their labs, it occurred to me that I had never looked into the instructor of the course: Professor Ben Dunn. I contacted Professor Dunn and he agreed to show me around his lab and introduce me to his research. I was immediately drawn to his research on HIV-1 protease and the lab environment—most of the people working the lab were also undergraduates and the lab manager, Dr. Goldfarb, seemed eager to get me involved. After taking some time to consider the different options, I decided that Professor Dunn’s lab was the best fit for me.

Through previous experience from the Vanderbilt Summer Research Internship Program, I know that scientific advancement is the product of significant time and effort. Therefore I intend to dedicate all four years of my undergraduate stay researching in Professor Dunn’s lab. In this relatively short amount of time, I am determined to co-author scientific papers that will contribute to a greater understanding of HIV protease and help pave the way for better treatments. I am very passionate about my current project as I believe it is helping to shed light on a much neglected aspect of HIV research by focusing on the HIV-1 C subtype. Although this subtype accounts for half of the world’s HIV infections, it has not received nearly as much attention as the B subtype which infects primarily Europe and the Americas.

Currently I spend 8 to 16 hours in the lab each week. Although I try to plan my classes for earlier in the day to free up my afternoons for working in the lab, having to work around my academic schedule is definitely a challenge that inhibits my research’s progress. Consequently I look forward to this summer, when I’ll be able to spend 40 hours a week in the lab and get done in one week what would have taken me 4 weeks during the school year.

Following my undergraduate education I plan to pursue a MD, or PhD, or MD/PhD degree. Next year I plan to apply for the Junior Honors Medical Program (JHMP) at UF. I believe this research experience will not only make me a stronger applicant to the program (and other medical schools if I am not accepted into JHMP) but also a better doctor by developing my analytical skills. If I choose to pursue a PhD instead, this experience will be invaluable to my development as a scientist; already, I have become familiarized with the scientific thought process and common lab protocols. Additionally, if I choose to go the MD/PhD route, this experience will help me to apply what I learned in the lab to clinical practice and provide the best patient care possible.

This summer I plan to accomplish enough with the HIV-1 subtype C protease to merit being a co-author on Dr. Goldfarb’s paper. If the opportunity arises and if Professor Dunn allows, I hope to attend a conference relating to HIV research this summer. During the school year I hope to present a poster of my research at the Undergraduate Research Symposium. Next summer I plan on applying for the HHMI Extramural Scholarship and visiting an off-campus collaborator’s lab to gain new experiences and skills that I can bring back to UF.

Abstract

The contribution of the N88D/L90M mutation in altering the biochemical and structural characteristics of HIV-1 subtype C protease. 

Chen Q, Dunn B

Approximately 33.4 million people are infected with human immunodeficiency virus (HIV) worldwide. 1 50% of these infections are due to HIV-1 subtype C.2 Study of HIV-1 subtype C protease and its mutants is relatively limited. Two nonactive site mutations, N88D and L90M, were engineered into the wild type HIV-1 subtype C protease without the Q7K/L33I/L63I stabilizing mutations. Previous research demonstrated that these two mutations give the protease a 50 fold increase in Ki compared to the wild type when bound to the protease inhibitor, saquinavir. X-ray diffraction data was collected on the crystals to a resolution of 2.4 Å. The wild type HIV-1 subtype C protease is currently in the process of being synthesized for crystallization trials.

References:
Personal Statement

I worked with Dr. Tseng during the Summer 2009, under the mentorship of graduate student, Peu-Hsun Wu. I also wrote a draft 25 page report on the topic as requested by the PERC summer program. Unfortunately, the sources of my grant were discontinued so I am now focused on my job at the AT Teaching Center as a Mathematics and Statistics tutor instead. I plan to continue working with Professor Yiider Tseng and his research team in the future, as soon as I am funded once again.

My goal for this summer is to focus on researching full-time to get the project going once again, and I plan to continue working on at UF next semester. I have been focused on experimental work at Dr. Tseng's laboratory. I mainly enjoy hands-on projects, but I prefer to allow for some experience doing theoretical studies this summer. I have been planning on combining the two into one project, doing experimental work in Dr. Tseng's laboratory and theoretical work with Professor Dmitry Koperlech. Dr. Tseng focuses on biomechanics of cells; whereas, Dr. Koperlech works with transport of lipid membranes as well as dynamics of cells and drug delivery. I have spoken to both and they have agreed on mentoring this project. I am a very dedicated and committed researcher.

I have also taken research credits with Dr. Tseng in the past, during the Fall semester. I learned to incorporate research into every day. It wasn’t an easy task, specially because I was also working long hours at the AT Teaching Center, but I made a routine of going to the laboratory early in the mornings, and I gave myself 2-3 hours at least each day to only focus on research. I also had to keep track of experiments and come back to see the results in between classes or work, but I managed very well towards the end to keep organized.

I worked cooperatively with other undergraduate and graduate students in the lab. Whenever I would run a gel electrophoresis test, I almost always ended up running other students’ results as well. And they would take a picture of the results later if I had to leave. This is an example of how I learned that team work is the most efficient way for everybody to accomplish what they need each day and to create a more pleasant environment. I love helping others in the laboratory because it gives me the opportunity to learn about their research. Many times there would be trouble-shooting to do with main pieces of equipment in the lab because many of us were getting negative results, and I enjoyed working together with everyone to solve the problem.

With the help of a grant, I would stop working on weekdays and enjoy more time focusing on researching only.

Abstract

Active targeting of liposome drug carriers using RGD (Arg-Gly-Asp) peptides
Chocron S., Sorg B.

I am currently an Undergraduate Research Assistant in the BITS (Biophotonics Imaging, Therapeutics, and Sensing) laboratory under the supervision of Professor Brian Sorg in the Department of Biomedical Engineering at UF. My project aims to assist graduate student Raymond Kozikowski in designing a noninvasive technique to improve the specificity of drug delivery to tumor microvasculature and tumor tissues while simultaneously improving the therapeutic efficacy of the cytotoxic agent over traditional nanoparticle formulations.

Chemotherapy is a standard treatment for metastatic cancer. However drug toxicity limits the dosage that can safely be used, thus reducing treatment efficacy. Drug carrier particles, like liposomal nanoparticles (LNs), can help reduce toxicity by shielding normal tissue from drug and selectively depositing drug in tumors. Over years of development, liposomes have been optimized to avoid uptake by the Reticuloenothelial System (RES) and effectively retain their drug content during circulation. As a result, liposomes release drug passively, by slow leakage, but this uncontrolled drug release can limit treatment efficacy as it can be difficult to achieve therapeutic concentrations of drug at tumor. Therefore, my aim is to enhance the peak concentration of drug in the tumor region as well as suppress release of the drug in healthy tissue by (1) devising an accumulation strategy and (2) designing a method of controlled drug release from the LN's.

To this point, I have succeeded in applying a method of active targeting of LN drug carriers specifically to tumor microvasculature and tissues. RGD (Arg-Gly-Asp) peptides, which recognize 3 proteins present within tumor microvasculature, were incorporated onto the surface of LN's. My hypothesis was that targeting the blood vessels would provide a gateway to the tumor tissue and interior of the tumor region. Figure 1 below demonstrates my success in using this strategy to deliver these particles in a murine window chamber model of a developing tumor.

Once accumulation is achieved, the next step is to release the drug that is encapsulated in the LN's by controlled disruption of the liposome lipid bilayer. My undergraduate student mentor has been studying a method of delayed bolus-release from liposomes using photosensitizers and red light, with the activation for delayed-release taking place ex vivo.

In the future, I will be studying the ability of accumulated LN's to lyse using photothermal therapy (PPT) as an alternative method. With this technique, heat is generated in selective regions using an applied laser light that is absorbed by chromophores present in the region. Specifically, I will devise a method of trapping and quantifying effective concentrations of indocyanine green (ICG), a selected chromophore, inside the targeted RGD-LN's that we have synthesized. ICG absorbs light in the near-infrared (NIR) spectrum, which is advantageous as it is able to penetrate biological tissues. Literature points out that heat emission from the absorption of laser light injures and/or kills cells. I will study (1) the effect that heat emission from NIR light absorption by ICG has on the lipid bilayer that makes up the LN membrane, and (2) the possibility of localized lysis for controlled drug release in tumor regions. This will enhance the concentration of drug released from the LNs and subsequently, the dose actually internalized by the neoplasm.

Figure 1: Tumor vasculature fluorescence microscopy images: (a) Control LN's- Non-RGD LN concentration around tumor tissue decreases significantly after a day, (b) RGD-LN's- Tumor vasculature demonstrates very high concentrations of RGD-LN's in the first hours and continues to increase and level off at a very high concentration after a day.

*Note: Only semi-quantitative comparison in this case between the control mouse and the RGD mouse because of possible differences between the thickness of the tumors and vessel density.
Personal Statement Before Starting Science For Life Award

When I began applying to colleges one of my primary goals was to continue my passion of science. University of Florida is world renowned for its state of the art research facilities. I immediately began contacting principle investigators to become involved in either cancer metastasis research, or glial carcinoma effects, or cre-cre recombinase mediation. Dr. Lewin's lab appealed to me the most. The research was 'cutting edge' and allowed me to explore areas of interest including genetic diseases of the eye and brain. Dr. Lewin immediately put me to work shadowing a postdoctoral candidate, Soojung. Since I began working in the lab in February of 2009, I have committed myself to working there everyday. It is the best part of my day. Since I have created my own research project, I have outlined a plan for the next year. Including this summer as I will be completing organic chemistry II. My ultimate ambition is to obtain an MD/PhD in genetics as I plan on making medical research a life long career. Dr. Lewin has discussed my co authorship if Soojung's paper publishes, and first author on my research of 'Adverse Expression of floxed genes of AMD Knock-Down Mice.' I love the challenges of research and the rewards of discovery. I will always do research to some capacity while at UF and beyond; as I have plans to compete and present at every level of symposia from the local, to the state, to the national, to the international. I hope one day soon to represent my research, Dr. Lewin, and the University of Florida on a national level at the National Conference of Undergraduate Research. I would love to participate in the Science for Life extramural research opportunity. I hope to find a corollary between my current genetic research and similar research abroad. To further explore this passion I am planning to attend, during summer intersession, a microbiology research course at the Paris Research Center entitled 'Legacy of Pasteur' in Paris, France.

Abstract

Locating Leaky Expression of Recombinating Factors in AMD Mouse Models

Cohen Z, Lewin A

Age related macular degeneration AMD is an incurable disease that affects a wide majority of adults (>50 years old) 1. AMD is caused by oxidative stress in the macula of the retina and primarily affects vision quality leading to drastically reduced nearsightedness 2. Utilizing mouse models that exhibit this disease is necessary in understanding the diseases pathology and working on a cure. The mice models are engineered using cre-recombination to delete a gene, Super Oxide Dismutase-2, SOD2, which regulates radical products of cellular respiration without this gene the tissue expresses oxidative stress which mimics the symptoms of AMD 3. It is in these mouse models that unusual traits were noticed. The promoters that obligate recombination are retinal specific. However, due to the unusual phenotype expressed by these mutant mice, there must be leakiness of expression in other tissues.

References:

1. Downregulation of p22phox in retinal pigment epithelial cells inhibits choroidal neovascularization in mice. Li Q, Lewin AS Raizada MK Hauswirth WW.
2. SOD2 Knockdown mouse model of early AMD, Department of Molecular Genetics, University of Florida, Gainesville, Florida, USA. Justilien V, Pang JJ, Hauswirth WW, Lewin AS.
3. Cre reporter mouse expressing a nuclear localized fusion of GFP and beta-galactosidase reveals new derivatives of Pax3-expressing precursors. Stoller JZ, Degenhardt KR.

Personal Statement After Starting Science For Life Award

My summer started with a trip to Paris. Not a vacation but a course offered through the microbiology program-The Legacy of Pasteur was a weeklong program chock full of lectures, tours, and museums. The course couldn’t have come at a more opportune time. Traveling to the Mecca of scientific ingenuity offered me the opportunity to incorporate method to my idea. Louise Pasteur is the father of modern theory-an innovative scientist who knew how to ask a question and more importantly how to answer it. I had noticed that the mice I was working on were phenotypically different from the negative control wild type mice; but I was unable to find the means that expressed a concise methodology. The answer was simple- first verify a weight difference and then go about finding ‘leaky’ expression in various tissues starting with the brain. With the help of Dr. Lewin and post doctorate Haoyu Mao I am well on my way to solving both of these riddles. My excitement about going to lab everyday and continuing my research is motivation enough-but the continual support I receive, the knowledge I gain, and the feeling of accomplishment all are contributing to the success of this research. The summer research will carry into the fall, the spring, and most likely the summer. This project is very open ended-even if I do locate leaky expression in foreign tissues, I will then design a more specific promoter for tighter tissue expression, or perhaps I will investigate the means as to how and why retinal specific promoters are expressed in other tissues-there are many routes to take. For now I am focused on determining why these mice are larger than their wild type counterparts, as well as the full load of courses, intramural tennis, and my artistic pursuits.
Personal Statement Before Starting Science For Life Award

For at least the next four years, I plan to develop and characterize the bioartificial pancreatic constructs in vitro and in vivo. I am currently in the process of gathering data that will be integrated into upcoming papers. Once this collection process is complete, and under the guidance of my mentor, I will publish papers. Upon entering the University of Florida, I was determined to study to become a pediatric endocrinologist. My research plan helps me gain more insight on diabetes and its consequences on the body. I get first-hand experience on the latest technology and developments for diabetes, but more exciting is that I am a part of a cure that I will provide for my future patients with diabetes.

I will work diligently to accomplish my future goals of poster presentations, publishing papers, and representing the accomplishments of the University of Florida, the lab, and my individual studies. I promise to follow the HHMI Science for Life's mission statement "to strengthen and transform undergraduate research and interdisciplinary laboratory education in the life sciences." I am a committed and driven individual; nothing will stop me from reaching my educational and career goals in the research field to make an impact in the lives of others and to be the change I want to see in the world.

Abstract

Development and optimization of a bioartificial pancreatic construct

Corrado MM, Carstens MR, Albert KS, Beveridge MJ, Simpson NE

By the year 2025, over 330 million people globally will be affected by diabetes. Currently, about 8% of people with diabetes have type-1, or insulin dependent, diabetes mellitus. The current treatment for this group is daily insulin injections, though the treatment is insufficient long-term, and patients still may suffer from consequences such as blindness, limb-loss, and cardiovascular disease. A bioartificial pancreatic construct would replace these injections for patients with type-1 diabetes mellitus to prevent long-term diabetes-related complications. In vitro studies measured the viability of entrapped TC-tet cells, while in vivo studies measured the potential of the constructs to reverse an alloxan-induced diabetic state in mice, as well as acceptance of construct materials in the body. We found that a polydimethylsiloxane (PDMS) ring containing cellular LVM-alginate beads in a LVG-alginate enclosed cavity allowed for sufficient cellular viability and proper function. The steps to create these constructs are outlined here. Additionally, this design allows for future insertion of an NMR coil to non-invasively monitor the survival of the construct.

Personal Statement After Starting Science For Life Award

Words cannot express how fortunate I am to have been involved in Science for Life (SFL), a part of Dr. Simpson's lab, and an HHMI scholar. Research has played an integral role in my college education since the beginning of my freshman year, and I know it will continue to be part of my life, even years from now when I am a physician. In my first year being a SFL scholar, I worked on perfecting techniques imperative to our studies, from cell culture to our in vivo mouse study surgeries. In my second year as a scholar, I have been doing more “science.” This year, I have used my techniques to answer questions and come up with even more questions. I have learned that a major component of the scientific process depends on these questions and answers, not just techniques. My critical thinking skills have helped contribute to our lab and set new directions to solve our current issues. Thanks to HHMI/SFL, I have had the opportunity to present at several conferences, and these experiences have also helped build my critical thinking skills. This past summer, I had the opportunity to share my experiences with SFL to incoming UF freshmen at “preview,” tell them of all the opportunities our school has to offer to undergraduates, and answer all of their seemingly endless questions. Once again, I am very fortunate to be a part of the SFL/HHMI program and to share my experiences with others, while building my own scientific skills.
Research has been an integral part of my life at UF. Since spring 2008, I have worked in two laboratories. Currently, I’m with Dr. Brandi Ormerod’s lab and have been working there since summer 2008. In this time, I have worked diligently to show my abilities and potential for success in research, with an ultimate goal of ascertaining my own research project.

In Dr. Ormerod’s lab I have been able to observe undergraduate and graduate students at work. I’ve witnessed and experienced what is expected and required of students in conduct and progress in both lab and projects. Many of the undergraduates in Dr. Ormerod’s lab are HHMI recipients. The recipients are highly capable students expected to work 20 hours a week during the school year and at least 40 hours a week throughout the summer.

When Dr. Ormerod approached me about HHMI, all of her expectations were clearly stated along with requirements for co-authorship. It is an honor to be co-authored and requires much work to achieve. Our lab standard for co-authorship is the collection of enough data to provide a figure on a peer reviewed publication paper. My ultimate goal as an undergraduate is to be co-authored, so I plan to work fervently to attain this.

This semester I have coordinated my schedule so that I will take classes in the morning and work in lab in the afternoons. Also, on Tuesday and Thursdays I have only one class. This allows time each week to catch up in either school or lab work. In spring 2008, I worked under Dr. Jane Brockmann and was enrolled in 15 credit hours. In summer 2008, I took nine credit hours and worked part time in Dr. Ormerod’s laboratory. My work with Dr. Ormerod continued into fall 2008 and I was enrolled in thirteen credit hours. From these experiences, I have become proficient at making school schedules which allot time for successful laboratory work.

Being a sophomore is also an advantage, since I have already acclimated to college life. I am efficient in my study habits and do well at allocating my time responsibly. I understand and appreciate the value of research positions at UF. I realize the trepidation primary investigators have in taking undergraduate students. It requires a substantial amount of their time and effort to train people in their lab. Therefore, I appreciate the time they dedicate to me and know in return I’m obligated to be committed to their lab and work consistently at my highest ability level.

Having my own research project is my lab putting their faith in my capabilities. I will be expected to think as a researcher and be up to date in current publications in the field. I realize that my responsibilities will be greater than before however, feel that my training in lab has prepared me. If my research goes well I could have the opportunity to present my findings at the Society for Neuroscience.

After receiving my B.S in Biological Engineering, I plan to attend graduate school and pursue a PhD. Although the content I would like to study is underdetermined, having a strong research background will help me to thrive at the graduate level. The proposed research and the HHMI scholarship will help me tremendously to reach my goals as an undergraduate and graduate student.

Abstract

Neural progenitor cell transplant influence re-growth of the neural network after mechanical insult of cortical cells in vitro

Crim E, Stephens CL, Demarse TB, Ormerod BK

Traumatic brain injury is a frequent cause of death and disability. Transplantation of adult neural progenitor cells may aid the repair after such injuries, however the effect of cell addition to damaged neural networks remains unclear. We developed an in vitro model of mechanical injury on microelectrode arrays (MEAs) to simulate blunt trauma or spinal cord injury while having the ability to monitor network activity. First, we tested several methods of injury in culture to find one that served our purpose: one that gave us control of where and to what degree the cultures were injured, to sustain some recordable neural activity, to injure the cells without damage to the MEA, and to provide enough of an injury that we did not see immediate re-growth. We found that scraping a 1µl pipette tip across the cultures met our criteria. We grew embryonic day 18 Sprague Dawley cortical cells (30,000 cells/mm²) on 6 MEAs and 8-well chamber slides (for immunohistochemical analysis) for 40d before injury. Two hours post trauma we added GFP-expressing adult neural progenitor cells, or progenitor conditioned media. The MEAs were recorded every 48h and the chamber slides were fixed every 7d for 4 weeks post progenitor addition. Through extensive immunohistochemical analysis and electrophysiological recordings we expect to understand many of the cellular interactions between transplanted progenitor-derived cells and the damaged neural network. So far our observations reveal that the majority of progenitors thrive in the injury site, while cell death occurs along the injury border.

Personal Statement Before Starting Science For Life Award

I have been working in Dr. Ormerod’s lab for two semesters. Currently, I’m with Dr. Brandi Ormerod’s lab and have been working there since summer 2008. In this time, I have worked diligently to show my abilities and potential for success in research, with an ultimate goal of ascertaining my own research project.

In autumn 2008, I took nine credit hours and worked part time in Dr. Ormerod’s laboratory. My work with Dr. Ormerod continued into fall 2008 and I was enrolled in thirteen credit hours. From these experiences, I have become proficient at making school schedules which allot time for successful laboratory work.

Being a sophomore is also an advantage, since I have already acclimated to college life. I am efficient in my study habits and do well at allocating my time responsibly. I understand and appreciate the value of research positions at UF. I realize the trepidation primary investigators have in taking undergraduate students. It requires a substantial amount of their time and effort to train people in their lab. Therefore, I appreciate the time they dedicate to me and know in return I’m obligated to be committed to their lab and work consistently at my highest ability level.

Having my own research project is my lab putting their faith in my capabilities. I will be expected to think as a researcher and be up to date in current publications in the field. I realize that my responsibilities will be greater than before however, feel that my training in lab has prepared me. If my research goes well I could have the opportunity to present my findings at the Society for Neuroscience.

After receiving my B.S in Biological Engineering, I plan to attend graduate school and pursue a PhD. Although the content I would like to study is underdetermined, having a strong research background will help me to thrive at the graduate level. The proposed research and the HHMI scholarship will help me tremendously to reach my goals as an undergraduate and graduate student.

Personal Statement After Starting Science For Life Award

My summer experience has greatly expanded on my critical thinking abilities, lab task abilities and time management. I have become competent with the culture of both dissociated cortical cells and neural progenitor cell lines. Growing these cells can be finicky and can take time to grasp but now that I am successful at it, it is an invaluable asset to have. Most undergraduate students do not possess this ability and I think it will give me a competitive edge in applying for graduate school. My future plans still entail going to graduate school to pursue my PhD. All of my experiences in the Ormerod Lab will help me in my career and give me a better understanding of what to expect when I begin graduate school. My experience also helped elucidate what I would like to study in graduate school. I now know that I want to stay in the biological field but maybe find something that has more of an engineering base. Considering I previously didn’t know at all what I wanted to study in graduate school, this experience has been invaluable on helping me decide what I’d like to accomplish in the future. The biggest gain however, was from my superior who is a PhD candidate, Crystal Stephens. Interacting with her I have gotten a better idea of what getting a PhD entails. She has offered me great advice and guidance both in the lab and in directing my life to be able to accomplish my goals. Working under Dr. Ormerod and Crystal has been an amazing experience. They are two strong intelligent women who are successful in a field that is predominately male. They have encouraged me and have been great role models to me both in life and in lab.
Charles Crooks
Freshman
Mentor: Dr. Benjamin G. Keselowsky (Biomedical Engineering)

Personal Statement Before Starting Science For Life Award

I chose Dr. Benjamin Keselowsky as my principle investigator because he was recommended to me by Professor Henry Hess, a previous distinguished mentor award recipient of the HHMI program. Although he couldn’t take me in himself, as his group is transferring to New York, he stated that Dr. Keselowsky would be an excellent mentor in the field of applied biomedical engineering, and his work taking place at his lab, and as a result, devoted significant volunteering and training time in my mentor’s lab.

With acceptance into the program, positive attention will be directed to both me as a researcher and my mentor as a supporter of undergraduate research. Possessing aspirations of coauthoring papers as an undergraduate, a three year stay at the lab I currently work at is an excellent possibility. The likelihood of this would be made all the better with acceptance into the HHMI program and the assurance of limited interruptions (i.e. non-academic job to pay for rising housing, tuition, and living costs) to pursue research full time in the summer following this term when other traditional, undergraduate, merit-based financial aid benefits (i.e. Bright Futures) fall short. It is my hope to use this experience as a starting point for other opportunities like research abroad at a collaborator’s lab, completing an honors undergraduate thesis, greater competitiveness for a spot abroad at a collaborator’s lab, completing an honors undergraduate thesis, greater competitiveness for a spot at a public university as an undergraduate.

Abstract

Characterization of Cell-Targeting Ligands Immobilized on Poly(DL-lactide-co-glycolide) Microparticles

Crooks CP, Lewis JS, Acharya AP, Keselowsky BG

One immunotherapeutic approach for the development of an effective vaccine against autoimmune diseases involves the specific targeting of certain antigen presenting cells (APCs) by the coating of microparticles (MPs) with various formulations of ligands that exclusively bind to the adhesion and receptors on the target leukocytes. Currently, the targeting of human dendritic cells (DCs) is of great interest because they are pivotal immune system regulators. Additionally, it has been shown that DCs can effectively phagocytose MPs. It is the eventual goal of this research to customize the MPs using various surface densities of adhesion peptides and antibodies against endocytic cell-surface receptors that achieve a high specificity for uptake by DCs over other APCs. The selectivity demonstrated by DCs to phagocytose coated microparticles will enable the encapsulated adjuvants, antigens, and other immunomodulating molecules greater effectiveness than if administered with uncoated MPs or solubly. Various adhesion peptides targeting DC integrins will be nonspecifically adsorbed to the charged surface of Poly(DL-lactide-co-glycolide) MPs to elicit phagocytic uptake by DCs. Similarly, adsorbed antibodies to endocytic receptors expressed prominently on DCs, such as CD-205, are also compelling candidates for increasing the uptake specificity of MP encapsulated medicines. Particle analysis involves quantifying the density of these ligands on the particle surface and developing a protocol for reliably modulating the densities of these peptides. The densities of various peptides and proteins on the microparticle-solution interface will be controlled by varying the incubation concentration of these surface modifiers during the adsorption to the MPs. We hypothesize that rate and specificity for which DCs phagocytose coated MPs is a ligand surface density-dependent response. Controlled customization of ligand density in addition to ligand type on the surface of MPs could permit more precise and reproducible uptake and activation responses, thus, significantly advancing the development and standardization of MP based treatments.

References:
1. Acharya, A. P.; Clare-Sahler, M. J.; Keselowsky B. G., A high-throughput microparticle microarray platform for dendritic cell-targeting vaccines
2. Martínez Gómez J. M.; Csaba N.; Fischer S.; Sichelstiel A.; Kündig T. M.; Gander B.; Johansen F., Surface coating of PLGA microparticles with protamine enhances their immunological performance through facilitated phagocytosis

Figure 1: The adsorption profile of PD2 Peptide on PLGA MPs as a function of both the PD2 and CD-205 Ab incubation conditions

Figure 2: The adsorption profile of CD-205 Ab on PLGA MPs as a function of both the PD2 and DEC-205 Ab incubation conditions
Personal Statement Before
Starting Science For Life Award

At this point, my main scholastic concern is strengthening my resolve to double major. Although I was uncertain during my first semester at the University of Florida as to how to manage two very disparate interests—after all, life sciences and fine arts do not have much common ground—I have decided that I do not need to present myself with ultimatums regarding a choice of major. The duality will be beneficial in helping me keep an open mind, and the two fields will complement each other in providing what the other might lack, scientific calculation and receptivity to intuition.

Taking the Science for Life seminar in the fall of my freshman year was of great use as it resulted in my introduction to the faculty of the horticultural sciences department and possibility to explore long-held interests. Despite taking general science courses, I am able to learn outside class in a personalized environment about plant science and the genetics relevant to contemporary research. Until coming to the university, my experiments with transplanting citrus, growing multi-headed sunflowers and so forth had been a hobby, molecular biology nothing more than magazine articles and an inordinate interest in textbooks. Professor Settles, who presented during the seminar, invited me to volunteer in his laboratory after an interview and has since given me the chance to better focus my scientific involvement from the start of the project.

I do not expect my schedule to deviate far from the one I currently maintain as a volunteer; it has been relatively simple to reserve large blocks of time to dedicate to learning more in the lab, and I spend a total of about twelve hours each week there. I will continue helping with and learning from Professor Settles’ research group during the summer and following semesters. My current activities and intentions to become a more integral member will parallel and benefit plans to take organic chemistry and a genetics course this fall in addition to art courses that are specialized towards drawing majors. While I won’t be able to claim Renaissance status, I hope that, through my studio work and research involvement, to become at least a well-rounded person.

Abstract

Maize Genomics: Generation of Mutant Populations and Mapping
Dailey S, Tseung CW, Martin F, Spielbauer G, Settles AM

The ultimate aim of this project was to fine map mutation locations in the maize genome, or, more plainly, to identify which specific genes have been disrupted in selected corn families. Getting genetic material from which to conduct tests was the first step; pre-existing populations of maize, generated by the lab, were self-pollinated during the summer and yielded an average of fifteen ears of maize for each of the twenty-nine families. Self-pollination was a must; it decreased likelihood of new mutations and increased heritability of those already present. After collection, genetic material was extracted from kernel tissues or, in a few families, from embryos germinated in a greenhouse.

Mutations that existed within this population were not limited to one per family; rather, an unknown number existed that could cause, singly or not, the visibly different kernels. More specifically, these disruptions consisted of insertions into the genetic sequence of Mu transposons, a specific type of DNA sequence that moves about chromosomes and is always found duplicated many times at its insertion site. Also known as Robertson’s mutator, its mutations are unstable, but useful because they have been proven to insert near or within genes; they cause significant disruptions, though are not always phenotypic.

All families were generated using the W22 inbred line of maize and either the B73 or Mo17 lines; since the genome of each has been sequenced, precise positioning of disrupted genes is possible with transposons tagging, a procedure that identifies the genetic material on either side of the area of interest. Using a TAIL PCR procedure refined by the lab, a set of seventy-nine primer sequences had been developed that roughly represent all of the Mu insertions in a DNA sample, and these were used throughout the course of the research.

Personal Statement After
Starting Science For Life Award

Participating in the Science for Life program has helped me, in plain terms, to figure out what I want to do with myself. I think that I am unsuited for strictly laboratory research as I have time and again proved myself mediocre, not in skill but motivation; what engaged me most, and what I am currently involved in, was the more visible and tangible aspects of the work. Although I have enjoyed learning new lab techniques and seeing the eventual results, I have not been interested enough in the scientific mechanisms to pursue study, either with the research or in an academic degree. The summer I spent generating the plant population necessary for the project, working in the field and later extracting material, strengthened my relationship and regard with the biologists and other students to such that I do wish to continue to be some part of the group and to be useful, but not in a leadership position. At the present, working closely with the plants necessary for others’ research might be applicable to an interest in nursery or landscaping positions.

As a final point, though I have not been officially recognized for participation in extracurricular activities, I do regularly participate in sports and keep a small garden of sorts on my balcony.
I discovered the Fanucci lab group while browsing the index of professors and their respective projects on the science for life website during the fall semester of 2009. After reading through an abstract pertaining to the flap confirmations of HIV protease on PubMed, I contacted Dr. Fanucci and interviewed her PhD candidate, Jaime Keer. After our meeting, I decided to pursue the project due to its inherent relevance to the development and implementation of AIDS therapies. I especially appreciated how quickly I became involved in actual research.

In addition to the practical aspect of the project, one facet that caught my attention was the relatively new research protocols being implemented. As I soon learned, the use of pulsed EPR was considered a relatively innovative method of analysis in the field of biochemistry. Respectively, pulsed EPR accurately measures the flap confirmations of HIV protease, which can generate insight into the function and formation of drug resistance.

The research I perform with Jeffrey Carter has become one of my main focuses at the University of Florida. Currently, I spend about eight hours a week in the laboratory and plan to further my research in the upcoming years. I eventually hope to publish the findings from our research in a nationally recognized biochemistry journal. Due to the practical implications of the mechanisms of flap confirmations, we believe that our results will yield both an insightful and an interesting paper. We expect to complete this project within the upcoming months, and then proceed to study the role of gag pol extension in the initial steps of viral maturation. Despite the projected end to this phase of the project, I will continue research on other ventures related to its results until my graduation.

Outside the realm of undergraduate research, I aspire to obtain a M.D. or PhD; either of these projected paths would incorporate and further compile research in a field of my discretion. My time spent in the laboratory has foremost spurred an interest and enthusiasm in research as a potential career option.

Abstract

Enzyme Kinetics of Active Human Immunodeficiency Virus Type 1 Protease
D’Amore PW, Carter JD, Kear JL, Fanucci GE

Human immunodeficiency virus type 1 protease (HIV-1PR) is an aspartic protease responsible for the first step of viral maturation, therefore marking it as the foremost target in AIDS drug therapies. Previously, our lab has investigated HIV-1PR using Electron Paramagnetic Resonance (EPR) combined with site-directed spin labeling (SDSL). For SDSL studies, the native cysteine residues in HIV-1PR were mutated to alanine residues and lysine residue 55 was mutated to a cysteine to act as the reporter site for double electron electron resonance (DEER) spectroscopy. Typically samples for DEER experiments are placed into a solution consisting of 60 percent glycerol, which in turn partially solvates the protease. Ultimately, such DEER experiments are designed to produce distance profiles that correlate to flap conformations of wide-open, semi-open, closed, tucked and curled. Our project is concerned with testing the activity of the HIV protease via enzyme kinetics that mimic the conditions of...

References:

Personal Statement After Starting Science For Life Award

The knowledge and techniques I have acquired since becoming a Science for Life recipient have greatly impacted my ability to conduct meaningful research and to understand the methodology behind the research process. While studying conformational polymorphisms and enzyme kinetics of HIV protease, I learned a great deal about spectroscopy, kinetics, and general biochemistry. Additionally, I have acquired a solid foundation for future research projects by mastering fundamental procedures, such as protein purification.

In addition to the academic aspect to my research experience, I had the privilege to work in collaboration with many graduate students and professors. Their expertise, mentoring, and friendship is indispensible.

My experience this summer has proved to be both rewarding and insightful. The benefits from conducting research truly transcend the laboratory, applying both to both academics and personal life. I have thoroughly enjoyed conducting research, and now am taking into consideration applying for acceptance into a combined medical doctorate PhD program. Such a program would allow me to continue researching while I work to become a practicing physician. I plan to continue working for Dr. Fanucci for the duration of my undergraduate career, and to apply for the HHMI Extramural Scholarship.
In order to make it in such a tough environment, one needs to be entirely engrossed and passionate in their area of research. One of my goals is to go to the University of Washington for graduate school. It has one of the top graduate schools in the nation, and offers a variety of programs that pertain to areas that are of interest to me such as virology, neurobiology, and pathology.

Exposing myself to the rigors of research and life in the lab as an undergraduate will help me immensely in my years of graduate school. I intend to make the most of every opportunity I have in research both on and off campus. Getting a chance to work on a research project through the HHMI Undergraduate Research Award program will benefit my future goals greatly. I will do the best I can as an undergraduate researcher so that I can achieve better goals in graduate school.

Abstract

Localization and interaction of human parvovirus B19 nonstructural proteins.

Datar R, Ignatovich IV, Hobbs JA

The human Parvovirus B19 (B19) is a member of the family Parvoviridae, genus erythrovirus. It is a ubiquitous non-enveloped, single-stranded DNA-containing virus. The molecular mechanism of B19 infection is unknown. B19 is only known to fully replicate in erythroid precursor cells (Ozawa et al., 1986), although many other cell types can get infected. B19 was recently shown to be highly associated with papillary thyroid carcinoma (Wang et al., 2008) as well as a variety of other diseases such as polyarthritids in adults (Kerr et al., 2009), autoimmunological disorders (Lehmann et al., 2003, 2005), and B19 disease in children (Anderson et al., 1983), transient aplastic crisis (Young and Brown, 2004), and Hashimoto’s thyroiditis (Lehmann et al., 2005). Recently, an association of B19 with various neurological disorders including meningencephalitis, cerebellar ataxia, seizure, and stroke has been documented (Barha et al., 2003). In our lab, it was shown that B19 persists in adult human brain including those with bipolar disorder, schizophrenia, and unaffected controls (Hobbs JA, 2006).

B19 genome encodes for 3 major proteins, such as non-structural protein NS1 and two structural proteins VP1 and VP2. However there are a few minor components such as two small non-structural proteins – 11 kDa and 7.5 kDa proteins. The 11kDa protein has been shown to play a role in cellular apoptosis, as was the NS1 protein. The role of the 7.5 kDa protein, however, is unknown. This study investigates the properties and functions of these proteins, as well as the effects that expression and co-expression of these proteins might exert on different cell lines. Through this, we hope to attain a better understanding of the association of B19 with brain and thyroid diseases. Revealing the mechanism of association of B19 with these two systems will contribute to a higher understanding of viral-induced pathologies and towards finding more effective cures.

References:


Personal Statement After Starting Science For Life Award

Thus far, I have truly enjoyed working on this project. From the subject matter I’m dealing with to the people I get to learn from, every aspect of my lab work has been a positive experience for me. Each day I come into lab, I meet new challenges, I make new mistakes, and ultimately, I learn new things. During the course of this research project, I have learned how to perform the following techniques: primer design, PCR, DNA extraction from agarose gel, bacterial transformation, cell culture, transfection of mammalian cells, and immunofluorescence and confocal microscopy.

The opportunity to gain experience in a research laboratory as an undergraduate has already benefitted me greatly. I have become a better problem solver, and a more confident student. I also feel that I am much better prepared than the majority of other undergraduate students who may wish to work in a lab as a graduate student. I have gained some fundamental microbiological laboratory skills and I hope to hone those skills and learn more as my time in the lab goes on.

Thanks to my experience in the lab, I have become more interested in the area of virology, and I now hope to someday pursue a career in this area of research. A large amount of what I am learning in the lab will serve as an aid to me in my classes as well. As a biology major, I was looking for an opportunity to take an in-depth look at cellular and molecular biology which will unquestionably benefit me in the coming years. I am constantly being armed with a good amount of background knowledge in areas that are crucial to my coursework.

The idea of being a researcher truly intrigues me. Working in the lab, I have had a glimpse of the determination, the drive, and the dedication it takes to succeed in graduate school.
Personal Statement Before Starting Science For Life Award

Since arriving at the University of Florida I have known that I wanted to pursue a career in the biological sciences. This is because in middle and high school I had had success in my math and science classes and found biology to be the most interesting of them, particularly the lessons on genetics and evolution. At UF I declared my major to be Microbiology and Cell Science with the intent of either: attending graduate school, medical school, or possibly switching to engineering.

I have since eliminated engineering and began volunteering both at Shands with pediatrics and in Dr. Steven Sugrue's lab in the Department of Anatomy and Cell Biology in the College of Medicine. The intent of each was two-fold. Obviously, to improve my resume for whichever professional program I decided on. More importantly for my future, I wanted to be able to make an informed decision about my career path. Freshman year I had taken the Science for Life seminar course and later used the faculty listing online to contact several professors (including Dr. Sugrue) whose work piqued my interest. Dr. Sugrue was one of a small handful that responded and I felt he had the best understanding of my academic responsibilities and what I would be capable of in his laboratory. While my experiences with both his lab and in the hospital have been very positive I would say it has been the interaction with patients that has led me to pursue medical school. This does not mean that I am not interested in research in the future and indeed I would consider something like an MD/PhD program.

I am excited about working on this project and appreciate the support I have had already from more senior members of the lab. Last spring Dr. Pin Ouyang, a visiting professor from Taiwan and Dr. Sugrue's first graduate student, showed me some fundamental laboratory techniques for cell culturing and molecular analysis. Since then, Dr. Jeong Joo has given me tasks and instruction on a near daily basis. Lab manager Nick Dunn has taught me how to stain both cultured cells and mouse embryo sections with dye and antibodies for microscopic analysis. Former Science for Life member Kanthi Dhaduvai and current Science for Life member Min Jiang have been very helpful as well. My project is a part of a broader project of the lab to study Pinin's effect on intestinal differentiation. Ideally, if I am successful I will be given the opportunity for co-authorship as Kanthi was with a previous project studying the eye.

I will be able to meet the time requirements of the Intramural Research Program, in addition to my coursework. This past fall semester I increased my volunteering time in the lab to approximately what is required by the program. I was working with cell cultures (the LoVo line mentioned in the proposal) that needed maintenance every two days at a minimum. In addition my coming spring semester is not light but I will definitely be able to handle both my academic and research responsibilities. I am working on a business minor so two of my classes are online which makes my schedule highly flexible. For summer 2010, I would not take classes in order to work full time in the lab. This will not impact my ability to graduate on time in May of 2011. I intend to work on the project outlined in my proposal spring 2010, summer 2010, fall 2010, and spring 2011.

Abstract

Pinin (Pnn) is involved in the alternative splicing of Fibroblast growth factor receptor 2 (Fgfr2)

Degan WJ, Joo JH, Sugrue SP

Mutation of Pnn has been shown to cause improper embryonic development of eyes in mice. Additionally, Pnn has been shown to be involved in alternative splicing. We are interested in knowing if Pnn plays a role in alternative splicing that accounts for the mutant eye phenotype. Fgfr2 has one splicing product that is specific for epithelial tissues and another for non-epithelial tissues. We collected control and mutant corneas and anterior eyes and isolated RNA. We then performed competitive RT-PCR and quantitative real time RT-PCR with primers for the alternative splicing products of Fgfr2. These results show that the controls and mutants have similar total Fgfr2 levels. In control anterior eyes (and isolated corneas), the epithelial splicing product is the dominant form. Interestingly, in mutant tissues (without a functional Pnn), the splicing product essentially switches to the non-epithelial form. The full effects of this apparent switch must be further explored. Still, these preliminary data suggest that Pnn is involved in the alternative splicing of Fgfr2 in the anterior eye.

Personal Statement After Starting Science For Life Award

My experience as a member of Dr. Stephen Sugrue's lab in the Department of Anatomy and Cell Biology has greatly improved my understanding of biology in ways that traditional lecturing and studying are not able to. Since high school (and briefly even in middle school) we are taught about cells, genetics, embryonic development, etc. Though college courses and associated labs are much more in depth, there is something about designing and performing your own experiments that can really make all that information come together and make sense. While I have personally settled on pursuing a career as a practicing physician, I feel that I also now have a greater appreciation for the importance of research in medicine. I now view the practice of medicine as being fundamentally connected to both clinical and basic science research. Healthcare personnel are all operating within a knowledge base that has been established by researchers. The best possible physician would likely need some sort of connection to active research in order to be most effective as a clinician. I will continue my research over the coming year and hope to continue working with Dr. Sugrue and his lab during medical school, presumably through the UF College of Medicine Research Track.
**Personal Statement Before Starting Science For Life Award**

Contributing to current research as an undergraduate at the University of Florida is an opportunity in which I am eager to participate. As a student of the life sciences, I have found that obtaining textbook-knowledge is only half the experience of learning. Volunteering in Dr. Sugrue’s lab for two semesters, I have learned volumes about the methods and daily schedule of an investigator, in addition to important techniques in the field of cell biology. My experience in the lab has only furthered my curiosity and passion for science and the pursuit of knowledge, as well as improved my study habits.

Dr. Sugrue’s research on the molecular determinants involved in epithelial cell-cell adhesion has significant biological importance, and could further our understanding of cell adhesion-related diseases of the epithelia. I plan to contribute as lab member for several more semesters. Through the HHMI Science for Life Intramural Research Program, I want to contribute to a long-term project. Even without the possibility of publication, I hope to gain practical experience in preparation for graduate-level research. Being a full-time student and undertaking this project will be challenging, but I feel this program will benefit my critical thinking, organization, and communication skills in my undergraduate career and as well as in my future scientific pursuits.

Interacting with faculty mentors, improving my presentation skills, and contributing to current scientific discovery as an undergraduate can greatly enhance my experience as a student of science and influence my career decisions. In the future, I am strongly considering attending graduate school, pursuing a career in biological research, and working in an academic setting.
Yasmany Dominguez
Sophomore
Mentor: Dr. Edward K.L. Chan (Oral Biology)

Personal Statement Before
Starting Science For Life Award

The Science for Life HHMI undergraduate program is one of the best opportunities I have found at the University of Florida for undergraduates to develop and learn valuable research skills. The skills and techniques learned through this program will stay with me for the rest of my professional career and will ultimately help my overall career in the medical research field. In addition, working firsthand with doctors and PhD students is an amazing learning experience. I believe that the Science for Life Program will be an invaluable experience that will get me one step further to my overall goal of obtaining an MD/PHD degree.

My interest for research was first developed in the spring of my freshman year, after speaking to one of the Honors Advisors. They explained and exposed me to all the great opportunities the University of Florida has for undergraduate research. When I got home that night, I searched the research database and found various research projects that interested me. Dr. Chan’s project stood out to me because his research deals with the medical sciences and also with Microbiology. I was lucky to find a research project that incorporated my major (Microbiology) and the medical sciences because that is the kind of research I have always wanted to be a part of. I also liked Dr. Chan’s research because in time, it could benefit the world; by revolutionizing the way we screen, detect, and even treat autoimmune diseases such as multiple sclerosis, lupus and arthritis. When I talked to Dr. Chan, I found him to be one of the nicest people I have met at the University of Florida, he told me all the details about his research, gave me a tour of his lab and was also kind enough to introduce me to all his PhD students. If I was selected, Dr. Chan explained to me what my responsibilities would be in his lab. After hearing about what I would be doing, I knew I had to be part of his research team.

This research project should run for approximately one year or more depending on how many positive samples we obtain. I have been a part of this research since fall of 2008 and have been able to manage my time wisely. The research that I am doing will help me with the higher level microbiology classes that I am required to take prior to my graduation. I can honestly say that I enjoy doing research with Dr. Chan, there is never a dull moment and I truly get excited every time I go into research.

After this project is over, Dr. Chan has guaranteed me that there will be more opportunities to work on either another one of his projects or one of his PHD students project as a co-author and also be able to present at a national meeting. Additionally, Dr. Chan promised at the end of this project, there might be an opportunity to co-author a scientific paper on the project. I have also been speaking with Dr. Chan about doing my senior thesis with him. I am going to continue to be a part of his lab until I graduate from the University of Florida and maybe longer if I get accepted into the MD/PHD program. I believe that this research is going to make a significant contribution to the scientific community by creating new diagnostic tests for autoimmune diseases and I am proud to be a part of it.

Abstract

The First U.S. Population-Representative Sample Study of the Prevalence of Autoantibodies and Their Demographic and Xenobiotic Associations

Dominguez Y, Chan EKL

Autoimmune diseases are characterized by harmful chronic inflammation and are associated with autoantibodies or self-directed T lymphocyte responses. These acquired, incurable illnesses are estimated to affect over 22 million American and it is among the leading causes of death for young and middle-aged women. Investigations have demonstrated that autoimmune diseases are multifactorial and result from both a genetic predisposition combined with an environmental trigger. The most likely explanation for the striking increase in the prevalence of many autoimmune diseases is increasing exposure to novel environmental agents.

The NHANES project is the first U.S. population-representative sample study on the prevalence of autoantibodies and their demographic associations. This project consists of testing a representative sample of 5000 individuals from across the U.S. to determine the correlations they autoantibodies have with: age, sex, ethnicity, and the environment. The most reliable assay for the detection of antinuclear autoantibodies is the traditional indirect immunofluorescence method on cultured HEp-2 cells, since the method is standardized, reproducible, validated and the patterns and titers have been associated with a number of clinical conditions. This method also allows for the detection of autoantibodies to a wide range of antigens outside the nucleus, including cytoplasmic and mitochondrial components.

The results so far show potential, out of the 1500 samples tested so far out of the total 5000 samples over half have tested positive for some type of autoantibody patterning. This means that there appears to be an increase in some types of autoantibody patterning. However, we do have to finish screening the rest of the 5000 samples before we can make any type of conclusion to the prevalence of different autoantibody patterns of the U.S. population.

Personal Statement After
Starting Science For Life Award

Having had the opportunity to participate in this project has been one of the best opportunities I have encountered here at the University of Florida. Through working on this project I have learned and developed valuable research skills that I would not have been exposed to otherwise. I now have a great appreciation for the professionals that make research their career. I have learned that research is not just working in a lab and getting good results, it takes countless days of hard work to get the results needed.

I have had an unforgettable summer and I am really fascinated by the work I am doing in the field of autoimmune disease and cell biology. I have not only learned various lab techniques but their application in the field of research. I have become an expert in the art of immunofluorescence, the procedure and using the microscope to take fluorescent images has become second nature to me. Over the summer I also got to learn how to make a cell lysate that can be used to run gels. Lastly, I have productively learned the Western Blotting technique, used to compare similar proteins in the patient’s sera. I am happy that I found such an amazing lab that cares about my success and that are always glad to help me. I definitely hope that I am able to continue doing research in the future, including next summer, in a field that I enjoy.

As far as notable extracurricular accomplishments, I am a director for Alpha Epsilon Delta, which is a Prestigious Pre-Med Honor Society. I have volunteered countless hours at Shands Hospital and with Habitat for Humanity. I have also recently received the Peter J. Sones, Jr. Scholarship and I have also been recognized as an Anderson Scholar of Highest Distinction. In addition I received the Tylenol National Scholarship earlier this semester.
During my undergraduate studies, my desire is to learn as much as possible about the human body in preparation for medical school. As a result, I am interested in not only the theories being proposed by researchers about how the cell functions, but also the methods used to verify them. I aspire to be a physician and a scientist; it is a physician's duty to make his patients' life as comfortable as possible, and it is a scientist's duty to contribute to the advancement of knowledge. Performing research over the next year will provide me a great way to learn the responsibilities and critical thinking skills that I will have to use when doing research as a physician.

I am an undergraduate student in my third year at the University of Florida and am currently working in a research lab under Dr. Lizi Wu in the College of Medicine's Department of Molecular Genetics and Microbiology. I have always been interested in cancer and after emailing Dr. Wu and speaking with her about her research I was very impressed with the work she performs. We are investigating the Notch Signaling Pathway, which is crucial in the development of many different tissues, and if not correctly regulated, is linked to the development of many different tissues, including cancers such as leukemia.

The overall goal of our lab is to understand the pathways regulating Notch Signaling in hopes of developing therapeutic treatments to these diseases. Participating in Dr. Wu's lab has not only allowed me to perform the experiments which researchers are using to study cell signaling pathways, but it has given me the opportunity to examine the cell from the perspective of an objective observer who is attending to discover how the world behaves. I am better prepared to formulate answers to the problems I am faced with because I have had to reason much more critically than I would have otherwise had to do in a purely classroom-based college environment. I have taken many biological science courses which have given me the background necessary to understand the current literature which I am exposed to in Dr. Wu's lab. The overall goal of my project will be to contribute a new way of examining Notch activation, and I think that being involved in a project with such an extensive project will allow me to integrate the goals of a particular day's experiment with the long-term goal of completing this undergraduate research program.

Participating in research over the next year will allow me to interact with faculty, improve my ability to interact with scientists, and allow me to contribute new data to the great pool of knowledge already accumulated. These skills will serve me well when I am enrolled in a medical school program dealing extensively with the biological sciences, and especially when I am a physician participating in research.

Abstract

Generation of a Notch signaling reporter for monitoring cellular Notch activities

Fernandez E, Wu L

Notch signaling is a highly conserved signal transduction pathway that plays essential roles in tissue development. This pathway has been implicated in playing a key role in regulating self-renewal and differentiation of normal and cancer stem cells. Notch signaling is initiated by the binding of ligands on adjacent cells with Notch receptors. Ligand-binding induces proteolytic cleavages of Notch receptors by ADAM proteases and γ-secretase, resulting in the release of the intracellular domain of Notch (ICN) which then translocates to the nucleus. Inside the nucleus ICN interacts with CSL and recruits MAML co-activators to induce transcription of Notch-specific target genes. (1)

This pathway is a potential therapeutic target because its deregulation is linked to a number of human neoplasias. Since tumors often consist of heterogeneous cells with various tumorigenic potential, it is important to study Notch signaling status at the single cell level to establish its role in oncogenic events. Therefore, we aimed to develop a lentiviral-based Notch-responsive reporter system which will enable the determination of Notch signaling activation in a temporal and spatial fashion. This system will have the advantages of transducing any type of cell and having a high signal to background ratio. In preliminary studies, we have cloned the Notch-responsive enhancers to a lentiviral-based vector and confirmed that Notch-responsive enhancers are sensitive to Notch modulation. I hypothesize that cellular Notch activities correlate with cellular differentiation status and tumorigenic potential. I plan to use this system to study Notch signaling in leukemic cells and esophageal cancer cells to test this hypothesis.

Reference:

Personal Statement Before Starting Science For Life Award

The HHMI Undergraduate Research Award will allow me to focus on research in an academic setting, instead of pursuing temporary work outside of academia. This focus on research will allow me to acquire substantial laboratory and publication-writing experience, aiding me in my quest to attend graduate school. Over the next 24 months, the acquisition of such skills will improve my ability to approach novel problems. Through trial-and-error experiments with B. germanica, I have already learned to appreciate the virtues of patience and foresight. I am confident that with two more years of practice I will be completely prepared for integration into projects of increasing complexity. Two years from now, I intend to work in a lab in the Department of Biomedical Engineering. The two most likely candidates are briefly described below.

The first lab is headed by Dr. Justin Sanchez and focuses on human-machine interfacing. He currently studies rat neural networks to more fully understand motor-neural interactions. The research directly applies to humans as it may lead to the development of an artificial limb capable of responding to neural impulses like a real limb.

Dr. Brandi Ormerod coordinates the other lab that greatly interests me. Dr. Ormerod has several projects that focus on neural stem cells. She recently received a Ruth K. Broad Biomedical Research Foundation Extramural Grant to study the physical mechanism by which inflammation is transmitted from the body to the brain and how inflammation affects adult stem cells in the hippocampus. This research is exciting because it seeks to cure neurodegenerative disorders like Alzheimer’s disease by repairing or replacing damaged neural networks.

Such a glimpse into my future goals may not provide clarity to the question, “Why did you choose to begin your career in Dr. Scharf’s lab?” Initially, I was seeking a position as a laboratory assistant who works with organic subjects at the tissue or organism level. Dr. Scharf offered something unique to other investigators. His lab conducts insecticide toxicology research premised on a novel insecticidal approach called “RNA interference”, as explained in the Proposed Research Statement. Essentially, by targeting a protein that is both unique to an organism and key to its survival, one can synthesize a double-stranded version of the mRNA coding for the protein. Formulation of a pesticide from the double-stranded mRNA completely removes the risks associated with traditional chemical insecticides. When I understood the power of this approach, I knew that it could also be applied to many pests, such as B. germanica. Working under Dr. Scharf, I would learn not only basic research techniques, but also cutting edge approaches that I could adapt to a great number of biological issues. My intention is to use this funding to support my work and scientific education as a member of Dr. Scharf’s laboratory.

Abstract

Comparison of whole-body and hemolymph protein composition through development in the German cockroach, Blattella germanica L. Forhan MW, Gondhalekar AD, Scharf ME

Protein composition was studied across the various life stages in a multi-insecticide resistant field strain and an insecticide-susceptible laboratory strain of Blattella germanica L. Two cockroach strains were reared with standard methods outlined by Gondhalekar et al. (2008). Whole-body and hemolymph samples were collected and analyzed to understand the variation of protein expression through development. Developmental categories included large nymphal instars, small nymphal instars, adult virgin males, adult males, virgin adult females and gravid adult females. To ensure age homogeneity among nymphs, each sample was composed of a cohort hatched from a single ootheca. Each cohort was raised until late in the instar for which it was processed. Based on the assumption that nymphal weight is strongly correlated to its instar stage, average weights were determined to verify sample uniformity. Insects from the lower and upper end of the weight spectrum were separated from those that were to be processed and were allowed to molt until adulthood. If the insects on both ends of the weight spectrum were at the same stage at the point of sampling, the entire sample was assumed to be homogenous. Collected protein samples were run on SDS-PAGE gels that yielded a variety of data. Nymphal instars, gravid females and virgin females all prominently expressed hexamerin storage proteins (Figure 1). Nymphal instars were remarkably similar in general protein expression. Gravid females also showed high expression of proteins associated with ootheca production and maintenance. By understanding the composition of proteins for B. germanica, we can better understand the importance of these proteins and use this information to create novel insecticides that target B. germanica at specific life stages.

Personal Statement After Starting Science For Life Award

Participation as an HHMI Science for Life researcher has greatly accelerated my career path by helping me to learn many techniques and ideas that many scientists learn in graduate school. By directing my own project, I have learned effective time-management, networking (at the lab, department, state and national level) and organization within the project and lab. Unlike many other activities, research tests the concept of time-management by requiring a student to look at the hour-by-hour, day-by-day and year-by-year simultaneously and with a deal of flexibility. Out of necessity for information associated with my research, I found myself communicating with a great community of scientists whose knowledge I likely would not have been privy to otherwise. Collaboration with others at the department, state and national levels has greatly enhanced my overall experience. The scientific techniques and social skills learned this year have greatly enhanced the quality of my application for scientific internships, graduate school and permanent employment. I will be applying to graduate school in the near future and feel much more confident that the application and letters of recommendation I will submit will be infinitely stronger because of this experience. This experience has been the most useful and educational part of my undergraduate life.
A major reason I choose to go to the University of Florida instead of a smaller school was to experience doing research. The Rural LITE research project I am working on is allowing me to gain research skills and understand the process of how research takes place. Conducting research integrates well with my classes and allows me to spend time applying what I am learning in class to help solve problems facing people today. It is an integral part of learning to be able to use the knowledge one learns in class and apply it in different contexts. After working in the lab for a couple of months now, I have devised a good method for being able to accomplish my research, coursework, and remain involved in my extracurricular activities. Since my time is valuable, I have learned to manage my time more wisely and efficiently.

Like many university students, the specifics about what I want to do in the future have shifted during my time at the University of Florida. In high school I discovered the gift I had for understanding science and math. The application of these subjects amazes me, as do the various contexts in which they can be used. Through being involved in many various activities I realize that I enjoy collaborating with people and desire a career that will allow me to be around and help people. By doing research I have seen another outlet for how I can use my people skills. It astonishes me, as do the various contexts in which science and math. The application of these subjects can be used. Through being involved in many various activities I realize that I enjoy collaborating with people and desire a career that will allow me to be around and help people. By doing research I have seen another outlet for how I can use my people skills. It astonishes me, as do the various contexts in which science and math. The application of these subjects can be used. Through being involved in many various activities I realize that I enjoy collaborating with people and desire a career that will allow me to be around and help people.

Physical Activity Patterns of Rural Dwelling/Adults Upon Enrollment into a Long-term Behavioral Weight Management Program
Foss S, Mathews A, Ross K, Perri M

The Rural Lifestyle Intervention Treatment Effectiveness Trial (Rural LITE) is a NIH-NHLBI funded single blind, multi-site, randomized controlled trial to test the effects of 3 levels of a lifestyle intervention program on long-term weight management for rural dwelling adults. The aim of this ongoing sub-analysis is to evaluate the effects of the 3 levels of intervention compared with control on physical activity energy expenditure (AEE) and physical activity patterns as physical activity has been shown to be a major predictor of weight loss maintenance success(1). This study will recruit 542 men and women aged 21-75 from 9 rural counties in Florida. Presented here is a description of the first subset of subjects (n=98) and their total energy expenditure (TEE) and AEE at entry into the study. The average baseline BMI for the women (n=70) was 36.9 and for the men (n=28) was 35.9. To assess energy expenditure, each subject wore a Sensewear WMS Armband for 7 consecutive days. At baseline, the 98 subjects expended an average of 2682 calories per day with 12.0% of that (321 calories) due to AEE (> 3 METs). This is well below the 30% of calories from physical activity often used to describe physically active people (IOM, 2005). Men had a mean TEE that was 3168 compared to women with a mean of 2487. Of the men’s energy expenditure, 15.6% came from activity compared with 10.1% by women. Grouping subjects by minutes of weekly physical activity reveals that only 46% of the participants met the Physical Activity Guideline for Americans of 150 minutes of physical activity at the time of enrollment.

Abstract

Metabolic Regulations of Ragoletis pomonella
Fuller J, Hahn D, Ragland G

The cold-weather metabolic adaptations of the apple maggot fly Rhagoletis pomonella make this organism an excellent biological system to analyze the genetics of metabolic rate, a fundamental physiological parameter in all animals. These flies are able to dramatically lower their metabolic rates during winter, entering a hibernative pupal state known as diapause. Understanding the processes by which flies induce, maintain, and terminate this hibernative state can provide insight into metabolic regulation in other animals.

In addition, the flies’ partial sympatric speciation has led to variations on these metabolic control mechanisms. A portion of the original R. pomonella radiated from its native host, hawthorns, to domesticated apples after their introduction to the Americas 300 years ago. Because apples blossom and fruit 3-4 weeks earlier than hawthorns, Hawthorn-prefering and apple-prefering populations have become reproductively isolated. This difference in life cycle timing causes the apple subspecies to enter its overwintering hibernation period (diapause) earlier than the hawthorn subspecies. Because the flies’ metabolic rates increase with higher temperatures, the two populations endure different levels of metabolic stress, with the earlier-hibernating apple population being more stressed. To manage this difficult stressor, apple-prefering populations must have adaptations that increase their ability to store fat as larvae, or reduce their need to burn fat as hibernating pupae (or both). During my time working with Dr. Hahn and Dr. Ragland, I’ve learned a tremendous amount about molecular biology and the methods used to study it. The lesson that I’ve found most interesting is that an incredible number of similarities and conserved traits are present among all animals, and even among all organisms. I find it fascinating that at the most basic levels of observation, nearly every important molecule and life process is conserved between radically different organisms.

My most recent experiment has exposed me to the techniques of histology and tissue examination, and I believe that this knowledge will be extremely useful once I become a doctor. Learning and practicing these techniques has been very fun, and each new batch of slides has increased my confidence and improved my technique. Even when slides didn’t turn out perfect, I lived the challenge of determining what went wrong, and fixing it in the next batch. This experience has encouraged me to incorporate histological study into my future medical career if possible.

In addition to the research I’ve performed in the Department of Entomology and Nematology, I’ve been active in several other extracurricular activities on and off campus. I was president of the UF Taekwondo Club from summer 2009 to summer 2010, and I still teach classes for the club. In addition, over the summer I helped to coach a soccer camp for kids at the YMCA, and volunteered in the Flagler Hospital’s emergency room for two months.

I first met Dr. Hahn in his Thermal Biology class in the fall of my freshman year. In this class, Dr. Hahn referenced many projects that used insects as models for understanding metabolic processes in all animals, including humans. I found it fascinating that creatures that seemed so distant from each other could share so many of the same metabolic pathways and genes, and that such similarities could be used in medical applications for humans. As a pre-med student, I’m extremely interested in biology, especially in the human body and in methods of treating disease. Seeing the potential medical uses of Dr. Hahn’s projects opened my mind to the wide range of discoveries and cures that could be found by studying other species’ metabolic processes and traits.

I have been working in Dr. Hahn’s lab for about a year, and I plan to take every opportunity to continue working here during my undergrad study. I don’t think that fitting this work into my schedule will cause any trouble; the work schedule here has always been extremely flexible, due to the numerous projects happening every day. While working here, I have performed many experiments without much understanding of how each piece of data fits into the bigger picture; I believe that the increased workload involved with the HHMI program will give me greater exposure to the overall project, and give me a better sense of what we’ve learned, and what we have yet to learn. Because I’m not sure what medical school I will enter after my graduation, I’m not sure whether I will be able to continue researching under Dr. Hahn after my undergrad study is complete, but if the opportunity is available, I plan to use it.

changes of pupae as they broke diapause, in order to identify times at which pupae went through major metabolic changes and tissue reorganizations. We discovered a unique biphasic increase in metabolic rate, and mapped several visible morphological landmarks onto this metabolic trajectory. This research was published in the Journal of Insect Physiology in 2009. In 2010, we studied the process of adult development more closely, using histological examination to determine whether the timing of pupal-adult apolysis (shedding of the pupal cuticle) coincided with the initial increase in metabolic rate following diapause. We found that within six days of diapause break, extensive sections of pupal cuticle had separated from epidermal cells, and that these cells had begun the production of adult cuticle. By identifying those times at which pupae undergo major metabolic regulations and begin the production of new tissues, we will be able to analyze the gene and protein expression of the pupae during these critical stages. This will allow us to identify those genes associated with metabolic regulation.

Personal Statement After
Starting Science For Life Award

During my time working with Dr. Hahn and Dr. Ragland, I’ve learned a tremendous amount about molecular biology and the methods used to study it. The lesson that I’ve found most interesting is that an incredible number of similarities and conserved traits are present among all animals, and even among all organisms. I find it fascinating that at the most basic levels of observation, nearly every important molecule and life process is conserved between radically different organisms.

My most recent experiment has exposed me to the techniques of histology and tissue examination, and I believe that this knowledge will be extremely useful once I become a doctor. Learning and practicing these techniques has been very fun, and each new batch of slides has increased my confidence and improved my technique. Even when slides didn’t turn out perfect, I lived the challenge of determining what went wrong, and fixing it in the next batch. This experience has encouraged me to incorporate histological study into my future medical career if possible.

In addition to the research I’ve performed in the Department of Entomology and Nematology, I’ve been active in several other extracurricular activities on and off campus. I was president of the UF Taekwondo Club from summer 2009 to summer 2010, and I still teach classes for the club. In addition, over the summer I helped to coach a soccer camp for kids at the YMCA, and volunteered in the Flagler Hospital’s emergency room for two months.
**Personal Statement Before**

Before Julie Johnson agreed to be my research mentor, it was her work and the opportunities available at the University of Florida that initially drew me in. Throughout my time in her laboratory, I have been able to develop my research skills and gain valuable experience. Now, I am eager to continue these efforts and contribute to the field of pharmacogenomics.

My time in the lab has added nuance to and expanded on the research I have conducted in the classroom. As a third-year pharmacy student, I have been involved in several research projects, many of which have contributed to the understanding of human pharmacogenetics.

**Abstract**

Extending Genetic Predictors of Warfarin Dose: APOE and CALU

Carris N, Gawronski BE, Johnson JA

Genetic variations in the genes APOE and CALU have previously been studied as predictors for therapeutic warfarin dose among other genetic, clinical, and lifestyle variables.

We hypothesized that with the additional information of two SNPs in APOE and one SNP in CALU we could expand upon previously developed pharmacogenomic algorithms in selected cohorts to better predict therapeutic warfarin dose.

An Egyptian cohort 195 patients, from the study “Study of VKORC1, CYP2C9, and CYP4F2 Polymorphisms and their association with warfarin dose requirements in Egyptian Patients” by Mohamed H. Shafin, where genotyped by pyrosequencing for two SNPs in APOE (rs 429358 and 7412) and one SNP in CALU (rs 339079).

Data was incorporated into the previous study’s by using linear regression to show percent of variation explained in therapeutic warfarin dose. The same SNPs were genotyped using pyrosequencing in a second cohort of 350 black and Caucasian patients, from the study “Influence of coagulation factor, vitamin K epoxide reductase complex subunit 1, and cytochrome P450 2C9 gene polymorphisms on warfarin dose requirements” by Christina L. Aquilante et al.

In the Egyptian cohort variation rs 429358 showed no relation to warfarin dose. Patients with variant allele at rs 7412 showed a decreased warfarin requirement (parameter estimate -0.5958, p = 0.0246, partial r² = 0.0208). Patients with variant allele at rs 339079 showed an increased warfarin requirement (parameter estimate 0.93117, p = 0.0373, partial r² = 0.0164).

**Personal Statement After**

Starting Science For Life Award

Participating in and really becoming a part of Dr. Johnson’s laboratory has been some of the most enriching and best spent time of my life. Even in the relatively short time that I have been researching in the lab, I have gained a keen insight into how research is really conducted. I have experienced the frustrations and the joy that research can bring. The amount of knowledge and understanding that I have gained in areas as diverse as: genetics, biostatistics, pharmacy, medical ethics, cardiovascular medicine, etc. could fill seminars of classes. Adding to the benefit of this learning is the fact that it is applied. I have used what I have been learning in real world research creating a really strong set of new skills. I have learned a wealth of genotyping laboratory techniques such as: blood and buccal cell DNA isolation, DNA sample management, Nanodrop DNA quantification, polymerase chain reactions, gel electrophoresis, pyrosequencing, and Taqman genotyping assays. All of these techniques can potentially be used in my future career.

However, the skills I have gained go beyond laboratory or science skills. I have improved my public speaking and presentation skills through a journal club presentation. I have sharpened my time management skills. Also in a laboratory there is an abundance of interpersonal communication and I have been able to build communication skills in a science setting. Critical thinking, close reading, evaluating, and interpreting are all skills that were honed daily and have uses far beyond the laboratory.

My time in the lab has added nuance to and has strengthened my desire to pursue a career in research in the future. Being on the forefront of knowledge and uncovering new discoveries is exciting and fulfilling. Faculty, post-docs, graduate students, current pharmacy and lab staff have given me volumes of insight into different educational and career paths that I could take in the future. Clinical research has opened my eyes to how research can really impact medical practice, and the research I have been conducting combines pharmacy and genetics really suits me. I have been amazed by the amount I have grown and the skills I have developed. I look forward to seeing continued development as I continue.
I became involved in research with Dr. Semple-Rowland through the Science for Life seminar series my freshman year. She was one of the presenters to the class and I was intrigued by her research and accomplishments with gene therapy and the reversal of blindness caused by LCA1. It was through this class and my interview with her that I ended up being presented with the opportunity of assisting her with her research with a full time position over the summer. I am very enthusiastic about Dr. Semple-Rowland’s research and so have continued researching into the fall semester and plan on continuing for the 2-3 years I have left of my academic career at the University of Florida. Since I am already balancing my coursework with working 20 hours a week on research, I am accustomed to the time management required to be successful in both areas and I will be able to maintain this balance for the semesters to come.

I selected this project because it is the next step to improving the efficiency of the gene therapy used to treat LCA1. The previous findings of Dr. Semple-Rowland reversing blindness for about 4 months need to be extended to have the treatment last for 6 months or a year, and eventually for the lifetime of the animals. Then a possible treatment for LCA1 in humans can hopefully be devised.

Currently, I plan on going to medical school after finishing with my undergraduate studies. However, becoming involved in research has exposed me to an exciting field of science and greatly expanded my knowledge of all the amazing opportunities and possibilities presented by research. Being so intrigued by research and its endless opportunities, I have not ruled out the possibility of graduate school and research as a career or the possibility of a MD/PhD program.

This research will help me decide which career path to take in addition to greatly expanding my knowledge of molecular biology, gene therapy, and the scientific process involved with research. I also believe that research builds a lot of discipline and encourages analytical thinking, both of which are qualities that will be very beneficial regardless of which career path I take. The results of my proposed project will undoubtedly lead to another related project to further expand knowledge in the area of retinal disease and gene therapy and I cannot wait to see what progress I can contribute to in these next few years.

Abstract
Lentiviral Gene Therapy with an Avian Model of LCA1
Geesey M, Semple-Rowland S, Coggin W

My research project with Dr. Semple-Rowland focuses on LCA1, a genetic disease that causes severe vision loss or blindness in newborn infants. The primary retinal cells affected by LCA1 are the photoreceptor cells that are necessary to transduce light into the electrical signals that underlie vision. The genetic defect underlying LCA1 is a null mutation in the gene encoding guanylate cyclase-1 (GC1), a critical enzyme for rod and cone function (Semple-Rowland et al., 1998). In 2006, Dr. Semple-Rowland and her research team successfully reversed blindness in an avian model of LCA1 by delivering a normal copy of the GC1 gene to photoreceptor cells via a lentiviral vector (Williams et al., 2006). Unfortunately the reversal of blindness lasted only 3-4 months, and now we are working on correcting this problem by developing and testing several new lentiviral vectors that allow reliable delivery of two therapeutic proteins to photoreceptor or targeted cells (Semple-Rowland et al., 2007). Our current combination vectors deliver the GC1 gene along with genes encoding anti-apoptotic or trophic factors. Our hypothesis is that these combination therapies will support long-term vision restoration. We have tested vectors with various promoter combinations and a vector carrying dual EF1 promoters, which showed expression of only one of the two reporter genes it carried. A second WPRE element was added before the second EF1 promoter and this resulted in both reporter proteins being expressed, but not in the same photoreceptor cells. Using just one EF1 promoter and a 2A cleavage peptide resulted in both reporter genes being expressed in the same cells and was therefore the most successful vector of those tested (Semple-Rowland et al., 2010).

References:
1. Semple-Rowland, S.L., W.E. Coggin, M.

Mero Geesey
Sophomore
Mentor: Dr. Sue Semple-Rowland (Neuroscience)

Personal Statement Before Starting Science For Life Award

In addition to learning many different laboratory techniques, I have learned about other facets of research, such as how scientists can collaborate with each other to improve their experiments and what is involved in receiving funding and publishing a paper. I had never thought about going into research as a career, but now I am definitely considering it or possibly applying for a MD/PhD program. I love the idea of working on something that no one has done before, venturing into the unknown, and knowing that the results of research can have a profound impact on many people for generations to come.

In the past year I presented at two conferences, one at UF for undergraduates and the ARVO conference with scientists from all over the world. Presenting at ARVO was the highlight of my research project and an experience that I will never forget.
Personal Statement Before Starting Science For Life Award

Before the idea of the HHMI Undergraduate Research Award had even been presented to me, I knew that I wanted to have the experience of working in a research lab while still an undergraduate. Unlike many of my peers, I have always known the general direction that I wanted my career to take, and, after taking the Science for Life (IDH 3931) seminar, I was inspired by the available resources for undergraduates wishing to pursue many different areas of research. As part of the course’s curriculum, I was expected to conduct interviews with research professors, and, in doing so, I was able to stumble upon a professor that seemed to be a perfect match.

Dr. Sigmund was one of several professors at UF that I had considered interviewing, due to his work in the field of nanotechnology. Growing up, I knew that the vast field nanotechnology was something that I could find interesting both on an academic level and as a matter of great curiosity. Upon meeting Dr. Sigmund, I quite enjoyed both his positive demeanor, and his outlook on his research. He told me that he viewed research as more of an exploration than an examination (i.e. discovering what an innate property could be valuable as a coating for various substrates.

It has long been known that titanium dioxide (Aeroxide® p25) has exceptional photocatalytic properties, in addition to being relatively abundant and inexpensive, making it an ideal candidate for use in writing future papers, or perhaps even the project as a springboard for future projects, possibly for use in writing future papers, or perhaps even the Science for Life extramural program.

For me, the research I have been conducting has been entertaining and intellectually satisfying. While I hope that my research experience, along with any awards I may receive, allows me a competitive edge when applying to a graduate program, this is only a part of my reason for researching. I research because it is interesting to me, and, at the risk of sounding too clichéd, I want to make a difference. I know that the projects I undertake now will likely not amount to a scientific revolution, but it is my hope that these projects will help in some way, and that they will serve as a foundation for my future projects.

Abstract

Investigation into the Photocatalytic Properties of Aeroxide/Sol-gel Systems Sigmund W, Qing R, Geryak R

Photocatalysis can be informally defined as the conversion of light energy (photo-) into radicals, which can be used to break down organic materials (-catalysis). One of the most prominent uses of this property is the breakdown of harmful (or otherwise undesirable) organic materials on the surface. Clearly, a material for which photocatalysis is an innate property could be valuable as a coating for various substrates.

It is necessary for it to have a high resistance to scratching and a large degree of transparency. At the current time, there has not been an occasion to test these dye samples quantitatively, but such analysis is expected in the near future. From qualitative observation, however, it was clear that the dye had not been completely decomposed in the experiment, indicating that the photocatalysis occurring was not enough to do this. For a time, it was hypothesized that the samples needed to be heated above the crystallization temperature of the titanium dioxide, but, upon comparison with the normally heat treated samples, this did not appear to be sufficient (though it seemed to make some difference). It was eventually proposed by Dr. Sigmund that the primary obstacle was likely the surface area of the coated samples (as photocatalysis relies heavily upon surface interactions). The suspension was coated on glass tubes (instead of slides) in an attempt to increase the surface area, but a complication arose in the experimentation: the stirring processes stripped much of the film from the tubes, causing the film to become, essentially, a powder. Though this obviously skewed the observed results (as a powder has a much higher surface area than is possible for any surface), the complete decomposition of the dye showed that the film undoubtedly exhibits photocatalysis.

Though much of the groundwork has been laid, some work is still required before publication will be possible. The two remaining hurdles to surmount are dispersing the nanoparticles to a much higher extent and obtaining more quantitative data, fit for analysis. Because of the results obtained thus far, I am optimistic that a paper stemming from this research would be likely to be published in a scientific journal.
Personal Statement Before Starting Science For Life Award

After receiving my undergraduate degree in chemistry, I plan to continue my education and work towards a doctorate in chemistry. After that, I will likely continue to be involved in research throughout the rest of my life. My interests are in physical chemistry and its applications to biological systems. My current research is in biophysical chemistry, so it provides excellent experience to better prepare me for the rest of my academic career.

In the fall of my freshman year I was enrolled in the Honors One-Semester General Chemistry course. One of the requirements was to sit in on seminars given by professors from other institutions. One particular seminar was given by Carlos Simmerling on computational simulations of the dynamics of HIV-1 protease, which really interested me. He acknowledged that he was collaborating with Gail Fanucci, and so I looked into her research which interested me a lot. I did not choose the BMP project per se, but the project incorporates many of my research interests in it, namely magnetic resonance.

I began working in the lab in spring of 2008, and currently spend most of my free time in the evenings and weekends in the lab. Over this summer I didn’t have many classes and so managing my time was not as important as it has become over the fall semester. My experience in the lab has provided me with the knowledge to plan my sample preparation and experiments around my classes, as well as foresee any potential problems which may arise during the course of the experiment. In spring of 2009, my course schedule is set up so that I will have time to prepare samples in the mornings before class and then my afternoons will be free to conduct experiments. Additionally, I will be enrolled in the graduate course taught by my mentor, Biophysics of Biomembranes, which complements my research extremely well.

I have already presented a poster of my research at the SEMRC this past October and I’m appearing as a coauthor on two papers, one of which is under review and the other of which is nearing completion. The research that I am proposing to conduct under HHMI will go into another publication, of which I will be one of the main authors.

Additionally, I have discussed the prospects of applying for the HHMI Extramural award with Dr. Fanucci. She has been in contact with Tony Watts, director of the Biological Solid State NMR Facility at the University of Oxford in England, who has already said that he would be willing to allow me to work with him for a semester or two. I have planned out what courses I will take and when to take them so that I will still be able to make use of this amazing opportunity and take off a summer and/or fall semester and still manage to graduate on time.

Abstract

Characterization of POPC/Cholesterol/BMP/GM1 Model Membranes Using 2H NMR

Goff PC, Frederick TE, Long JR, Fanucci

Solid-state 2H NMR was employed to characterize the phase behavior of model membranes comprised of ternary mixtures of POPC/Cholesterol/Bis(monoacylglycerol) phosphate (BMP) and quaternary mixtures of POPC/Cholesterol/BMP/GM1 by monitoring the acyl chain dynamics of POPC-d31. Additionally, two-dimensional exchange 31P MAS NMR was used to characterize the lateral phase behavior of these model membranes by monitoring the PC/BMP cross-peaks that indicate proximity between the two phospholipids as a function of both cholesterol and GM1 composition. BMP is an anionic phospholipid found predominantly in the internal membranes of the lysosome and late endosome. Unlike typical phospholipids, BMP possesses two glycerol moieties each with a single oleoyl acyl chain as well as an unusual sn-1:sn-1’ stereoconfiguration, differing from the sn-3 stereoconfiguration exhibited by most phospholipids. In the cholesterol storage disease, Niemann-Pick type C (NPC), BMP is accumulated in large quantities and it has also been implicated in regulating endosomal cholesterol homeosta-

References:

Personal Statement After Starting Science For Life Award

Performing research has introduced me to a variety of techniques in biophysical chemistry and has helped me determine what fields I would be most interested in pursuing when I attend graduate school. I would like work on membrane proteins using NMR, EPR, and other biophysical techniques. While working in the Fanucci Group, I have learned how to analyze, interpret, and present data in a clear and effective format. Last February I attended the Biophysical Society meeting in San Francisco and at the end of July I attended the Rocky Mountain Conference on Analytical Chemistry, presenting a poster at each. Presenting these posters improved my skills at discussing and explaining the results of my research. While at both conferences I was exposed to research being conducted in a variety of fields which has also helped me in deciding on where I will pursue my graduate studies as well as what topics I am most interested in. The Biophysical Conference afforded an opportunity to meet with graduate school recruiters from institutions across the country.
Adam Grippin  
**Freshman**  
**Mentor:** Dr. Chang Yu Wu (Environmental Engineering)

**Personal Statement Before Starting Science For Life Award**

From the time that I heard about the Science for Life Program, I knew that it was something that I wanted to do. Coming into college I wanted to be in a position where I could make a concrete difference in the world, so I signed up for the research seminar. In this class I had my first encounter with Dr. Wu, who presented his project on filter respirators. In addition to Dr. Wu’s passion for his work, the project itself also hit me from the outset as something that I wanted to be involved with. I was seeking a project that aimed to fix a real-life problem, which is exactly what this project was designed to do.

After this first encounter I took the first step of asking for a position in the lab and never looked back. Now I am taking major responsibility for the project, spending my free time during the day running experiments and collecting results. This is something that I have definitely enjoyed thus far, and something that I earnestly look forward to continuing in my time at UF. The particular project that I am proposing will take a little longer than a year, but the possibilities for extension are enormous. I am looking for a way to solve this problem, and am determined to continue to try different ideas until I find one that works.

If awarded this scholarship, I plan to use the HHMI Undergraduate Research Award as a major stepping stool to other opportunities. I do not want to waste a single summer back home working at the local movie theater, and will use my experience in the lab and the prestige of this award to make myself a competitive candidate for extramural research opportunities, like those offered through the Science for Life program. I definitely believe that the next step in my maturity as an individual and as a researcher is going to be moving out of my comfort zone and heading to another university to do research with other people in a new environment, and will look to do this as soon as possible. In addition, I have always had a strong desire to study abroad, a goal that could be expediently realized if I am accepted into either a Provost Scholarship or a National Science Foundation funded program.

Beyond aiding me in these short-term aspirations, the HHMI award will also serve as a major distinction for me as I apply to graduate school, and ultimately as I apply for a job in the research sector. As a result of this award, I will have gained valuable experience in a laboratory setting, making me a very competitive candidate for any research position. In addition, if the research goes well, this award will enable me to present at national meetings and get published within my first two years of undergraduate study, a marked achievement for any applicant. I have spoken with my professor about this latter subject, and he has told me that he holds what I have found to be a very reasonable standard for co-authorship of publications. Dr. Wu maintains that if an undergraduate student is involved in every step of the research process, that is experimental set-up, preparation of samples, performance of the experiment, bioassy of the samples, analysis of the data and interpretation of the results, then he deserves to be a co-author on any paper that is turned out. This spring I began working on the project, and by the beginning of summer will be actively involved in all of these tasks, hopefully yielding a result that is worth publishing.

**Abstract**

Evaluation of microwave irradiation assisted filtration for capture and inactivation of viral aerosols for collective protection

Woo MH, Grippin A, Wu CY

HVAC (heating, ventilation and air conditioning) filters are frequently employed in air circulation units in house and building to capture various types of airborne particles including viruses. However, the physically captured viruses can still reproduce and get released later. Therefore, the disinfection of the collected biological agents is a necessary step to address these problems. The objective of this study was to evaluate filtration coupled with microwave irradiation for effective deactivation of viral agents during in-flight filtration for collective protection through HVAC filter.

For in-flight microwave decontamination, microwave was applied for three cycles of select irradiation time per 10 mins (i.e., 1, 2, 3, 5, and 10 mins/10 mins) under different microwave powers from 125 W to 375 W. SiC disk was used to support the filter and to facilitate microwave absorption. The survival fraction on the filter by microwave irradiation and the inactivation efficiency by the entire system were investigated to find out the integrated effect of filtration coupled with microwave. Also, the effects of different environmental conditions on inactivation efficiency were investigated.

Experimental results show that increased microwave power level and irradiation time resulted in decreased survival fraction and increased inactivation efficiency. The survival fraction and inactivation efficiency at 375 W for 10 mins cycle under low relative humidity produced log reductions of 1.85 and 3.70, respectively, when SiC disk was applied. These values were reduced to 0.91 and 1.61 without SiC disk. Ongoing experiments with different relative humidities will be reported in the conference.

**Personal Statement After Starting Science For Life Award**

My time in Dr. Wu's lab this summer has been one of continual growth and maturation. Entering the lab in my second semester, I was a wide-eyed freshman with no concept of what research, or even engineering in general, was all about. In just one Spring semester and one summer in the lab, I completely turned that around, and now have experienced both of those once foreign worlds first-hand. In that time I learned how to make an experimental schedule, think outside the box to develop new experiments, and work toward a long-term goal that always seems just beyond reach. While pursuing that goal I encountered many challenges to my success, like when I worked for almost a month of the summer without the comfort of constant oversight and guidance from my faculty and graduate mentors. In that time I didn’t have the option of tapping into the wisdom of my two mentors. Instead I was forced to figure things out on my own, and ended up learning more in those three weeks than in the previous three months that I had been in the same position.

Now as I continue my research I look forward to using my experiences this summer to enhance the experience of the remainder of my undergraduate (and future graduate) career. The most evident benefit that this experience has afforded me is the progress toward publications and presentations in conferences that will make me a much more competitive candidate for future scholarships and graduate school admittance, but the experience also afforded me much more in the way of intangibles that any resume-building it provided. In my time in the lab I have gained real-world experience working on a project that, unlike every other one in my academic career, did not have one correct answer and one correct path to take to get there. Research with Science for Life has given me the opportunity to see the world’s problems as obstacles to be overcome, and given me the experience of overcoming them myself.
Personal Statement

**Before Starting Science For Life Award**

The HHMI Undergraduate Research Award is an amazing opportunity for me, one that opens doors for my future career plans. I aspire to become a doctor and a contributor to my community, one who makes substantive advancements in medical research for the betterment of others’ health. This program enables me to dive into the deep end of the pool and undertake cutting-edge research as an undergraduate. I will be able to have experience in research that will only help to solidify my ambitions and foster the skills that are essential to making the advancements that will help society. I am intent on conducting useful research, that which has practical applications. Therefore, it is not surprising that I chose to work on a project that has profound implications; this project may provide therapies for cardiovascular ailments that include but are not limited to atherosclerosis, ischemic and congenital heart disorders, stroke, thrombosis, and hypertension.

It is fair to say that I may not have been interested in this subject if not for an illness in my own family. My father has suffered a heart attack and has heart disease. Despite initial surgery and preventive measures in the form of diet, medicine, and exercise, further bypass surgery was required. This is surprising given that my father has been a vegetarian his entire life; the lack of excess unhealthy fats that are acquired through regular meat consumption which contributes to the occlusion of blood vessels was not to blame. Dr. Berceli and Dr. Jiang’s research struck a personal cord with me for it strives to find a direct cause of intimal hyperplasia, which leads to an unsuccessful outcome after bypass surgery. If we can isolate the cause for this thickening of blood vessels, we may be able to inhibit or reduce this poor response to restenovascularization. In doing so, we may be able to successfully improve surgical outcomes and thus promote a healthier society.

The HHMI Undergraduate Research Program gives me the resources to make an early contribution to the health profession. I truly want my research to help others and this will keep me motivated. The coursework I plan to complete will complement my research as I will be taking chemistry and biology courses which will enhance my understanding of intimal hyperplasia; this knowledge will effectively be applied to my research. I plan on devoting at least 40 hours/week to the lab over the summer and approximately 15 hrs over the academic year for 2-3 years. I am focused and I plan to keep my long term goals in front of me; I will do everything needed to excel in school while conducting invaluable research, providing a solid precursor to my professional studies. I mentioned earlier that I aspire to become a doctor, but more specifically I aim to become a cardiologist—a specialty for which I already have a passion and one that will only be fed and intensified through this particular research project and the HHMI Undergraduate Research Program.

As Dr. Berceli and I have discussed, performing research while taking part in academics will give me insight into the everyday life of research surgeons, who balance their clinical commitments with their research efforts. As mentioned in the research plan, I will first examine differences in smooth muscle cell (SMC) proliferation, migration, and collagen production. These initial findings in one outcome will be presented at the UF Surgery Research Day in my first year. In my second year, the findings from all three outcomes will be submitted as an abstract for a national meeting such as the American College of Surgeons, which has a special medical/undergraduate student presentation forum. These initial findings will support application to extramural research sources. If differences in the SMCs in culture are found, I will pursue the mouse studies described in the research plan. This will further elucidate the contribution of TGF-β in IH development. If the experiments are novel as anticipated, the cell culture and mouse studies will be combined into a paper, which I will submit as first author to an appropriate journal. In order to expand my research, I will have the opportunity to work closely with the personnel in the lab of Dr. C. Keith Ozaki, an investigator at Brigham Hospital at Harvard University. Dr. Ozaki collaborates with Dr. Berceli and techniques from his laboratory will be introduced into the proposed experiments to further my education and advance the merits of the study. This research project will provide me an opportunity for co-authoring of a paper as well as presentations to researchers around the nation in hopes of applying the results of the study to human and thus pave the way for cardiovascular therapies.

**Abstract**

TGF-1 Mediated Intimal Hyperplasia


Arterial blockages, caused by hardening of the arteries or atherosclerosis, continue to be a major unsolved problem, with heart attack and stroke caused by these blockages being a major cause of death in the United States. Clinically, arterial blockages are treated with endovascular angioplasty and/or bypass vein grafts. These endovascular treatments have become commonplace as means to reduce risk associated with these lesions. While these treatments offer immediate success in the improvement of blood supply to the ischemic organs, their long-term success limited by scar formation and the re-opened arterial segments or the bypass vein graft. The scars frequently build up over weeks to months leading to re-narrowing of the artery, reduced blood flow to the heart or brain, and increased risk of heart attack or stroke. Recent data indicates that almost 75% of these treatments are prone to significant scar formation within one year. The scar formation at the sites of angioplasty or stent placement, termed neointimal hyperplasia (NIH), is caused by the migration of smooth muscle cells (SMCs) from the tunica media of blood vessels to the tunica intima where these cells begin to proliferate and secrete collagen and other matrix proteins. The progressive buildup of these cells and proteins, leading to severe re-narrowing of the artery, is the major unsolved problem with currently available therapies.

Although researchers have attempted to develop a variety of approaches to reduce this NIH formation and prevent this problem, none have been fully successful in the improvement of clinical outcome. Work in Dr. Berceli’s lab has been devoted to understanding the mechanisms and identifying key regulatory proteins that promote NIH formation. Over the past decades, transforming growth factor β (TGF-β) has been identified as an important factor for NIH formation and clinical outcome. While much has been learned about TGF-β signaling pathways, there are several important issues that need to be answered, in the hope of controlling the effect of TGF-β on neointimal cell proliferation and matrix production over the course of NIH development.

References:

**Personal Statement After Starting Science For Life Award**

As an undergraduate student who has applied to medical school, it is important to me to understand how research contributes to clinical practice. My invaluable experience in Dr. Berceli’s research lab up to this point has enlightened me as to the direct link between the bench top and operating room. My participation in the laboratory has allowed me to build a foundation for my own research project(s). Being involved in a laboratory setting has given me a new appreciation for scientists and those who have contributed to the infinite spectrum of knowledge we know possess. I realize now that research is meticulous and painstaking, a profession for which one has to have much patience and determination. Consequently, I have personally grown in that I have learned from my mistakes when an experiment does not go according to plan.

I have gained hands on experience using methods from a wide range of medical research fields and thus gained invaluable experience in academic medicine. The opportunity to pursue a research project with profound implications in vascular biology has complimented my interests and career aspirations in vascular medicine or surgery. My involvement with this research project has held a very special place in my heart as atherosclerosis and cardiovascular disease have plagued my family. My father had received treatment for occluded arteries responsible for his heart attack but like aforementioned, the treatment’s long time success was inhibited by scar formation upon which my father had to undergo further procedures including bypass heart surgery. I am curious as to what prompted this scar formation and this research project has given me some insight for answering this question. I am excited by the possibility of finding a way to prevent or reduce initial formation that can be monumental in saving lives. This very nature of medical research to tackle real-life problems with the goal of discovering meaningful solutions to fundamental problems plaguing society is what enticed me to join Dr. Berceli’s research team. By playing an active role in the lab, I have gained extensive knowledge about vascular biology and understood the process of the scientific method that underlies academic research. I hope to continue to develop critical thinking and problem solving skills that will serve me well in my future endeavors.

Figure 1: Normal blood vessel (left), Occluded vessel as a result of neointimal hyperplasia (right)
the lack of that very protein that caused my
her lab was Lung Surfactant Protein B. It was
realized that the protein under investigation in
molecular biology and work with proteins, both
mented by my touring of the Gurdon Research
lab protocols, and thus ignite my interest in
research at UF. I am extremely fortunate that
that I learn in the classroom and the lab are
important focus to keep. Whether I go on to a
not sacrificing other aspects of my life is a
dots or being baffled. The point of this example
success and failure, and between connecting the
proteins that coats the internal surface of the
lungs. Lung surfactant proteins that regulates lipid trafficking to
alveoli for oxygen transport. The C terminus
of a stable lipid monolayer at the surface of the
membrane, via Electron Paramagnetic Resonance. I
look forward to any opportunities to present the
research, and I want to continue to work on this protein while possibly starting a side project working with viral vectors. If I am successful in being granted this or other award stipends.
I currently have the summer of 2011 free of
courses here at UF, because I want to return to
Cambridge University over the summer to take
courses and perform research abroad.

Abstract

Structural Studies of Lung Surfactant Protein B59-80 via Electron Paramagnetic Resonance Experiments
Hannabass KR, Kuznetsova A, Long, JR

Respiratory Distress Syndrome (RDS) is one of the leading causes of neonatal death. RDS occurs in premature infants due to a lack of pulmonary surfactant, which is a mixture of lipids and proteins that coats the internal surface of the lungs. Pulmonary surfactant lowers the surface tension within the alveoli and allows for proper lung function, preventing the collapse of small airspaces associated with RDS. Lung surfactant protein B (SP-B) has been shown to be an essential protein that regulates lipid trafficking to the air-water interface (1). SP-B partitions into lipid lamellar bodies and mediates a complex lipid-water interaction that allows the formation of a stable lipid monolayer at the surface of the alveoli for oxygen transport. The C terminus (SP-BC), which includes residues 59-80, maintains many of the important properties of SPB, and is thus of therapeutic interest for development of peptidomimetics for use in clinical PS formulations. Current treatments rely on animal derived lung surfactant, which can pose immunological risks to patients, and thus a synthetic peptide based treatment option would be ideal. There have been interesting studies of the lipid partitioning and helical structure of SP-BC within the clinically relevant DPPC and POPC lipid environments (2). These studies provide indirect evidence that differential partitioning of SP-BC may allow it to traffic specific lipids, particularly DPPC, to the air-water interface. These experiments require site directed mutagenesis to introduce cysteine into each residue position within SP-BC, producing 22 mutant peptides corresponding to positions 59-80 of SP-B being individually replaced with cysteine. Subsequent spin labeling using nitroxide labels will enable me to use the power saturation electron paramagnetic resonance (EPR) experiment to examine the helical structure and position of SP-BC within the lipid bilayer. My project is to use site directed spin labeling and EPR spectroscopy to determine a more quantitative picture of SP-BC in lipid bilayers of varying composition. This approach has been used by the Long research group to examine a simple peptide mimic KL4 stemming from a side project at my lab. I am extremely fortunate that I can pursue the research that I love at the university level and be exposed to the latest research in the field.

Personal Statement Before Starting Science For Life Award

Over the last two semesters here at UF, research has become a large part of my academic life. I still enjoy succeeding in the classroom, and last semester’s finals showed me how good it feels to really get out what you put in. These two parts of my academic life, research and coursework, are not exclusionary. I have found that they rather complement each other. For instance, in the HHMI undergraduate core lab CHM2054L, proper scientific note taking was one of the major themes of our first class, and learning in the lab within
the fall, and I was participating and learning in the lab within two weeks of arriving at UF. If the results are successful on our current research on Lung Surfactant Protein B, C terminus, I will be a co-author on the paper, which will describe the structure of the protein in-situ of the membrane, via Electron Paramagnetic Resonance. I look forward to any opportunities to present the research, and I want to continue to work on this protein while possibly starting a side project working with viral vectors. If I am successful in being granted this or other award stipends. I currently have the summer of 2011 free of courses here at UF, because I want to return to Cambridge University over the summer to take courses and perform research abroad.

Personal Statement After Starting Science For Life Award

The HHMI program gave me my first chance to see what a full time research experience was all about. I gained a great deal of confidence in conducting lab work by myself, new research skills, and most importantly, an essential lesson in patience and good planning. By being in the lab day in and day out I realized that problems and obstacles will always arise, even with the most straightforward protocol or task. Despite my unrelenting optimism, facing problems with good planning and literature based knowledge may be the most important research skill that I am taking away from my participation with the HHMI program. My experience working full time in the lab over the summer was enjoyable and certainly much more productive than my previous work during the Fall/Spring semesters, during which a busy academic schedule limited my productivity. With this in mind, I have no doubt that next summer I will pursue a chance to do research out of state on a project following up on my work with lung surfactant protein B. Another appealing option I will look into is working on a separate project over the summer and bringing back my work and any newfound skills to continue at my lab here at UF. I will continue to recommend the HHMI program and the undergraduate research experience as a whole to my peers; there is no question that it is an invaluable experience that prepares undergraduates for bright futures in graduate and professional schools.
The HHMI Science for Life Intramural Research Program presents a unique opportunity for me to gain valuable research experience in a field that I hope to study further in graduate school. I am currently an undergraduate majoring in Electrical Engineering with a minor in Physics, but I plan to continue my education studying the brain as a biomedical engineer or neuroscientist.

I chose my mentor, Dr. Simpson, based on his presentation at a luncheon for the Biomedical Engineering Society. His work seemed like a perfect mix of biomedical and electrical engineering concepts that would give me a head start on the path to entering a career in life science research as well as better understanding of the techniques used in studying the brain (fMRI) through my work designing NMR coil systems for imaging and spectroscopy. Dr. Simpson has also shared his graduate school experiences and given me much needed advice and I look forward to continue working under him.

Although I may be older than most of the students that apply for this award I believe that this gives me additional knowledge and experience that will serve to advance my research at an accelerated pace. I have already moved passed certain stages in my preliminary work with my mentor as a direct result of my prior class experience in circuit design and modern physics. I also have the advantage of having already completed my most difficult classes and my remaining schedule is quite lax. I have only six additional classes to take over the next year (including this summer) before I graduate and I plan to fill my remaining hours with research credit. I plan to use the extra time to write an Honors Thesis for graduating with Summa Cum Laude honors and attempt to include my research in any peer reviewed publications submitted before my graduation.

I hope that you will consider me for this award which would invariably help me on my path towards graduate school and further biomedical research. I have made it a personal goal of mine, as part of my career, to make a contribution to the collection of human knowledge and this is my first step toward that end.

The HHMI Science for Life program has been an exceptionally rewarding experience for me. I have not only learned more in the field of my degree, I’ve also learned so much about science in general.

One of my life goals is to contribute something, no matter how small, to the collection of human knowledge. The time I have spent in the Science for Life program has shown me that there are others with the same goal and that there is an atmosphere geared toward these ends. My research experience thus far has only validated my desire to continue my education and I have been accepted to the Biomedical Engineering Ph.D. program at Johns Hopkins University. It may be a difficult, 6 year ordeal, but I look forward to the challenge.

All that I have learned in the program has also nicely rounded out my Electrical Engineering degree. I had very little work in radio frequency engineering prior to this project, but I now have a solid knowledge base from which to work.

Overall, the Science for Life program has been exceedingly valuable as a preview of the next stage of my life. I enjoy going to work every day trying to better understand the world around me and I am excited about continuing my scientific studies.

Abstract

Development of a multiple-frequency, inductively-coupled, implantable, NMR coil system at 11.1T

Harden BJ, Volland NA, Beck BL, Simpson NE

Diabetes is a potentially life threatening disease affecting over 23 million Americans. A new therapeutic approach to treating Type I diabetes involves the implantation of a tissue engineered macro construct. Direct, non-invasive monitoring of this “bioartificial pancreas” can be accomplished with an inductively coupled, implantable, NMR coil system. Development of a multiple frequency system is presented as part of ongoing efforts to characterize the construct’s cells in vivo. Dual frequency implantable coils are shown to provide sufficient Q when resonating within the acceptable range, but require more advanced manufacturing techniques in order to be built reliably. A flaw in one of the design theories used to construct dual frequency surface coils is examined, along with its correction and the subsequent circuit simulations. The long traces required when using variable capacitors are shown to create additional, unexpected resonances, which are corrected with a fixed component design. Further development of the system shows promise, but requires professional construction of both the implantable coil and the surface coil’s printed circuit board to better implement the theoretical designs presented.
My interest in science and conducting scientific work began at an early age. Growing up, I participated in regional and state science fairs, as well as any opportunity provided via my teachers’ assignments. As an IB student in high school, independent thinking was encouraged. Thus, many of my assignments allowed me to complete independent investigations and satisfy my natural inclination to learn about topics not covered in class. After starting my education at UF, I realized my opportunities for research were even broader. Now, I was not limited to the confines of a specific class or subject. Instead, I found I could pursue a research opportunity in any field of interest.

Within my first week as a freshman, I found Dr. Sue Percival’s lab and began shadowing right away. I spent Fall 2008 learning more about her research, and was able to begin my first independent project Spring 2009, during my second semester as a college student. As mentioned, my first college-level research experience came from food and nutrition related studies. I chose nutritional sciences as my major, so it made perfect sense to learn more about the field from an aspect different from that presented in classes. Having a natural interest in the subject made conducting research an extremely rewarding experience.

When I entered UF, dentistry was just one, among a few, of the career paths I was considering. During Spring 2009, my second semester at UF, I began shadowing Dr. Storoe, and also volunteering in various departments at the Shands College of Dentistry, I knew that dentistry would be the right career goal for me. Right away, I wanted to learn as much about the field as possible; conducting dental research seemed like the next logical step.

During my search for a potential mentor, I came across Dr. Riley’s page online. I read about his prior research and was immediately interested in getting involved in his laboratory. Overall, his research studies different responses to pain, whether behavioral, emotional, or cognitive. More importantly, however, his pain studies are based upon the completion of trials on human subjects. I see this as an amazing opportunity to improve my interpersonal communication skills – a skill crucial in order for dentists to maintain a good relationship with his or her patients.

Fortunately, I have been able to transition smoothly into Dr. Riley’s lab. I have spent the end of Fall 2009 and now Spring 2010 familiarizing myself with both the protocols and the equipment used in his lab. This will certainly allow me to succeed in his lab in the future.

During this time, I have also been able to learn more about the ongoing studies in the lab. Dr. Riley and I recently discussed potential research projects for me, and decided a longitudinal study spanning the remainder of my time at UF would be perfect; allowing me to continue working on a single project for the next two years. If everything goes smoothly, I plan on applying for the Science for Life extramural award in the future.

Dental research is an excellent opportunity for me since I want to pursue both dentistry and research after undergraduate. My goal is to attend dental school here at UF; UF’s dental school has two programs that certainly interest me – the Summer Research Program and the Research Track Program. The Summer Research Program is for incoming freshman dental students, while the latter is for students who wish to obtain research experience during dental school. What I learn from this research experience with Dr. Riley will allow me to become a better-qualified candidate for both of the aforementioned dental school programs.

Abstract
Real-Life Implications of Reduced Pain Inhibition During Laboratory Pain Testing
Hasan SE, Riley JL

It is common for chronic pain to increase with age, and it is the older adults who are at increased risk for acute pain developing into chronic pain in the first place. Laboratory studies involving experimentally induced pain have established that older adults are simply more sensitive to painful stimuli. Since complex endogenous systems presumably both facilitate and inhibit pain, it is proposed that a dysfunctional pain modulation system is responsible for the increased pain incidence in older adults.

The primary goals of this project were to figure out whether older adults who exhibit reduced pain inhibition during laboratory pain testing will a) experience real-life pain at more bodily sights, b) report pain that is more frequent or more intense, and/or c) use pain medication more often than either younger adults or older adults who exhibit greater pain inhibition during laboratory pain testing.

In order to determine this, healthy subjects were recruited using fliers that advertised the pain study. After recruitment, the volunteers were then run through the orientation session and subsequently, the actual pain testing sessions from which data were collected. The orientation session was critical since it allowed a) the subjects to become familiar with rating pain using the electric visual analog scale and b) the researchers to determine the appropriate temperature to use during the following pain testing sessions. Specifics of each of the pain testing sessions varied according to the predetermined protocol.

Subjects were asked to complete post-testing questionnaires via telephone – once three months post-testing and then again six months post-testing. By analyzing the data collected from the laboratory sessions and the post-testing questionnaires, it will be possible to determine the correlation between reduced pain inhibition during laboratory pain testing and everyday pain incidence. In other words, it will be possible to decide whether laboratory results may be used as a predictor of everyday pain incidence.

References:

Personal Statement
Before Starting Science For Life Award

Conducting research as part of the Science for Life program has been an extremely rewarding experience for me thus far, and I am very lucky to have gotten this opportunity. The skills I have learned will not only help me throughout the remainder of my academic career, but they will also be useful once I transition into my eventual workplace. I spent a considerable amount of my time this summer at the lab learning how to set up the pain testing apparatus, use the computer programs, and run the specific protocols. While those lab techniques were certainly fun to learn and very important, I feel that my interaction with both fellow student researchers and recruited volunteer subjects was the most valuable aspect of my experience. One of my main tasks this summer was being responsible for subject recruitment. From start to finish, subject recruitment involved putting up fliers, explaining the research study to prospective subjects, and finally scheduling subjects at a time that was mutually convenient for the subjects and researchers.

This entire process clearly required a lot of patience and interaction with others, and essentially helped me improve my interpersonal communication skills. After getting the chance to do this, I realized that I really enjoy meeting new people and working with others. The communication skills I picked up this summer will definitely benefit me in the future. They will, without a doubt, be useful when completing group projects assigned by my professors here at the University of Florida. Furthermore, my plan is to become a dentist, and interacting effectively with patients and coworkers will be a necessity for running a successful practice.
I vividly remember when my vision began to wear away in the fifth grade. As images became fuzzier to me, I became more concerned about how my decline in vision would affect my life. My experiences with my own nearsightedness stimulated an interest in the visual system. In many ways, the deterioration of my vision allowed me to appreciate the sense of sight. When I took the Science for Life seminar class in the spring of 2009, I wanted to do research that involved vision. I also had a burgeoning interest in genetics, as I was enjoying the genetics unit in my biology class. My interest in the visual system motivated me to join Dr. Semple-Rowland’s retinal neurobiology lab. When Dr. Semple-Rowland presented her research to our class, I found the lab I was searching for. I knew that I would be able to have a long term interest in developing a gene therapy for children who completely lose vision early in their lives.

I trained in the summer of 2009 for Dr. Semple-Rowland’s lab, learning the techniques and procedures needed for the lab. In the fall, I began conducting research on a more intense basis. Now, I steadily work on building various genetic vectors that help move us towards our goal. Although dividing time between a heavy course load and research can be tough, I balance these responsibilities by going to the lab after-hours or on weekends. I intend to conduct the stipulated 40 hours of research per week during the summer and at least ten hours of research per week in the following fall. My plan is to conduct this research for the rest of my undergraduate career; I have already discussed with Dr. Semple-Roland my desire to write a senior thesis on the genetics research from the lab. Additionally, I aspire to apply to other research programs in the following terms, like the University Scholars Program. In the long term, this research will benefit me in my goal of becoming a doctor because it has given me practical experience in understanding how genes can cause disease, and how they can cure them. Solidly understanding gene therapies and their developments can help me to communicate information about these therapies to patients.

From personal experiences, I know how disheartening a loss in visual acuity can feel, but can only imagine the devastation blindness can create in young children with this disease and their families. By obtaining the HHMI Science for Life award, I hope to continue my work in Dr. Semple-Rowland’s lab this summer and beyond. Finding a solution for Leber congenital amaurosis type 1 has not been simple, but the possibilities that lie behind the 2A and WPRE elements are exciting. I look forward to continuing our laboratory’s progress this summer by furthering our examination of these elements if given the opportunity to do so through the Science for Life intramural program.

Abstract

Development of Novel Lentiviral Vectors Using the Viral 2A Cleavage Sequence


Leber congenital amaurosis type 1 (LCA1) is an autosomal recessive disease that causes blindness in children. The underlying genetic mutation disrupts expression of guanylate cyclase 1 (GC1), an enzyme critical for retinal photoreceptor function. Dr. Semple-Rowland’s research team successfully reversed blindness in an avian model of LCA1 using lentiviral gene therapy, but the therapeutic effects of the treatment were not lifelong (Williams et al., 2006). Based on these results, we hypothesized that a successful therapy for LCA1 will require both the gene encoding GC1 and genes encoding factors that will support survival of the treated photoreceptors. In testing this hypothesis, this study was carried out to develop a lentiviral vector that reliably expresses multiple proteins in targeted cells infected by the packaged lentivirus.

Standard cloning techniques were used to build our vectors. We used the 2A cleavage peptide, PTV1, a viral peptide sequence that is able to self-cleave permitting expression of two proteins from a single transcript in our constructs. To test our vectors the developing neural tubes of early stage chicken embryos were injected with lentivirus in ovo. Retina whole mounts were analyzed using a fluorescent microscope in order to determine transduction efficiency. The amounts of the proteins encoded by the vector were determined using western blot analyses.

The vectors pFIN-EFI-GFP:PTV1-Cherry(HA)-WPRE and pFIN-EFI-GFP:PTV1-(6MYC)XIAP-WPRE were constructed to examine the efficacy of the PTV1 2A sequence. We found that approximately equal levels of both GFP and Cherry(HA) proteins were expressed in photoreceptor cells transduced with pFIN-EFI-GFP:PTV1-Cherry(HA)-WPRE and pFIN-EFI-GFP:PTV1-(6MYC)XIAP-WPRE (Figure 1). Furthermore, expression of both proteins was high. Chicken embryos transduced with pFIN-EFI-GFP:PTV1-(6MYC)XIAP-WPRE vector died before hatching. We suspect that over expression of XIAP, an inhibitor of apoptosis cell death, may be disrupting normal development of the embryo.

Figure 1: Fluorescent images of retinal whole mounts transduced with pFIN-EFI-GFP:PTV1-Cherry(HA)-WPRE lentivirus. The whole mounted retinas were photographed using filters for GFP and mCherry, respectively. Merge of images is the rightmost image.

Reference:

Personal Statement After Starting Science For Life Award

Going into this summer, I was unsure how participating in full-time research in Dr. Semple-Rowland’s neuroscience lab would affect me and my career goals. It was exciting to learn more about the research I was doing, the previous research done in this field, and the science and rationale behind our current research. Importantaly, I gained an appreciation for the scope of the research that has been done on the mechanisms of the disease we study (Leber congenital amaurosis type 1, or LCA1) and on other multi-gene expression systems (such as internal ribosome entry sites and other promoter vectors) that have helped to focus the direction of the research being carried out in Dr. Semple-Rowland’s lab today.

Working in Dr. Semple-Rowland’s lab also helped me to learn more about myself. Perhaps the most important lesson was patience. My experience this summer was certainly full of the “error” side of research’s trial and error-like nature. Thankfully, Dr. Semple-Rowland’s research group functions as a team: we all work together on our individual research goals. Building plasmid vectors from many fragments of DNA can present quite an array of challenges. If anything, I have learned that it is necessary to be strong and persistent to succeed in scientific research.

I enjoy conducting research and would like to incorporate it into my career. I remain committed to becoming a medical doctor but now appreciate the effort it takes to make medical advances. While I would enjoy incorporating research in my medical career, I feel that the time commitment required to be successful in both research and medicine may lead to compromises that would negatively impact my ability to meet my professional and personal obligations. Nevertheless, my summer research experience has opened me up to the possibilities of conducting research as an MD.
Zilan Hu
Sophomore
Mentor: Dr. Ben M. Dunn (Biochemistry and Molecular Biology)

Personal Statement Before Starting Science For Life Award

Ever since I watched the news on TV when I was younger about how HIV could lie dormant for over ten years until it becomes infectious in a host’s body, I became very curious about this deadly disease. I eagerly wondered why it was so powerful, why there was no complete cure for it and how it affected the host. Since high school, my simple curiosity has transformed into a larger interest in HIV, which has led me to participate in many HIV related events, conferences and summer HIV educational programs. When I entered the University of Florida, I took the Science For Life class in my first semester and found out about Dr. Ben M. Dunn’s research lab and his HIV-1 project. I immediately became interested after Dr. Dunn presented his power point regarding his research in class. I wanted to be in his lab, so I emailed Dr. Dunn for an interview. After being accepted into the lab, I spent two semesters volunteering and learning about all the techniques used for the HIV-1 research--PCR mutagenesis, protein expression, purification, refolding and crystallization of the proteins with inhibitors.

At the beginning of this semester, I started my own independent research. When I completed the protocol for the first round, I obtained good results: pure and highly reactive HIV-1C clone. I immediately continued on to the second round, which I completed for the first time in one week. I am a patient worker; I am able to dedicate more time on it. Also, this will help me to improve my knowledge and refine my skills in the lab. Making this type of research a life commitment will help me make discoveries and further the HIV-1 research.

My passion and excitement for HIV-1 research is what inspires me to dedicate so much of my time into it; however, I am still capable of managing my other studies. For example, a week ago, I had three exams, a quiz, a biology II practical and a biology lab report due in the same week. I continued to do research every day while studying for my exams and ultimately received straight As on all my tests and assignments. I completed what I planned to finish in lab that week. These moments reveal that I can deal with stress and a multitude of tasks at the same time. No matter how heavy my course load might be, I will still have time for research because it is my motivator.

I want to work on the HIV-1 project for the remainder of my time at the University of Florida and to continue with the work further in an MD-PhD program. Not only can I focus and use my time efficiently on one research subject, but mostly I am very interested with this area. I want to devote my research attention in this field and accomplish many goals for HIV-1 project, and I know that would be realized much more when I am able to dedicate more time on it. Also, this will help me to improve my knowledge and refine my skills in the lab. Making this type of research a life commitment will help me make discoveries and further the HIV-1 research.

During my undergraduate degree, my goal is to present my research in HHMI poster sections and HHMI national conferences. In the next summer, I also want to apply to the Undergraduate Extramural Research Program in order to gain new experiences for broadening perspectives towards my research and HIV-1 in general.

Applying for the intramural Science for Life research program is my first step into many remarkable opportunities associated with research in UF and beyond. I am a competent candidate for this program because I will contribute valuable work to my chosen field of research. This research project will benefit from my responsibility, work ethics and intelligence. I am a devoted researcher and have a great thirst for uncovering the intricacies of HIV, and also making significant contribution to the HIV-1 project.

Abstract

Reengineering of HIV-1 Protease AC 150L clone and Later Its Expression, Purification, and Crystallization

Hu Z, Goldfarb N, Shabashvili DE, Dunn BM

My research project focused on examining the role of polymorphism of non-B HIV-1 protease on drug resistance after the acquisition of protease inhibitor selected mutations. I specifically worked with HIV-1 AC 150L. The study on HIV-1 subtype AC with mutation 150L could provide knowledge about HIV-1 AC’s drug resistant properties including its structural and enzymatic mechanism used to escape drug inhibition. Some basic techniques include PCR mutagenesis, DNA transformation, French-press, dialysis and column chromatography were conducted. The analysis on the purified active protein will be done through kinetics and X-ray crystallography for the purpose of promoting better development of drugs for non-B subtypes. Currently, due to the erroneous promoter sequence of HIV-1 AC 150L, proper transcription and translation could not take place and thus, no desired protein can be expressed so far (some expressed ones did not show much activity). Therefore, new clone of HIV-1 AC 150L is undergoing the reengineering process, which will soon result the correct clone for continuation of its protein expression and purification.

Personal Statement After Starting Science For Life Award

My first contact with research was by volunteering in Dr. Ben Dunn's lab in the summer of my freshman year. I enjoyed pipetting till my thumb ached and washing streams of shiny glasswares during my training period. At first, I assisted other students with their projects in order to learn and accumulate knowledge and skills. It was a great feeling to see other people’s accomplishments because although very small but I played a part in them. When I started independent research, I was at first intimidated by certain challenges. I even confronted a few experimental failures and problems that I have never dealt with before. Although feeling frustrated at times, nothing disheartened me enough to stop me from continuing working hard. As time passes, my skills improved and knowledge increased immensely, and successes have come along the way. The many hours of repetitive work in a slow but stimulating process has become very encouraging to me.

I have derived pleasure and satisfaction from doing research within HHMI, not due to successes alone but also obstacles, which have led and will lead me to successes. I love research because I enjoy the systematic approach of dissecting problems, solving puzzles, receiving new knowledge daily and making new discoveries. Research has augmented my study by adding a unique dimension to my education. The most thrilling part of research is the fact that I will in the future, impact people’s lives with what I obtain from my own research. Within the HHMI Intramural Program, I had been cloning and characterizing the directed site-specific mutations in HIV protease. My project focused on HIV-1 subtype AC with the mutation 150L. My goal was to analyze the interactions and activities of the protease and with selected inhibitors after successful protein expression and purification. I treasured the opportunity to perform research in HHMI and have been really grateful about that experience.
Having been accepted to the UF Honors Program, I was introduced to the tremendous research opportunities available at the university before I even set foot on campus. The program's website provided me with a wealth of information on scholarships and mentors, and my honors advisor subsequently recommended the Science For Life course because I expressed interest in undergraduate research. My two reasons for getting involved in a lab were simple. First, research will inevitably be in my future as I plan to attend either graduate or medical school, so getting early experience is invaluable. Second, research would allow me to work closely with a professor and his post-doctorate associates, which is a learning environment that I take preference over lecture halls and TA discussions.

I met Dr. Stratford May through the Science For Life seminar. My interest in wanting to be a part of his lab stems from his area of research as well as his outstanding character. The medical field has always held my attention, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine.

The HHMI Science for Life Program has afforded me a tremendous opportunity as an undergraduate to work in UF's research field. In my time that I've been involved in Dr. May's Laboratory in the Oncology-Hematology department, I have learned many essential techniques that are widely used in laboratories and taught to graduate students, such as Western blot, cell culture (Osteosarcoma, breast cancer, etc.), fluorescence microscopy, DNA purification, transfection (Nanojuice and Neon), and flow cytometry (including TUNEL) with cell cycle analysis. In addition to honing my practical lab skills, research has given me to a deeper conceptual understanding of genetics, microbiology, and biochemistry. Working with cancer cell lines, I learned about the pathways involved in cell cycle regulation and apoptosis, as my project in the lab focuses on the PKR-p53 pathway. Performing transfections of small-interfering RNAs for gene knockout purposes and DNA fragments that lead to over-expression of certain enzymes and proteins give me a deeper understanding of the DNA transcription and protein synthesis processes, which are concepts rooted in genetics. And through using many chemical reagents (protein inhibitors, ribonuclease, antibodies, etc.), for different experiments, I think critically about the downstream consequences of a cellular reaction. Having constant communication and a personal relationship with my mentor has allowed me to anticipate what graduate studies entail and given me the confidence and support to embark on further studies. In addition to my research, I have been involved in Habitat For Humanity and represented the UF chapter as its President. Having been accepted to the UF Honors Program, I was introduced to the tremendous research opportunities available at the university before I even set foot on campus. The program's website provided me with a wealth of information on scholarships and mentors, and my honors advisor subsequently recommended the Science For Life course because I expressed interest in undergraduate research. My two reasons for getting involved in a lab were simple. First, research will inevitably be in my future as I plan to attend either graduate or medical school, so getting early experience is invaluable. Second, research would allow me to work closely with a professor and his post-doctorate associates, which is a learning environment that I take preference over lecture halls and TA discussions.

I met Dr. Stratford May through the Science For Life seminar. My interest in wanting to be a part of his lab stems from his area of research as well as his outstanding character. The medical field has always held my attention, as I am continually amazed at the strides we make in human health and medicine. Dr. May's research impressed me, as I am continually amazed at the strides we make in human health and medicine.

The cell cycle and its embedded checkpoints keep the organism healthy and functioning. Many proteins and transcription factors go into regulating cell growth, mitosis, and apoptosis, all of which are part of the cell cycle. One important transcription factor is the p53 tumor suppressor gene, which determines the survival or death of a cell based on individual conditions. Cancer manifests when there's abnormal expression of p53. The specific pathway of interest is the RAX-PKR-p53 pathway, where RAX causes a downstream signaling series of events that ultimately affects p53 expression. We tested this pathway in hopes of knocking down abnormal p53 expression (NF-kB and p53 perform immunological and genetic repairs, respectively, in tumor cells). To test this pathway, the K562 cells were serum-starved to induce PKR activation, and new cell lines were created from K562 (siRNA PKR, siRNA RAX, and ptran RAX) in order to confirm successful knockdowns of each protein. We succeeded in knocking down PKR expression levels, and we hope to manipulate the proteins further down the pathway.

The RAX-PKR signaling axis enhances p53-mediated cell cycle arrest by a SUMOylation dependent mechanism

Hui T, May S
I first met Dr. David Oppenheimer and his lab early in the fall 2009 semester. I was doing research on the University of Florida's website on current research studies that were being conducted. The description of the research that Dr. Oppenheimer's lab was doing about genetics and molecular biology intrigued me the most. I have always been more fascinated with genetics than with other biological topics, so this lab suited my interests the best.

I have already completed one semester of research in Dr. Oppenheimer's lab and understand the importance of time management. I know the amount of time that must be committed to research and how that can affect your school life. When choosing new classes for the next semester, I try to schedule my courses early in the day to allow more time for research and other school related activities in the afternoon and evening. With this research, I plan to further develop my skills and techniques I learned in lab and anticipate learning more about cellular biology and genetics will help me incorporate that into my research and coursework. I hope that this opportunity will help prepare me and single me out for medical school. After medical school, I want to specialize into the field of oncology and learn more about how genetics can affect the development of cancers.

I am aware that there is a possibility of getting some of the research published by the end of my undergraduate research career but, in order to become published, I understand that I must be diligent, patient, and determined. With prior experiences, I know that many times experiments do not work out but with determination and analysis I can perfect my skills and have positive results.

Abstract

Live cell imaging of the Endoplasmic Reticulum in plant cells with altered actin dynamics

Hwang A, Grey PH, Cuddy K, Oppenheimer DG

The endoplasmic reticulum (ER) is the first step in the secretory membrane system, and plays an important role in membrane trafficking. In plants, the secretory membrane system is responsible for secreting the needed materials for cell expansion during development. Previous results from analyzing plant epidermal hair cells (trichomes) in our lab showed that disruptions in actin dynamics leads to problems in membrane trafficking. Since the ER is the entry point for all material controlling cell expansion, we hypothesized that the ER will show defects in mutants that have altered actin dynamics. In this study, we used an ER-targeted Green Fluorescent Protein (GFP) to observe the ER in living Arabidopsis thaliana mutants that have altered actin dynamics. In this study, we used an ER-targeted Green Fluorescent Protein (GFP) to observe the ER in living Arabidopsis thaliana mutants that have altered actin dynamics. Confocal microscopy will be used to view the ER in living mutants and we will quantify the differences in the ER between wildtype and mutants in terms of organization and dynamics. Because altered actin dynamics is implicated in many human diseases, a better understanding of the relationship between actin dynamics and membrane trafficking may have important implications for human health by providing new possibilities for drug targets.

Personal Statement After Starting Science For Life Award

Doing research in Dr. Oppenheimer's lab really means a lot to me. Working in this lab has helped me to grow as person and understand myself better. It has given me an opportunity to experience the amount of work and dedication that goes into research. It has also helped me improve my critical thinking skills and time management. I feel like research has helped me in my science courses that I have attended. It allows me to apply what I have learned in lectures to an actual lab setting. Not only has research given me the chance to apply what I have learned class but also it has allowed me to apply some of the things I learned in research to my classes. Learning new things in lab has given me background information on some of the material covered in my science courses, which makes it easier for me to understand the concepts.

During my work in the summer, I have learned many new techniques such as crossing two different Arabidopsis ecotype with each other, vacuum infiltrating a foreign gene into the next generations' genome, performing PCR, and making protein gels. It is also important to learn the concept and methods behind each experiment. Anyone can follow the steps in a protocol but understanding why and how the protocol work is a very crucial knowledge for researchers to have.

I believe research has really helped me reach closer to my future goal of going to medical school. Research requires a lot of hard work and time so I use that effort to do well my schoolwork. Because I want to succeed in research, it motivates me to succeed in my classes and other activities too. Research has taught me a lot in organizing my priorities and I use what I have learned in research to achieve my goals.
I met Dr. Kladde through the HHMI Science for Life class and was interested in Dr. Kladde’s research in epigenetics. I have been working in his lab since the beginning of the fall semester in 2008. I have worked on several projects and wish to pursue a long term project that will be my main focus and accomplishment in the lab.

My academic goals are to graduate with a degree in biochemistry and move on to medical school or graduate school to study medical research. This project works into my long term goals in the fact that I will utilize and even more understand how basic research is conducted in a lab, but most importantly I will be working and creating ways to map out locations of histones, as well as temporal movement in single molecules. Ultimately it is a technique that can be used in mammalian cells to study and find ways to identify and prevent Tumor suppressing genes from being silenced and becoming cancerous and causing tumors and allowing time for early diagnosis. This is very important to my career as I will be studying and involved with cancerous and tumor causing genes in my future career, and will need a fast and efficient technique to study these cells. This research project is fundamental to my beginning in the medical research field. I have all intentions of working in Dr. Kladde’s lab until my undergraduate degree is over and will be committed to projects that may take years to complete. I will divide my coursework and research as I have done in the past few semesters partaking in the lab for a few hours every day, some weekends, and leaving time open for my own academic studies. In the summer I plan to work full time in the lab on my projects maybe taking 1 class, but the focus of my summer will be on research. One of my major goals in the lab is to accomplish a more efficient technique with mapping histones that will get published and recognized at the national level. I would as well be interested in working in collaborators labs in the future though a HHMI program.

Abstract

Fusion of Progesterone Receptor Nuclear Localization sequence in M.CviPI DNA Methyltransferases Inci E, Kladde MP, Darst RP

The basic unit of chromatin in eukaryotes is the nucleosome, which consist of a histone octamer each bound to approximately 147 base pairs of DNA. Chromatin modifications include methylation, acetylation, and repositioning of nucleosomes. We are able to find the approximate locations of the histones via chromatin immunoprecipitation and the recently developed technique MAPI(methyltransferase accessibility protocol for individual templates). MAPI employs exogenous DNA methyltransferases as in vivo probes of chromatin structure in the budding yeast Saccharomyces cerevisiae. These methyltransferases methylate unbound DNA between the nucleosomes, showing accessibility to DNA by showing of unmethylated regions and methylated regions [Kladde et al., 2008]. However currently, several problems exist in that we are only able to see the end product of the MAPI test, leaving a grey area between start and finish in the movement of the histone. Secondly, the current test provides a weak signal as to where the histones are protecting methylated DNA. It is our proposal to fuse the Progesterone Receptor Nuclear Localization Sequence, which allows progesterone receptors to dimerize and enter the nucleus given a signal, to the M. CviPI DNA methyltransferases, and integrate the fusion construct into yeast strains. The protein would synthesize outside the nucleus and upon addition of a progesterone receptor agonist, dimerize, and enter the nucleus. This would allow for better temporal resolution to observe the chromatin structure via exogenous DNA methyltransferases, and may also increase the amount of DNA methylation providing higher penetration of higher-order chromatin structures.

Personal Statement After Starting Science For Life Award

I am very glad to have been the recipient of the Science for Life award and have the opportunity to conduct research over the summer of 2009 and continue with it till the present day. The knowledge that I have gained from working in the Kladde lab has taught me aspects of science that go beyond what I am learning now in my upper division courses. I am a biochemistry major, so working in the Kladde lab has given me great insight to protein interactions and other aspects relative to my field. My experience has also delved into the finer arts of genetics, with gene expression, gene fusion, gene mapping, as well as gene replication. I have learned many biochemistry and molecular biology scientific techniques including designing primers, Genomic mini plasmid preparation, electrophoresis, polymerase chain reaction, western blotting, DNA digestion, DNA ligations, cell transformations, cell genotyping, and more. I am also diversifying in other projects which include tagging proteins with identifiable markers and working with new ways to map genomic DNA.

I am now working on attaining enough data for my honors thesis as I plan to graduate in May 2011. I then plan to apply to Medical school and pursue a career in medicine. Working in the lab has been relevant to this goal in more than one way. For one, I have actually been able to witness and work on the research which is making medical advancements for our future. I have had practice in learning procedures which involve sterility, accuracy, and delicacy which are similar in element to the ones I hope to perform in the future. More than anything I think the greatest thing I have taken out of Dr. Kladde’s lab is the analytical assessments I have been trained to make while working in the lab. This includes mapping out and designing specific experiments to achieve successful results as well as trouble shooting when results do not work which involves just as much analytical and critical thinking to diagnose the problem.

The decision to embark in the research world through the Science for Life program has introduced me to some great minds and people, in depth knowledge to my field of interest. I have learned experience, responsibility, and fulfillment in working on my project, and most importantly has made me grow as a scholar and person.
Personal Statement Before Starting Science For Life Award

I chose to work in this area of research because I am interested in learning more about the way in which the body is affected by pregnancy. I am planning on going to medical school and I would eventually like to become a neonatologist. I believe working in this area of research would allow me the opportunity to be exposed to what issues surround the balance of hormones that make a pregnancy result in a healthy pregnancy instead of an unhealthy pregnancy. Moreover, my chemistry major has intrigued me about affects chemical principles have on large systems like hormones. I think this project helps to bridge the gap between my career interests and the classes I am currently taking.

This project though is a continual process to better understand the effects of hormones in the human system. I plan to remain part of this research project for the rest of my college career if possible. I would eventually like to write my honors thesis on this research. I will have four semesters left starting in the fall to work on this project. I am hoping that by participating in the HHMI science for life program, I will be exposed to what issues surround the balance of hormones that make a pregnancy result in a healthy pregnancy instead of an unhealthy pregnancy. Moreover, my chemistry major has intrigued me about affects chemical principles have on large systems like hormones. I think this project helps to bridge the gap between my career interests and the classes I am currently taking.

Because of the way the HHMI program is structured, I am hoping to produce publications or presentation of my lab work. My mentor and I have discussed the possibility of using this work toward an honors thesis. In hopes of getting prepared for this, the HHMI program would allow my mentor and me the opportunity to do a poster presentation and participate in the undergraduate research symposium. Since I will be working with graduate students, the work I am able to help them with during the research process will allow me to have the opportunity to see what the publication process is like. Initially, I need to get experience in the lab but my mentor is interested in allowing me to be part of publications produced by the lab prior to my graduation.

Abstract

Cortisol’s affect on pregnant ewes
Jeske J, Keller-Wood M

This project focused on determining the effects of cortisol and pregnancy on the baroreflex in ewes. The samples used were taken from non-pregnant ewes and pregnant ewes for RT-PCR and from non-pregnant ewes for immunohistofluorescence (IHF). The RT-PCR tested for expression of MR, GR, AT1R, iNOS, and nNOS mRNA expression. There were two sections of brainstern giving general understanding about mRNA expression in nuclei within these regions. Cortisol increased expression of GR in the rostral section; whereas cortisol had opposite effects on nNOS expression in the pregnant and non-pregnant ewes. AT1R, MR, and iNOS expression was not changed by either cortisol treatment or pregnancy in the rostral section. In the caudal section, cortisol decreased GR and MR mRNA and both cortisol and pregnancy decreased iNOS mRNA, but AT1R and nNOS mRNA was not changed by either cortisol or pregnancy. IHF showed neurons stained for GR alone, MR alone, GR/MR, DBH alone, and GR/DBH within these brain regions. The NTS, RVLM, and DMN were the regions found to have staining for both MR and GR. GR and DBH co-localized in NTS and RVLM. IHF also showed some iNOS staining in NTS, but it is not clear if this staining was specific. The overall results were genes contributing to blood pressure regulation could be found in the ovine brainstem, and the changes in expression of iNOS and nNOS might be differences associated with blood pressure control during pregnancy and elevated cortisol. However, AT1R had no change in expression from pregnancy or cortisol.

Personal Statement After Starting Science For Life Award

My participation in the Science for Life program allowed me to have my first experience with scientific research. I enjoyed the experience because I was able to manage my own project like a graduate student would. I was able to work through various difficulties that occurred during the project requiring problem solving and further research into literature. The most beneficial part of my research was learning about how research is cumulative. My research mentor has worked in the same area of research for many years to understand the physiology of ewes during pregnancy. I also learned how the variability of publications results in more unanswered questions because research is different for each lab and often subject to subject. I do realize that the research I did was not completed but it was still intriguing to work through which helped in my transition to medical and self driven learning. I believe my experience with research will allow me when I do become a physician to recognize the value of research. I see how medicine is becoming more research driven and constantly changing. The need for general physicians is still present but more transition is occurring to the medical field to allow more research to go from the lab bench to the patient. I believe the literature and experiences I have been exposed to will continue to change through the next few years and beyond. I will not be continuing my research during medical school or pursue a Ph. D; I do plan to try to work on research during the summer and hope to better understand transitional medicine. Although I have finished my project and started medical school, I do believe my experience allowed me to better understand the effect research has on the scientific and medical community.
The field of neuroscience has intrigued me since high school, and I am grateful that UF offers so many chances for undergraduate research. During my senior year I briefly volunteered in a graduate student’s lab at FSU. He studied the neurobiological model of aggression and introduced me to the usage of animal models for research. After coming to UF, I searched for a similar lab in which to volunteer my time. During my freshman year, I began working in Dr. Bruijnzeel’s lab at the McKnight Research Institute which focuses specifically on nicotine and alcohol addiction and withdrawal. I devoted at least three to four hours a day, three times a week to working in this lab. I have also come in on weekends to help run the animals and perform cranial surgeries. I have worked in Dr. Bruijnzeel’s lab for a year and will continue to be involved in this lab through my senior year.

In the lab, we are studying the neuronal substrates that underlie nicotine and alcohol addiction and withdrawal. My proposed research, however, will focus specifically on nicotine. Many negative affective states come with cessation of smoking/tobacco usage, and treatments are being investigated that could potentially ease the quitting process. We will be testing a vasopressin antagonist that has already been experimented on for its antidepressant and anxiolytic effects. Given the successful research on this compound’s dual ability, it is expected to also reduce the negative affective states associated with nicotine withdrawal. No literature has recently been published that links this drug with treatments of addiction, so this research has potential for finding a novel pharmaceutical treatment of nicotine withdrawal in humans. An average experiment will take about four to five months with an extra two to three months for brain sectioning and data analysis. To merit being a co-author on a peer-reviewed publication, I must be involved with the design of the experiment and conduct at least 20% of the project.

For integrating research time into my academics, I have already been scheduling my classes so that I will have ample time to work in the lab. Ever since my first semester in the lab, I have juggled heavy science/math courses with time spent doing lab work. Despite being challenging, I find the participation both satisfying and enjoyable.

The HHMI Intramural award will help me gain a background in methods of scientific inquiry and analytic skills in preparation for higher-level education. I will apply for the Extramural Award in 2011 and find an out-of-state summer program. Ideally, I’d like to find a professor to work with at the National Institute of Health. Although my current project and lab focuses predominantly on nicotine and alcohol, I am also interested in researching the effects of drugs such as cocaine. The HHMI award will also benefit my post-college plans of pursuing more independent research opportunities. After graduating from the University of Florida, I plan on obtaining a PhD in Behavioral Neuroscience through a combined Masters/PhD program. During my graduate school years I hope to also mentor high school or undergraduate students and spread interest in the field of neuroscience. After completing my education, I will either look for an assistant professor position or find work as a postdoc so that I can accrue merit and publications to better my chances for a professorship position. I hope to eventually have my own lab and continue to research the undiscovered human brain.

Abstract

Acute effects of vasopressin 1b antagonist SSR149415 on precipitated nicotine withdrawal in rats Ji Y, Alexander J, Bruijnzeel A

Nicotine addiction is defined by the DSM-IV-TR as: a chronic disorder that includes loss of control over smoking, unpleasant withdrawal symptoms, and increased risk for relapse upon smoking cessation (APA, 2000). Tolerance to the effects of nicotine develops rapidly, and quitting rates are usually unsuccessful without intervention via therapy or pharmaceuticals as nicotine users are highly prone to relapse. The key motivator that leads to relapse after spontaneous cessation of smoking is the adverse affective states related to withdrawal. Such symptoms include anxiety, depression, fatigue, and irritation (Rose, 1996). The negative mood state associated with nicotine withdrawal leads to cravings; therefore, reducing or possibly eliminating the intensity of these negative withdrawal symptoms can be a possible target for decreasing chronic nicotine use and addiction.

To combat the anxiety and depressed mood induced by nicotine withdrawal, drug research targets the neuropeptide vasopressin (AVP), a key modulator of the hypothalamic-pituitary-adrenal (HPA) axis, the body’s main response to stress (Frank & Landgraf, 2008). High levels of chronic stress correlate with elevated levels of AVP (Surget & Belzung, 2008). SSR149415, a highly selective antagonist at the vasopressin 1b (V1b) receptor located exclusively in the brain, has been shown to have significant anxiolytic and anti-depressant effects (Griebel et al., 2002). Griebel et al. (2002) observed the effects of SSR149415 on rats placed in various stress-inducing laboratory tests such as the forced swimming test. Results showed that this compound decreased anxiety and increased actions normally blocked by anxiety.

Based on these previous findings, SSR149415 was hypothesized to alleviate the stress and anxiety associated with precipitated nicotine withdrawal. However, data suggests that acute injection of SSR149415 into the lateral ventricles has no significant effect on decreasing the emotional states of withdrawal. More effective results may be obtained with chronic administration of SSR149415 into the brain.

References:

Personal Statement Before Starting Science For Life Award

Personal Statement After Starting Science For Life Award

My experience this summer has been nothing less of enriching, enjoyable, and educational. With help from postdocs, I was able to head my own project and learned about the process of completing an experiment from beginning to end. I was taught standard laboratory procedures such as osmotic mini-pump surgery, how to prepare and dissolve drug compounds, brain staining, and other methods of drug addiction research. From the hours I spent in the lab, I learned that research is a meticulous process that must be regarded with keen eyesight and careful planning. Every little detail counts, and precision is of utmost importance.

In addition, I realized the significance of responsibility and not cruising on autopilot while doing research. One must continually keep his or her mind open and contribute ideas during the process of a study, even if the work is routine procedure. This summer also taught me to be patient about the entire research process. One of the postdocs told me, “Ninety percent of science doesn’t work,” so it is ultimately up to us to find the ten percent that does. While the project I worked on this summer may not have produced positive results, I am still nonetheless very satisfied with the opportunity for the experience and will strive to find ways to “make it happen.”

Being able to work by myself and closely with my professor and postdocs helped me understand what graduate school is all about. Since I plan on applying for a Masters/PhD program after college, I was given a little preview of what I will be encountering in the future. I feel more prepared for taking on a personal project and being handed such responsibility. This experience reassures me that while the research process is not as easy as the scientific method makes it out to be, I am wholly capable of being a well-rounded scientist.
Personal Statement  Before Starting Science For Life Award

When I first started my freshman year at the University of Florida, I decided to try something new and get the most out of my undergraduate experience here. Research was one of the things on my list of things to do. I have always enjoyed science classes in high school; however, the one aspect of research that I was interested in the most was the several projects we did for local science competitions. Through those projects I was able to see how formulas and theories were translated into real, hands-on applications. Now I am a biochemistry major in college, and I try to expand my experience with science beyond the textbook. With my undergraduate research, I have been able to apply what I learn in class to new issues that interest me while simultaneously developing a better understanding of the research process by actively engaging in research with my mentor, Dr. Edward Chan.

I was introduced to Dr. Chan’s laboratory when I was browsing through the Science for Life website. At the interview, Dr. Chan talked about his interest in autoantigens and autoantibodies that are associated with systemic autoimmune disease and cancer. Currently, his lab is working to characterize the mRNA associated protein GW182, which is essential for the regulation of RNA interference. I was intrigued by his description of the profound effects that tiny molecules such as GW182 have on gene expression. I was fascinated to discover how acutely autoantibodies and autoantigens affect the investigation of the molecular and cell biology of macromolecules as well as the prediction of various diseases and cancers. After working in the lab for the past few months, I feel grateful to have a professor who is so enthusiastic about his research. I have been privileged to work with a staff that is also energetic and helpful. My curiosity in the science behind gene regulation has driven me to decide to commit to this project until it is completed—even if it takes the rest of my time here at UF. Because gene regulation is a dynamic field, being a rising sophomore allows me to utilize my next three years to explore and conduct further research in GW182-AGO interactions and miRNA-induced gene silencing. With these next three years, I will be able to optimize my data and experiments and contribute to writing the manuscript. It is my ambition to produce first-author articles in peer-reviewed science publications; this would provide me with the potential to attend national meetings and communicate with professionals in my field of interests.

As both a dedicated daughter and college student, I feel it is my responsibility to share the burdens of my family’s financial difficulties. However, being an international student, I am not permitted to work in the U.S. Receiving the HHMI Undergraduate Research Award will provide me with the peace of mind and security to manage my daily expenses. The scholarship will give me the time to focus on my heavy class load along with preparations for my research and thesis. After working with hands-on experiments, I am now considering a degree in MD/PhD.

My experiences in the lab have opened my eyes to research, and I want to continue doing it as a career. In addition, the scholarship would increase my chances in the competition for the Science for Life extramural research opportunities, which I value as a precious experience for all researchers.

Abstract

Metaplasia of corneal epithelium: role of p68 in β-catenin regulation and corneal epithelial gene expression

Jiang M, Kim YH, Joo JH, Sugrue SP

Nuclear protein Pinin (Pnn) plays a key role in the regulation of corneal epithelio-genesis and maintenance of specific corneal epithelial identity. A good understanding of Pnn’s function is essential for the prevention and treatment of severe ocular disease and maintenance of a healthy ocular surface. Our current project focuses on the functional interaction between Pnn, p68, and Wnt signaling-associated proteins, with a long term goal to discover the role of Pnn and p68 on corneal epithelial metaplasia. In previous studies, we have observed both sustained p68 expression and an increase of Wnt-β-catenin signaling in Pnn-knockout corneal epithelial cells. Local regulation of Wnt-β-catenin-signaling activity is essential for the determination of cell fate within the ocular surface ectoderm. Corneal epithelial cells with forced accumulation of β-catenin demonstrated increased proliferation of corneal epithelial cells. Additionally, our data and previous publications by Yang et al. suggested that Pnn-partner p68 may have a role in the regulation of β-catenin accumulation (2006). In this project, we will explore the exact mechanism by which p68 exerts its influence on Wnt-β-catenin signaling and the subsequent consequence on corneal epithelial metaplasia.

Personal Statement  After Starting Science For Life Award

The Science for Life program has provided me with the opportunity to really get a glimpse into what scientific research is like on a day to day basis. I was able to apply knowledge and methods that I learned in classes into laboratory protocols. I have learned more in-depth knowledge about proteins as well as essential research design skills. In addition to academia learning, I have benefited in other ways from my experience with the Science for Life program. By participating in a research project, I have started to think more creatively, became more independent and proactive in my own education, and realized the importance of asking questions in both learning knowledge and optimizing experiments. This research opportunity taught me to become better at time management when it comes to academics and extracurricular involvements. After understanding the commitment as a researcher, I learned to appreciate the area of research and the ample amount of effort, dedication, and ambition it requires.

Min Jiang
Freshman
Mentor: Dr. Stephen P. Sugrue (Anatomy and Cell Biology)
Correy Jones
Sophomore
Mentor: Dr. David Clark (Environmental Horticulture)

Personal Statement Before Starting Science For Life Award

With the HHMI Undergraduate Research Award, I will be able to incorporate the knowledge that I have obtained from my biotechnology classes. The research training that I have received is something that I would not see until graduate school. Thus, my research training has prepared me for graduate school.

Before I received my project I was a volunteer in Dr. Clark’s lab and I worked many hours in order to receive that highest caliber of research training. I enjoy classes and research because due to my major, a lot of what I learn in my classes relates to techniques used in the laboratory.

My career goal is to work as a geneticist, specifically working in the biotechnology field. The research that I have been working on for the past year has been in molecular genetics, biotechnology and tissue culture. Thus, my research training has prepared me for the rigor of a graduate program. Dr. David Clark’s laboratory has given me great opportunities to achieve my goal in becoming a geneticist because all the work I currently do involves work with genomics. I chose to specialize in tissue culture because I am fascinated by genetic transformations. I am sure that working with Dr. David Clark will guarantee my opportunities in the future in genomics due to his knowledge in molecular genetics, biotechnology and tissue culture.

Through my research I plan to publish information regarding genomic studies that will impact the world of plant biotechnology. This publication will help me obtain opportunities in the biotechnology field.

Abstract

Miraculin, sour to sweet taste-modifying glycoprotein, expressed in tomato and strawberry.

Jones C, Colquhoun TA, Kim JY, Clark DG

Figure 1: Miraculin Vector

Miraculin is a taste-modifying glycoprotein that turns sour tastes into sweet tastes and is natively found in the Miracle Fruit, Richardella dulcifica, in West Africa. To study the function of the miraculin, transgenic tomato and strawberry plants were made to constitutively express miraculin through Agrobacterium tumefaciens-mediated transformation. The mRNA of ripe tomato fruit of the T0 line was analyzed for expression of the miraculin gene, and revealed that miraculin was being expressed in transgenic tomato fruit. Strong expressers were selected and grown for T1 line and are currently being screened for single copy insertion. The transgenic strawberry containing miraculin are currently being screened for miraculin expression in the mRNA.

Reference:
1. Tomomi Matsuyama, Makiko Satoh, Rieko Nakata, Takashi Aoyama, and Hiroyasu Inoue. Functional Expression of Miraculin, a Taste-Modifying Protein in Escherichia Coli

Personal Statement After Starting Science For Life Award

Thinking critically is the major lesson I learned from my summer research experience. My research has revealed that not everything goes to plan and instead of relying heavily on others, I should use critical thought to overcome my problems with my research. By thinking critically, I have become highly successful in all facets of my research. The techniques that I learned during my research have helped with the understanding of my studies in biotechnology and plant molecular and cellular biology. Thus, my experience has affirmed decision for a career in research.

I thoroughly enjoy studying gene function. I find it amazing that I can insert a non-native gene and have it expressed in a plant that normally does not express that gene. My favorite procedure in lab is the isolation of RNA and DNA. Being able to isolate nucleic acids from tissues in a plant is an astonishing and fulfilling procedure.

My trip to Ecuador this summer also reaffirmed my research career. Many of the scientists in Ecuador stressed that lack of research in South American countries. I want to be able to share my research experience with people who have not been exposed to research.
the lab has investigated the neuroprotective roles of multiple RAS peptides in the brain including angiotensin II (Ang II) acting via type 2 receptor (AT2R). Previous work in the Sumners lab has also suggested neuroprotective actions of AVE-0991, a Mas agonist, when administered centrally in stroke. However this has not been studied in detail, nor has the presence of neuroprotection been determined when AVE-0991 is administered peripherally. With these considerations, I chose Dr. Sumners as my research mentor and chose the study of neuroprotection of Mas agonist AVE-0991, when administered both centrally and peripherally, in stroke to base my research project on.

According to my mentor, if my findings suggest that there is conclusive correlation between neuroprotection and AVE-0991 administration in stroke, I will be able to submit them to a peer-reviewed scientific journal for potential publication. Additionally, I hope to be able to present these findings not only at the Undergraduate Research Symposium and the Science Day at the Museum here at the University of Florida, but also at the labs of Dr. Sumners’ collaborators also studying the brain angiotensin system, and national meetings. I also plan to compete for the Science for Life Undergraduate Extramural Award that will allow me to investigate further into my chosen topic at the lab of one of Dr. Sumners’ collaborators. The research could potentially be on determining if other metabolites of Ang II, such as angiotensin III (Ang III) have similar, previously undetermined, neuroprotective mechanisms in stroke.

Abstract
Angiotensin III and cerebroprotection during focal cerebral ischemia
Joseph JP, Mecca AP, O’Connor TE, Sumners C

Unpublished data from our lab suggests that Angiotensin III (Ang III) may have a role in the attenuation of the deleterious effects of ischemic stroke and is therefore a viable target for disease prevention and treatment. We proposed that central administration of Ang III via lateral ventricular cannula would provide cerebroprotection in a rat model of Endothelin-1 (ET-1)-induced middle cerebral artery occlusion (MCAO). Prior to ET-1 induced MCAO, rats were treated with intracerebroventricular Ang III (1μg/h) or artificial Cerebrospinal Fluid (aCSF) for 7 days. Ang III pre-treatment had a trend toward the reduction of both neurological deficits and infarct size measured 72 h after MCAO induction. However, none of these results were significant. Infarct size had a trend toward reduction to 40.67 ± 6.21% (n = 20) of ipsilateral gray matter in the Ang III treated rats compared with 56.00 ± 5.74% (n = 21) in artificial Cerebrospinal Fluid (aCSF) controls.

Figure 1: Neurological deficits showed a trend toward reduction in Ang III treated rats as indicated by a lower Bederson Exam Score of 1.2 ± 0.3 (n = 17) compared to 1.7 ± 0.3 (n = 12) in control rats, a trend toward a higher Garcia Exam Score of 16.0 ± 0.6 (n = 17) compared to 14.7 ± 1.0 (n = 12) in control rats, and a trend in improved sunflower seed eating from 117.9 ± 21.9 s and 18.5 ± 2.1 (n = 10) shell pieces compared to 207.7 ± 35.4 s and 198 ± 3.3 shell pieces (n = 6) in control rats. Although none of these results were significant, there was a clear trend toward the attenuation of the neurological deficits and brain tissue damage produced in an ET-1 induced MCAO model of ischemic stroke in Ang III pre-treated rats.

Personal Statement After Starting the Science for Life Award
Integrating a full time research project into my previously rigorous schedule was certainly a challenge. However, it has truly furthered me in ways that no other extracurricular activity could have achieved during my time as an undergraduate. Balancing my research project with my coursework and other extracurricular activities leaves me with little free time each week, however, it has sharpened my time-management and organizational skills tremendously. Additionally, my research experience has provided me with unparalleled senses of accomplishment, leadership, teamwork, and satisfaction. I have also gained invaluable mentors whose guidance extends far beyond the research setting from which each relationship stemmed.

Engaging in such a full time research project has not only advanced me as an undergraduate student, but as a future physician scientist. As an undergraduate, partaking in such a project has allowed me to learn the material in many of my science courses to a greater depth due to the practical application I am making in the lab. It is to this fact that I can credit my greater performance in the classroom. I have no doubt that this will also apply to standardized tests for medical school admission. Although I had been considering the idea of pursuing an MD/PhD program upon the completion of my undergraduate studies, I had no concrete desire to do so. Since engaging in a meaningful research project in the Sumners lab, I have gained this desire without doubt. With this in mind, the knowledge, techniques, and research methods I have gained from this experience will be invaluablely applied to my PhD research as well as research I plan to carry out in an academic medicine setting.
I knew that I wanted to pursue research from a very small age; at that time my fascination was epitomized by dreams of winning a Nobel Prize. I believe my original interest came from my dad sharing his research with me and telling me what it meant to be published in a journal. As I have grown older, my interest in research has become more realistic and down-to-earth-but that does not mean that I plan to lower the bar. With the help of the HHMI award, I hope to take another step to pursuing significant research in the future.

Immediately when I arrived at UF during Preview, I was thrilled by the presentation of undergraduate research opportunities-specifically the “Science for Life” class. I went on to enroll in the class in both the first and second semesters. After interviewing many distinguished professors, I finally found the one I thought was the best match for me. Dr. Michael Bubb offered very interesting research opportunities, experience in the medical field, and appealing collaborator prospects. I plan to pursue a career in medicine while maintaining a high focus on academic research and the career guidance, interesting research projects, and collaboration with a leading research institute in France was exactly what I was looking for. I am minoring in French and hope to do a semester abroad; this would allow me to successfully integrate coursework with research.

The project I am pursuing has implications with many areas of healthcare including pathologies such as Cancer and AIDS-another reason for my interest. As such, there are many opportunities for publication and presentations of my work. This project will continually captivate me-as it doesn’t end upon completion of my primary research objectives; it will be enduring. I hope the HHMI award will launch my long journey in pursuit of the advancement of scientific and medical research.

### Abstract

**MARCKS’ Role in the Signaling Pathway of TNF-a**

Khalid H, Bubb M

Myristoylated alanine-rich protein kinase C substrate (MARCKS) is a gene composed of 332 amino acids in the human body, and codes for a protein-substrate of protein kinase C. MARCKS is expressed throughout the body-including in the brain, spleen, lungs, pancreas, kidneys, and liver. The pervasive nature of MARCKS coupled with its overall plasticity means that it is relevant in many important processes in the body. I plan to study MARCKS in relation to its interactions with Tumor Necrosis Factor (TNF) and Rheumatoid arthritis. The hypothesis of the proposed research is that if MARCKS is indeed important in the signaling pathway of TNF, then it may be able to play a drastic role in TNF-induced apoptosis.

A proposed idea for the interaction between MARCKS and TNF is that MARCKS may be important for transmitting in the signaling cascade through the actin cytoskeleton. Thus, if the hypothesis is supported, strategies could be determined to activate MARCKS in the affected joints of the Rheumatoid arthritis patients thereby aiding in the treatment of this disorder.

Specifically, MARCKS-deficient cells will be created by small interfering RNA (siRNA) and compared with wild-type cells for apoptosis in response to stimulation to TNF. Using siRNA, knockdown cells can be created by specifically degrading the homologous mRNA (1). Thus, the response to, and interactions between MARCKS and TNF may become much clearer.

### References


Personal Statement

Before

Starting Science for Life

Award

I became involved with Dr. Mandel's lab in the spring semester of my sophomore year and I plan to continue research here for what is remaining of my undergraduate career. Personally, I am fascinated by how the brain functions and I plan to attend medical school and hopefully pursue a career as a neurologist. Alongside practicing medicine, I want to continue research in this field. On top of being a very prestigious scholarship and a financial help, the HHMI intramural research grant will help make my undergraduate research experience more structured, by preparing interim reports, and will hopefully give me a base to share my findings, by participating in the Science Day event and presenting at an Undergraduate Research Forum. Participating in research forums sponsored by HHMI is extremely pertinent to my growth as a scientist since it will give me a chance to learn about other pioneering research in similar areas.

As a way to get exposure in conducting research, I was part of Dr. Dallman’s neurobiology lab in University of Miami this past summer. I had a chance to learn many lab techniques in the first half of the summer and I began working on my own project in the second half. I wanted to continue with research in neuroscience and after exploring Dr. Mandel’s research page, I became very interested and asked for the opportunity to work in his lab. I found it very beneficial to have worked in another lab since it broadened my skill set and knowledge. Therefore, the prospect of working abroad University of Florida through opportunities such as Science for Life extramural research is extremely intriguing.

This spring semester, I am realizing that being actively involved in research alongside taking a full course load and other involvements such as clubs, volunteering, and sports can be quite challenging and time consuming. Nonetheless, I enjoy the challenge and in this past semester, I have been able to successfully balancing these activities. My involvement in Dr. Mandel's research lab requires many hours every week but fortunately my project allows some flexibility. I have learned that I often have to multitask. For example, I usually study while I am waiting for experiments to run its course. I plan on continuing to be energetically involved in research while trying to excel in school and a few other activities.

I have started working on my own project, as outlined in the proposal. According to Dr. Mandel, the project should take a little more than a year but working fulltime during the summer will provide a great headway. Alongside my main project, I am also helping to quantify and image data required for my mentor's project and he has indicated that continued effort on this side project will also merit a co-author position. From previous experience, I know that trying to answer one question invokes many more questions so I plan on picking up another project when the one I am currently working on has concluded.

Abstract

Dopaminergic cell death in the substantia nigra as a result of alpha-synuclein knock-down.

Kundhkar T, Manfredsson F, Mandel R

Parkinson’s disease (PD) is a neurodegenerative movement disorder that has been linked to the reduced activity of dopaminergic cells in the substantia nigra pars compacta (SNc) region of the brain. Over expression of Alpha-synuclein (α-syn), a protein found throughout the central nervous system, has shown to induce the pathogenesis of several neurodegenerative disorders. Inconsistently, α-syn knockout mice have shown no obvious development of PD. Nonetheless, there is evidence of altered dopamine (DA) release, altered DA levels, and changes in DA vesicle number. Alpha-syn is part of Lewy bodies, a protein inclusion found in the brains of most PD patients. Locus duplication or triplications with abnormal over-expression of α-syn and point mutations in the gene have been shown to result in PD like neurodegeneration in humans. Consequently, it has been proposed that decreasing the expression of α-syn might alleviate neurodegenerative symptoms. However, there is evidence of significant death of dopaminergic cells following α-syn reduction in expression, four weeks post injection. Furthermore, shRNA delivered through viral vectors targeting α-syn in the rodent SNc results in significant dopaminergic cell death and resultant motor behavior corresponding to level of α-syn reduction in expression. It is proposed that α-syn is associated with synaptic vesicles, and there is evidence that it regulates the size of the synaptic vesicular pool and is involved in exocytosis or endocytosis of multiple neurotransmitter release pathways. Accordingly, the resultant decrease in α-syn disrupts this process and abnormal handling of dopamine occurs resulting in acute oxidative stress and cell death.

References:
1. Al-Wandi A, Ninkina N, Millership S,

Personal Statement

After

Starting Science for Life

The HHMI Science for Life program has been rewarding, educational, and central to my development as a scientist. Working in Dr. Mandel’s lab over the summer, I have made great advancements on my project, learned and refined many laboratory techniques, and developed an insight into the world of scientific research and the collaborative nature of scientists. My time in the research laboratory complements my coursework as a junior majoring in biochemistry. My coursework teaches me the background behind many laboratory methods and the research setting furthers my understanding. To meet the aims of my project, I became proficient in lab methods such as gel electrophoresis, plasmid construction, immunohistochemistry, stereology, and immunoblotting. From simply pipetting to using software for data analysis, everything I have learned this past summer will help me in my career.

Conducting research can be very time-consuming and frustrating. Through my experience this summer, I have realized that to be a successful scientist, I have to develop endless passion and a problem solving mentality. Personally, I am in search for these qualities but in the meantime, I have a much greater appreciation for scientists. My mentors, Dr. Mandel and Dr. Fredric Manfredsson, emphasize that I work independently to develop these characteristics.

I am very grateful to the HHMI program for encouraging undergraduate research and involvement in the program has truly enriched my research experience.
Jonathan Kubik  
Senior  
*Mentor:* Dr. Alan R. Katritzky, (Chemistry)

**Personal Statement Before Starting Science for Life Award**

As a chemistry major and pre-medical student at the University of Florida, I feel that the HHMI Undergraduate Research Award gives me experience in the field of Organic Chemistry and Life Science in general that I would not be able to find elsewhere. The opportunity to work in a lab researching peptide synthesis will give interesting insight into the biological processes that I will see should I choose to enter the medical field. More importantly, this program will allow me to decide if I truly want to enter the medical field or start research in the pure sciences by entering graduate school to earn a masters in chemistry. I could also combine these two and enter the field of biomedical research after either medical school or graduate school.

I discovered this program through my organic chemistry laboratory class. After a month of laboratory exercises in the class, I developed an interest in the research field. I asked my TA in the class if she had any available research opportunities for undergraduates in her research lab. She has a spot available, and while we were discussing the plans for next semester, we discovered this program. Instead of simply helping out with her research, I would be able to conduct my own research plan to potentially be submitted in a scientific journal or presented at chemistry seminars, which is an incredible opportunity. She introduced me to my mentor for this program, and will also be assisting me in the lab.

**Abstract**

**Efficient Syntheses of Thiadiazole Peptides**  
Katritzky AR, El-Nachef C, Bajaj K, Kubik J, Haase DN

My research focused on the synthesis of novel thiadiazole peptides. Previous research had showed that these 1,3,4 thiadiazoles have various potential applications, such as antimicrobial, anticancer, and anti-HIV. The currently used method of synthesis, however, involves harsh conditions, and thus correspondingly low yields and is unable to retain chirally pure molecules. Our research planned to explore a novel method of synthesis using cheap and readily available amino acid starting materials and performing the reactions under microwave radiations. By this method, yields were improved to 50-70%.

**Personal Statement After Starting Science for Life Award**

This research has been an invaluable part of my college experience. Not only has it allowed me to learn the techniques necessary to be able to perform research at the collegiate level, but it also has given me the opportunity to explore other options besides my original plans for college and beyond. In regard to the research experience, I was able to learn many valuable techniques. My lab has access to its own HPLC and NMR machines, and after training I was able to use these machines completely independently of my mentor. I also had experience performing various types of organic chemistry reactions, also without the need for supervision. This research has also allowed me to see how it could have potential for me as a career. Although I still believe that my current track for pre-med is my best option, I could easily see myself performing research such as this if for some reason medicine does not work out. There is also the possibility of combining the two and performing some form of biomedical research after either medical school or graduate school.
I believe that my participation in the Science for Life HHMI Undergraduate Research Program will greatly enhance my understanding of science and the field of research. It will open a door to many great opportunities beyond what I can gain from my biochemistry undergraduate degree. With my strong passion and intellectual aspiration, I hope to contribute to the scientific field a deeper understanding of the science around us and within us. I hope to learn the constantly improving knowledge and continuously advancing techniques in the field of science and to use that knowledge to apply to my career and to contribute to the scientific community.

My passion for science is my greatest motivation to pursue an experience and a career in research. I am always inspired when I learn about DNAs, RNAs, and proteins since I knew about their important role in every living organism. Many synthesizing processes such as transcription and translation intrigue me and the details of these processes on the molecular level amaze me. I believe by deeply understanding this field of science, many of the diseases that humans suffer today such as cancer can be prevented, diagnosed early, and possibly cured. I’m glad that I found a mentor, Dr. Chan, who is working in my area of interest. I kindly contacted him after I read about his research focus on the University of Florida dental research website. After my visit to his lab, I learned that his research has the potential and the futuristic approach to treat autoimmune diseases such as cancer, systemic lupus erythematosus and arthritis. By enhancing our knowledge of miRNAs and RNA interferences, replacement therapy for diagnosis and treatment of these autoimmune diseases can be made possible which will save many lives and increase our overall quality of living.

I plan to work in Dr. Chan’s research lab this summer and the upcoming two years, and hope to acquire more science knowledge through working on my project. I hope to attend a professional school and possibly earn a research-oriented PhD. I hope to continue to excel in various areas including research in the near future. As a highly motivated and passionate person, intellectual challenge will push me to become the best of who I am.

I believe this research will bring me countless professional development experience which includes presenting my research findings to knowledgeable professionals who are experts in the field, participating in regional and national meetings such as the Undergraduate Research Forum and many professional conferences that become available to me, writing as a co-author on a peer-reviewed scientific publication such as in the field of miRNA which I hope to become an expert in, and possibly joining HHMI Extramural Research Award Program and Provost Scholar Program. The opportunities that the HHMI Undergraduate Research Program provide are endless. Researching in the field of interest will further my undergraduate studies and provide me a hand-on laboratory understanding of the science that I learned from textbooks. Within this research, I can see how science comes to life and the futuristic screenings and treatments for autoimmune diseases.

Abstract

The role of GW motifs in the functioning of GW182 protein in miRNA-induced translational repression

La L, Chan EKL, Yao B

miRNAs (miRNAs) are 21-nucleotide-long RNAs that regulate gene expression in many living organisms (1). At least a thousand miRNAs are predicted to play an important role in regulating gene expression in humans. MiRNAs are transcribed extensively from their encoded genes and further incorporated into the RNA-induced silencing complex (RISC) in the cytoplasm. Based on the sequence complimentarily, miRNA guides the RISC complex to the target miRNAs to affect translational repression or RNA degradation (2). The Argonaute protein family, a highly conserved key component of the RISC complex (3), is represented by four proteins (Ago1-Ago4) in mammals, and is involved in miRNA-mediated translational repression.

GW182 was first identified and characterized by Professor Chan’s laboratory in 2002 as a novel protein recognized by an autoimmune serum from a patient with motor and sensory neuropathy (4). It is an 182 kDa protein characterized by multiple glycine (G) and tryptophan (W) motifs and is an essential component of GW bodies (also known as mammalian processing bodies, or P bodies), since knockdown of this protein leads to the disassembly of these cytoplasmic foci (5). To date, GW182 is known to play a critical role in the repression of translation of the miRNA-targeted miRNAs (4-8). Two non-overlapping regions, the middle region Δ12 (aa1219-1239) and the C-terminal region Δ5 (aa1670-1962) were demonstrated to induce silencing in a tethering reporter assay. Transcript of Δ12, but not Δ5, released miRNA reporter repression regulated by endogenous miRNA. Alanine substitution showed that GW/GW motifs in Δ12a (aa896-1045) were important for repression activity and endogenous miRNA function.

To further fine map the functional significance of GW/GW repeat in Δ12a region, individual mutations from GW/GW to AA will be generated to evaluate their specific role in silencing tethered reporter or interfering endogenous miRNA function. To achieve this goal, mutagenesis will be performed, confirmed by direct sequencing and analyzed in i) luciferase reporter tethering assay for the effect on repression activity and ii) “20 bulge” reporter miRNA interfering assay. References:


Personal Statement Before Starting Science For Life Award

I plan to work in Dr. Chan’s research lab this summer and I fully enjoyed it. With research, I could manage to balance my time well to achieve success academically with extracurricular activities on the side. In the near future, I hope to participate in the DMD-PhD combined degree program to continue pursuing my research interest as well as obtaining a dental degree.

Personal Statement After Starting Science for Life Award

Participating in the HHMI science for life intramural research program is an invaluable experience that allows me to grow both academically and intellectually. I’m learning a vast amount of scientific knowledge that possibly opens up a new direction for my future career. Most important of all, I’m participating in the ongoing scientific findings that help make a difference in people’s life. To me, science is interesting and intriguing. Thus, participating in research brings it to another level which I want to be a part of, learning and contributing. It is within the research laboratory where I see my scientific knowledge from textbooks and lecture halls comes to life. Being able to make the connection and apply the knowledge increases my critical thinking ability, creativity as well as memorization of established facts and details.

Aside from the academic and intellectual side, participating in research also challenged my physical ability. I became much more proficient at minute hand and eye coordination and muscle’s endurance from techniques as simple as pipetting, which personally will benefit my future dental career. Aside from that, I become more careful and competent at staying well focused on my work because I know a small error can cost as little as a week of time and efforts.

Participating in research was the highlight of my summer and I fully enjoyed it. With research, I could manage to balance my time well to achieve success academically with extracurricular activities on the side. In the near future, I hope to participate in the DMD-PhD combined degree program to continue pursuing my research interest as well as obtaining a dental degree.
I chose Dr. Kleim as my research mentor after hearing him speak at the first Neuroscience Club meeting of the Fall semester. He explained his work with stroke patients and Parkinson’s disease and how it relates to neural plasticity. This seemed incredibly fascinating to me so I approached him after the talk asking if there were any positions for undergraduate students at his lab. He said there was one spot, and agreed to meet with me later that week. After touring the lab and hearing more about the current projects going on in the lab, I knew this lab was for me. Dr. Kleim offered me the undergraduate research position and I gladly accepted.

I choose this project because brain plasticity in response to disease has always really interested me and also because Parkinson’s disease is something that is close to home for me. During high school I created my own community service project that took place in a senior citizen home. I ended up growing very attached to many of the residents and Parkinson’s disease and how it relates to neural plasticity. This seemed incredibly fascinating to me so I approached him after the talk asking if there were any positions for undergraduate students at his lab. He said there was one spot, and agreed to meet with me later that week. After touring the lab and hearing more about the current projects going on in the lab, I knew this lab was for me. Dr. Kleim offered me the undergraduate research position and I gladly accepted.

I choose this project because brain plasticity in response to disease has always really interested me and also because Parkinson’s disease is something that is close to home for me. During high school I created my own community service project that took place in a senior citizen home. I ended up growing very attached to many of the residents and Parkinson’s disease and how it relates to neural plasticity. This seemed incredibly fascinating to me so I approached him after the talk asking if there were any positions for undergraduate students at his lab. He said there was one spot, and agreed to meet with me later that week. After touring the lab and hearing more about the current projects going on in the lab, I knew this lab was for me. Dr. Kleim offered me the undergraduate research position and I gladly accepted.

I choose this project because brain plasticity in response to disease has always really interested me and also because Parkinson’s disease is something that is close to home for me. During high school I created my own community service project that took place in a senior citizen home. I ended up growing very attached to many of the residents and Parkinson’s disease and how it relates to neural plasticity. This seemed incredibly fascinating to me so I approached him after the talk asking if there were any positions for undergraduate students at his lab. He said there was one spot, and agreed to meet with me later that week. After touring the lab and hearing more about the current projects going on in the lab, I knew this lab was for me. Dr. Kleim offered me the undergraduate research position and I gladly accepted.

I choose this project because brain plasticity in response to disease has always really interested me and also because Parkinson’s disease is something that is close to home for me. During high school I created my own community service project that took place in a senior citizen home. I ended up growing very attached to many of the residents and Parkinson’s disease and how it relates to neural plasticity. This seemed incredibly fascinating to me so I approached him after the talk asking if there were any positions for undergraduate students at his lab. He said there was one spot, and agreed to meet with me later that week. After touring the lab and hearing more about the current projects going on in the lab, I knew this lab was for me. Dr. Kleim offered me the undergraduate research position and I gladly accepted.
I was first introduced to Dr. Art Edison through the IDH 3931 Science for Life course my spring semester of 2009. He gave a brief overview to the class about the goings on of his lab, but when I scheduled an appointment with him, he gave me a more in depth description of just what his laboratory is focused on. I enjoyed the biochemical aspect of pheromone determination of nematodes, and after mulling over the opportunity, I decided that his lab was the best fit for me. I have been a part of the Edison Lab for a year now helping other students with their projects, and am well trained in worm maintenance. I will apply this prior knowledge to my current project when handed my own group to study.

Last semester, I enrolled for 3 BMS 4905 Medical Science Senior Research, and this semester, I am enrolled for 5. I set aside 15-20 hours a week to work in the Edison lab on various projects. My time at lab is mainly spent on general C. elegans maintenance –making buffer solutions, growing bacteria, forming agar plates, synchronizing worm growth, and assisting other laboratory members. With this experience, I will be able to smoothly transition to maintaining a population of nematodes for my research.

I aim to finish my project hopefully by summer’s end, but latest about midway through the Fall 2010 semester. Once my project is complete, I will co-author a scientific publication, detailing how my research panned out with the help of Dr. Edison. Optimistically, I hope to spend a semester with Dr. Edison’s collaborator Paul Sternberg at Caltech to gain another perspective of nematode research. This would be an excellent study abroad experience that would address my cultural, academic, and research interests. After this, I return to the Edison lab and will likely continue in nematode pheromone research, which I can hopefully complete before my graduation date so I can co-author another article with Edison. After undergraduate school, my goal is to spend a year working in an international research facility before enrolling as a dental student, preferably back at UF with its many research opportunities.

**Personal Statement Before Starting Science For Life Award**

Winning the HHMI scholarship has made a big impact on my life. It has deepened my understanding of what experimentation entails. Now I know that even the best of projects generally can’t be completed in 3 months time, and that one needs both time and dedication to successfully complete a project. During the summer, I had 40 hrs/wk to dedicate solely to my project, but now I need to manage my time wisely to balance both my academic obligations and work towards my first publication. I feel that my experience this summer will open many doors for me. I plan on applying for various scholarships to achieve my goal of attending Caltech for the spring and summer semesters to research with Paul Sternberg. I’m forever grateful of this opportunity, and am still continuing my research at the Edison Lab until I at least complete my first publication.

**Personal Statement After Starting Science For Life Award**

On-going research as to how ascarosides affect egg-laying behavior in Caenorhabditis elegans Lassegue C, Ajredini R, Nimalandran R, Edison AS

Caenorhabditis elegans is a transparent nematode, about one millimeter in length, which lives in temperate soil environment. Research into the molecular and developmental biology of C. elegans began in 1974 and since then, they continue to be studied as a model organism. C. elegans is one of the simplest eukaryotic organisms with a nervous system, so it can be studied to great detail (Butcher). Egg-laying research now focuses on how the worm controls the timing of the egg-laying events. Environmental and homeostatic cues are now being explored to see how the nematodes’ egg-laying habits are affected (Schafer). My research aims to answer if ascarosides, pheromones that control multiple behaviors of C. elegans, affect egg-laying behavior in adult c. elegans (Edison, et al 2009). Right now background research on how well the positive, negative, and neutral controls affect egg-laying is being conducted. Synchronized C. elegans (N2 Bristol) were placed on plates containing a thin film of e. coli (OP50) until the desired state of adulthood. Once they reached adulthood, they were individually placed in 96 well plates to study the effects of water, the neutral control, m9 buffer, the negative control, and varying concentrations of serotonin, the positive control. As of yet, no conclusive results have been obtained because the experiment is still undergoing its data collection phase.

**Abstract**

On-going research as to how ascarosides affect egg-laying behavior in Caenorhabditis elegans Lassegue C, Ajredini R, Nimalandran R, Edison AS

Caenorhabditis elegans is a transparent nematode, about one millimeter in length, which lives in temperate soil environment. Research into the molecular and developmental biology of C. elegans began in 1974 and since then, they continue to be studied as a model organism. C. elegans is one of the simplest eukaryotic organisms with a nervous system, so it can be studied to great detail (Butcher). Egg-laying research now focuses on how the worm controls the timing of the egg-laying events. Environmental and homeostatic cues are now being explored to see how the nematodes’ egg-laying habits are affected (Schafer). My research aims to answer if ascarosides, pheromones that control multiple behaviors of C. elegans, affect egg-laying behavior in adult c. elegans (Edison, et al 2009). Right now background research on how well the positive, negative, and neutral controls affect egg-laying is being conducted. Synchronized C. elegans (N2 Bristol) were placed on plates containing a thin film of e. coli (OP50) until the desired state of adulthood. Once they reached adulthood, they were individually placed in 96 well plates to study the effects of water, the neutral control, m9 buffer, the negative control, and varying concentrations of serotonin, the positive control. As of yet, no conclusive results have been obtained because the experiment is still undergoing its data collection phase.
Kristin Magrini
Sophomore
Mentor: Dr. David Reed, (Natural History)

Personal Statement Before Starting Science for Life Award

As I press though college, I have to face a subject head on that I had been avoiding as long as I can remember. Answering the question, “What should I do with my life?” even as a child seemed so far ahead and so final that it intimidated me. The suggestion that one can spend an entire lifetime searching for their calling and never find it is very unsettling. I have always enjoyed learning and participated in everything in school, but was never able to choose a favorite subject. I also did not feel exceptionally talented in any specific field. Although being mediocre in many of one’s efforts may not seem like an ideal for a future professional, I feel that this is a trait that forces an individual to work that much harder to succeed. I realized I had to utilize my enthusiasm and put forth all of my effort to achieve goals that some may accomplish on natural talent.

In college, I began by taking a variety of classes in hopes of moving in a direction. I found I am most interested in my science classes and wanted to find any opportunity to get more involved. In my first semester, I enrolled in the Science for Life class and met Professor David Reed. He explained all of the opportunities there are in working in research and soon offered me an undergraduate researcher position. I was immediately drawn to the lab because everyone I met was very passionate about his or her field and eager to share their own experiences. The lab is a molecular biology lab focusing on mammals and located in the Museum of Natural History and therefore is very diverse allowing me to be exposed to many different areas of research. Furthermore, the lab appeals to my love of animals and allows me for me to explore my interest in both biology and chemistry.

I volunteered at Reed Lab the summer after my freshman year while I took ten credits and worked twenty hours a week at a local tutoring company. Managing the workload that summer taught me how to efficiently organize my time to reach my goals. During my sophomore year, I continued researching in Reed Lab, working at the tutoring company to improve my teaching skills, and taking a rigorous course schedule. In my studies, I found myself very interested in molecular processes in the body and have been thinking about careers in medical research. In the lab I was encouraged to ask questions and think about putting together my own project to learn the entire process of a research study. After talking with Dr. Reed, we began to discuss a study focusing on genetic structure of an endemic bat species that would also allow me to gain field experience. My aim is to one day finish both an M.D. and a PhD program and work as a medical researcher and professor. I anticipate being able to use these skills for the rest of my undergraduate career and beyond.

This summer, I plan on only taking three credits so I may work full-time in Reed Lab. I understand the huge commitment a research project entails after speaking with many graduate students, but I am excited at the prospects of my own research. This research study will allow me to be the first author on a peer-reviewed publication and gain molecular lab and fieldwork experience in the Caribbean. There are opportunities for future research projects on the bats as well, such as dietary analysis or studies of social behavior. My aim is to have a publication in the journal Molecular Ecology and present the results at the yearly North American Symposium for Bat Research. I also hope to compete for the HHMI extramural program next year. The biological and medical fields are always growing and there is an infinite amount to learn. There are challenges every day, but with the challenges also come opportunities to discover more and help people. I feel that research is an area where being compassionate, curious and having integrity can truly make a difference every day.

Abstract

Multilocus phylogeography of Mexican free-tailed bats (Tadarida brasiliensis) on the Bahamian archipelago

Magrini KC, Soto-Centeno JA, Reed DL

The Bahamas are interesting biogeographically because of the natural boundaries that exist between islands. In the past, there have been few documented instances of flora or fauna having gene flow between the mainland of the United States and the Bahamas. Bats are the only native mammals inhabiting many West Indian islands and can disperse over sizable distances, which creates an exceptional case for examining species diversification and dispersal. Despite flight capabilities of bats, has been proposed that ocean barriers make migration between islands unlikely in bats and that populations on different islands were likely distinct due to a lack of gene flow between islands. Therefore, one can predict that bats of the West Indies would contain high levels of genetic structure (populations in each island are genetically more closely related to themselves than they are to populations in other islands). We have assessed genetic differentiation, dispersal and migration, and population structure using a multigene approach in the Mexican free-tailed bat (Tadarida brasiliensis mexicana). Currently, we have found significant insertions of nucleotide sequences in the Bahamian bats compared to mainland bats although the island bats likely diverged more recently than those on the mainland. Furthermore, without the insertions that the Bahamian bats have, the mainland bats appear to be more genetically diverse than the Bahamian bats.

References:


Personal Statement After Starting Science for Life Award

Participating in the HHMI Science for Life program has quickly become the pinnacle experience in my undergraduate career. I knew taking on my own project would be a huge endeavor, but I never knew how tied to one becomes to their work. I have gained countless research skill and have learned techniques to trouble-shoot many different situations. However, I feel that the greatest ability I have acquired is independent problem solving. Although the mentors of Reed Lab were always knowledgeable and supportive, they always encouraged independent thinking and curiosity.

My time in Reed Lab has been extremely beneficial in encouraging me to take the initiative to forward my endeavors and applying the skills I have learned to practical scientific work. Working in a lab moves a student beyond studying and test taking into specialized talents to solve scientific problems. Furthermore, I see myself acting on problems in the lab and in my everyday life instead of being a bystander. I still aim to one day finish both an M.D. and a PhD program and work as a medical researcher and professor. I anticipate being able to use the skills I am building now for the rest of my undergraduate career and beyond. In the short-term, I plan to use my research to be the first author on a peer-reviewed publication and travel to the Bahamas to gain fieldwork experience. I hope to use my research to complete an honors thesis and present the results at the yearly North American Symposium for Bat Research.
Many underestimate the power of the human voice. Be it singing, speaking, or advocating, indeed a great amount can be accomplished (or reversed) with a strong set of well-trained and well-used vocal chords. As a volunteer Disk Jockey on WUFT-FM, Speech & Debate team competitor, and campus leader, I take great pride in my ability to use my voice for good. Most importantly, I try to use it to teach.

I have long said that while my main interest is science, my true passion is education. It is for this reason that I was immediately drawn to becoming involved in the work of Dr. Troy Sadler, researching the implications of alternative methods and models of science education. “A way to combine my two greatest loves, the two things in which I believe most strongly?” I asked. It seemed too good to be true. I myself grew a tremendous amount from having a rich background in critical thinking and logic (the basic tenants of science), thanks in major part to my parents and teachers. I want to ensure that others, especially those of lesser means, are afforded the same—regardless of what they or their associates think about the value of a good science education.

It would mean a great deal to me to achieve publication as a first author in a peer reviewed research journal before leaving UF. Dr. Sadler and I have discussed this and he understands my aspirations. Essentially, though he would guide and advise me throughout the process, Dr. Sadler would have me take primary authorship on all publications. From my study, which will number at least one, I would shoulder the responsibilities and obligations associated with first authorship. This process could take at least one year and as long as several years. For the time being, I am already on my way to a three-level authorship sometime in the next year on a nonexistent project of Dr. Sadler’s. It is a dream of mine to perform research abroad. I plan to apply for HHMI Science for Life Extramural awards and have also made my research abroad desires clear to Dr. Sadler who has confirmed this as a possibility. I also would love to take the results of my work to conferences such as the National Association of Research in Science Teaching (NARST) or the Association for Science Teacher Association (ASTE). My primary major of Industrial and Systems Engineering should take me 9 main-sequence semesters to complete, affording me the leeway to spend one semester in between or afterward pursuing these activities and goals.

Though my long-term career plans are still rather fluid, I feel that my life will always involve a passion for teaching and learning. The opportunity to perform research work in this area so close to my heart will undoubtedly help me form a solid foundation upon which to base my career goals. Inevitably, whether I make it my profession or not, I will forever advocate for and make it my mission to improve the state of science education globally.

I think that the uniqueness of my proposed project could help bring a new light to the Science for Life initiative, the root purpose of which is to engage students in further study and pursuit of the life sciences. The goal of my research and the HHMI initiative are one and the same. I feel that all are deserving of a quality scientific education, and that if exposed to it in the correct light, they may truly enjoy it in a way which they never thought possible.

Abstract

Professional Development at the Cutting-Edge of Science: Teacher Experiences and Perspectives on Biotechnology Education

Mann J, Sadler TD

This study is focused on teachers’ experiences and perspectives associated with a professional development seminar focused on biotechnology. Teachers were observed and interviewed during a two-week professional development held at a major research university. The seminar focused on biotechnology and practices for incorporating biotechnology techniques into classroom instruction. Data from observational field notes were analyzed with an inductive approach consistent with naturalistic inquiry (Lincoln & Guba, 1985) and the Constant Comparative Method (Strauss & Corbin, 1998). Findings are categorized according to two main experiential parameters: 1) teachers’ perceived limitations on their ability to incorporate material covered in the PD upon returning to their classes and 2) the teachers’ expected or desired outcomes from their participation in the PD. Teachers attend PD experiences for myriad reasons, with various expectations of how doing so will improve their teaching. Also, participants have many concerns about what may inhibit their attempts to incorporate PD material into their classes. The results of our study shed light on possible amendments to PD design and enactment to improve effectiveness and aid in the incorporation of emergent fields such as biotechnology, which are of great importance in industry and medicine, into secondary science instruction.

References:

Personal Statement

Before Starting Science for Life Award

It is a dream of mine to perform research abroad. My experience in research this summer has been unique and unmatched in terms of impact on my way of thinking and career outlook. I still wish to pursue a path of engineering, and may not become a full-time researcher (or teacher) right away, but these are two paths that I am now very much interested in exploring at some stage in my life. This time that I have spent engaged in independent, novel research has also helped me develop important life skills that will certainly be invaluable regardless of what path I choose to take in life. These include, among others, initiative, time management, personal responsibility, and resourcefulness. I will undoubtedly have many interesting summers in my life, but the time that I was afforded to complete my research will certainly be unmatched in impact.

Additionally, I am completing an internship with the Walt Disney Company this Fall, and I feel that this would not have been possible without Science for Life. Both the individualistic skills that I attained as a result of completing my research and the credibility that participating in the program has granted me are assuredly factors in my success. I will continue to represent the HHMI and Science for Life positively in my future endeavors.
Ever since reading about the accomplishments of Gerhard Domagk, Howard Florey, and Ernst Chain, Nobel laureates who pioneered the field of antibiotic synthesis, the prospect of rational drug design has intrigued me. It is with this passion that I plan on ultimately obtaining my Ph.D. in organic synthesis, and, afterward, developing novel therapeutics and antimicrobial compounds at a pharmaceutical company.

With the knowledge that I wanted to pursue chemistry at the graduate level, I began searching, during my freshman year, for an organic research position. Initially, I discovered Dr. Ronald Castellano’s research through the HHMI Undergraduate Research Database. The Castellano group’s focus on employing organic synthesis to exploit supramolecular interactions in molecular self-assembly fit my academic and career interests. Nature employs these interactions in protein self-assembly and enzyme-substrate binding; thus, by learning how to manipulate these interactions, I could gain valuable insights into protein interactions and perhaps include this in future development of therapeutic compounds. After meeting Dr. Castellano and experiencing his enthusiasm for the subject, I decided to join his lab in the fall semester of my sophomore year.

The HHMI Undergraduate Research Award would fit well into my academic plans since it would be helpful with not only affording the graduate level courses I plan on enrolling in, but also would aid me in competing for national scholarships such as National Science Foundation awards. Additionally, the activities involved with the award will be invaluable to my development as a scientist. I will be able to practice presenting scientific data to individuals in other scientific disciplines and to the interested lay community, which is a significant aspect of scientific research. Another activity involved with the HHMI Award that would be a valuable learning experience is the preparation of the report for potential publication. While I had already planned on pursuing these activities, the HHMI provides an excellent program for practicing and refining my oral and writing skills.

**Abstract**

1-Aza-Adamantanetrione Derivatives from a Versatile Benzotrifuranone Intermediate

Marth C, Baker M, Castellano R

Donor-σ-acceptor frameworks have only recently been explored as molecular scaffolds for the design of supramolecular architectures. 1-Aza-Adamantanetriones contain model donor-σ-acceptor motifs with the nitrogen lone pair interacting through the σ-network with the three carbonyl groups, imparting a significant dipole and enhancing the shape persistence of the molecule (Figure 1). This study explores the versatility and functional group tolerance of the new methodology for synthesizing AATs by first ring-opening the three lactone rings of the versatile intermediate Benzotrifuranone 2 with electron-rich and electron-poor anilines, primary and secondary amines, and amines with synthetic handles. The resulting phloroglucinol derivatives underwent a subsequent Mannichtype cyclization with hexamethylenetetramine to afford a library of AATs in moderate yield with minimal purification required. Future efforts will focus on studying the effect of the peripheral functionalities on the electronics of the core, and post-cyclization functionalization of the AAT molecules.
Angela McCall  
Sophomore  
Mentor: Dr. Mavis Agbandje-McKenna, (Biochemistry)

Personal Statement Before Starting Science For Life Award

From a passion which developed in high school, I would like to have a career in research, be it in academia or a private institution. I have already been working with a research mentor for about three years now. With the HHMI Undergraduate Research Award, I will be able to continue my training in research in a more rigorous manner. My expectations are to work for my mentor for the remainder of my undergraduate education years and then pursue a Doctorate degree upon graduating. This award could also lead to the opportunity to meet students in other research areas, which are related to my studies or future studies.

I first met Dr. Agbandje-McKenna when I was assigned to her lab during my participation in the University of Florida’s Student Science Training Program (SSTP). I kept in contact with her throughout my senior year of high school, and when I was accepted to UF she invited me back into her lab.

I have been fully committed to doing research since my freshman year at UF. I have taken research for credit every semester while taking fifteen credit academic loads and participating in extracurricular organizations. I fully intend to keep this commitment for the next few years.

In order to co-author a peer-reviewed scientific publication, a significant contribution is required. I have already accomplished this as a student in the lab due to the work that I did on AAV9 as a high school student participating in the SSTP. As a HHMI scholar, my goal is to continue to achieve research success.

Abstract

Characterization of the Adeno-associated virus 8 receptor binding interaction  
McCall A, Ng R, McKenna MA

Adeno-Associated Viruses (AAVs) have the ability to package foreign DNA, a low toxicity, and serotype diversity that makes them ideal for gene therapy applications. Each serotype has unique cell binding properties and specific cell transduction efficiencies. Of the AAV serotypes, AAV8, has a particular affinity for liver cells (Gao, et al., 2002). As such, it has shown promise in gene therapy of liver-associated diseases. As these discoveries emerge it is critical to understand the viral capsids along with how and where on the capsid they bind to tissues.

This project explores the many methods used to determine the nature of these receptors and their interaction site(s) on the AAV8 capsid. The methods include using results from glycan arrays, and low salt crystal condition to co-crystallize the virus and sugar, in order to collect and analyze data by X-ray diffraction. Thus far, several glycan arrays have been performed, but the results are not strong and definitive. The co-crystallization method is also being used with a peptide that was found by a collaborative lab to bind to AAV8, in preliminary studies. Data has been collected on crystals produced in this manner, but the peptide is not being seen. It is for this reason that western dot blot analysis was performed in order to confirm peptide-virus binding. A positive signal was seen for low concentration of peptide. Next, negative stain electron microscopy (EM) samples were prepared with AAV8 alone, AAV8 with peptide, and each with or without DTT, for preliminary studies to see if 3-D reconstruction of cryo-EM data would identify viral receptor sites. Co-immuno-precipitation methods are being utilized to isolate cellular proteins that bind to AAV8. Another method used which will yield similar results is virus overlay protein binding assay (VOPBA). The results from this study will facilitate the improvement of gene delivery virus vector for the utilization of specific cell targeting.

References:

Personal Statement After Starting Science For Life Award

Throughout the summer, my passion for medical research was heightened. Prior to these months I was falling into a mundane cadence, but I wasn’t getting anywhere nor did I have the time learn tedious new techniques. The past few months allowed me to completely reverse this because I was in the lab so many hours a day for consecutive days I had the opportunity to perform many long processes. Also I learned a myriad of new methods used throughout the lab for my project as well as for the graduate student I work with, Robert’s project. Another great opportunity I was given by working in the lab over a summer was to mentor several high school students who also spent a large part of the summer in the lab. This included assisting them in researching each of their individual projects, purifying AAVs, and executing the preliminary steps of the project. I am without a doubt elated that I chose to enter this program, and continue my research in a strong fashion. It also could not have come at a better time to help boost me through my last two years as an undergraduate.

In my other extracurricular activities, I recently began serving as the Historian on the Executive Board of Phi Sigma Pi, National Honor Fraternity. As an active member of this organization I practice the ideals of scholarship, leadership, and fellowship.
Spinal cord injury is one of the most complex and most debilitating injuries that the body can sustain. The complexity and clinical significance of treating spinal cord injury is what draws my attention to it. I chose Dr. Paul Reier as my research mentor because of his vast knowledge and background in spinal cord injury and repair studies and what his current work in his lab is focusing on, especially spinal cord transplants. Dr. Reier’s previous work with transplants is what inspired me to design my current project using embryonic spinal tissue as a transplant. If I obtain successful results and data from the proposed research, I would extend my findings to other types of transplants as well as other possible candidates for elevating cAMP levels in the spinal cord besides rolipram through more experiments. I plan to publish an article depending on the results of my research experiments to highlight the significant findings.

I am currently in my fourth year of studying Biological Engineering and will remain in undergraduate studies for another year after which I will apply to graduate school for Biomedical Engineering. I hope to remain at the University of Florida and if so, to continue my research studies in Dr. Reier’s lab studying spinal cord injury and repair for the length that I remain here building upon the research that I am beginning now. I currently spend my available daytime in Dr. Reier’s lab when I am not in classes and spend my nights in the library, mostly working on coursework demands. With time management, it has been simple to maintain enough time for both activities. I have spent about 15-20 hours a week in the lab on a typical week during this past spring semester and plan to spend as much time as possible in the lab over the entire summer semester.

This research opportunity will greatly benefit me because of the independent lab experience I will obtain. I hope to remain in biomedical research after I complete my formal education and find this as a very good research project to begin my experiences. I am looking forward to learning the techniques of working with live research animals and survival surgeries. Additionally, the knowledge of animal behavioral testing and immunocytochemistry procedures as well as getting comfortable with the demands of successfully undertaking a research proposal will be beneficial for my future in this field.

Abstract

Rolipram and its effects on neuroplasticity following spinal cord injury in the adult rat
Mercier LM, Reier PJ, Lane MA

Spinal cord injury (SCI) causes loss of motor function at and below the level of the injury. Loss of respiratory function can occur if the injury is in the cervical region, where more than half of SCIs occur. The phrenic motoneurons (PhMNs), located between C3-C6 in rats, innervate the diaphragm via the phrenic nerves. A hemisection lesion at C2 (above the PhMN pool) disrupts descending bulbospinal axons which normally innervate the PhMN pool, resulting in paralysis in the diaphragm ipsilateral to the injury. Regeneration of axons in the CNS is inhibited by the proteins Nogo, myelin-associated glycoprotein (MAG) and oligodendrocyte myelin glycoprotein (OMgp), associated with CNS myelin. Increased cAMP levels can overcome the inhibitory affects of these proteins and promote axonal growth and repair. Levels of cAMP can be increased by inhibiting phosphodiesterase (PDE), the enzyme responsible for degrading cAMP and reducing cAMP levels in the injured spinal cord. Rolipram is a specific inhibitor of the subfamily PDE4, the main source of phosphodiesterase activity in the CNS. Treatment with rolipram has shown to overcome inhibition and produce axonal regeneration and has clinical significance because it crosses the blood-brain barrier and therefore can be administered subcutaneously (s.c.). In addition, research in our laboratory has revealed potential anatomical and functional benefits for transplantation of embryonic spinal tissue after SCI. This tissue is rich in neuronal precursors and has been shown to assist in repairing the injured spinal cord. The goal of this research is to test the effects of combination therapy with rolipram administration and cell transplantation after a C2 hemisection. The rolipram is to be administered via osmotic mini-pumps implanted during the time of injury to the experimental group of rats. Tissue for transplantation will be placed into the injured spinal cord immediately post-injury.

As injury in the cervical cord will affect both forelimb function and respiration, the effectiveness of treatment on promoting recovery will be in both these systems. determined by weekly plethysmography testing as well as behavioral analysis. Forelimb function will be assessed using the cylinder task and the sunflower seed opening task. Neuroanatomical tracing will be used to examine the integration of transplanted tissue with host tissue, and quantify the extent of axonal repair following treatment. At the end of each experiment, tissues will be perfused for histological and immunocytochemical analysis.

References:

The research I have been assisting with in Dr. Reier’s lab has exposed me to the field of neuroscience, a field I had not previously worked with. One of the experiences I have been most excited about getting a chance to participate in is the chance to work on the rats performing surgical procedures. Additionally, I have learned many procedures in the lab including plethysmography, various forms of immunohistochemistry, and other lab procedures all of which have broadened my knowledge of that will be useful in my future lab work not only in Dr. Reier’s lab but other labs I may have the opportunity to work in.

This summer I graduated with a Bachelor’s degree in Biological Engineering and spent my time in Gainesville continuing volunteering in Dr. Reier’s lab along with short trips to visit friends and family to various places. Towards the end of this past summer I prepared myself for starting graduate school the Interdisciplinary Program in Biomedical Sciences at the University of Florida.
Personal Statement Before Starting Science For Life Award

The activities I plan to undertake as part of the HHMI Undergraduate Research Award are designed to enhance my knowledge in intriguing areas of biochemistry, as well as continuously improve my abilities in the laboratory and in conducting research altogether. I am currently pursuing a major in biochemistry and I believe that information gathered in the classroom should be integrated in real world applications, such as in a laboratory.

I discovered Dr. Gail Fanucci's research group while searching through the biochemistry website and I came upon some of the group's research topics: Biophysical Electron Paramagnetic Resonance (EPR) in Structural Biology and Intrinsically Disordered Proteins (IDPs). The topic of IDPs was brought up in my general chemistry lab that past week and I decided to look up more information on it. I was interested in the subject because I discovered the crucial roles that IDPs play in biology, participating in such processes as transcription and translation. I also saw that using EPR as a biophysical tool to study IDPs was still being investigated and I wanted to understand the subject further. I also felt that the work I was going to be doing in the lab and the techniques I was going to be taught would benefit me immensely in my current and future classes, as well as in my own research projects.

I have been working in the lab since November of last year and have tried to be there as often as possible, both before and after my classes. This semester I have begun attending the weekly group meetings where other members of the group present the status of their research or practice seminar presentations. I have learned not only about the specific focus of the rest of the group, but also how to properly present data, whether it is in a PowerPoint or a poster. Time management will continue to be a crucial aspect of my commitment because achieving and being able to replicate results is the goal of any experimental design and such success does not happen overnight. I understand that schedules change from semester to semester and classes only get more challenging, but I have been able to deal with such transitions in freshman year, and I plan on continuing this trend in the future. The project I plan to do as part of this award is intended on lasting throughout the majority of my undergraduate career, with proper additions, modifications, and improvements along the way to further enhance its overall goals.

What I want to achieve from this experience is not only results, but an impact on my future. I have touched upon this subject earlier, and I would like to reiterate it now. Some of the benefits I hope to gain include being a co-author in a publication, which can come about through collaboration with other members of the research group, applying for other prestigious scholarships and awards in the future, such as the Science for Life Extramural Award and the Goldwater Scholarship, and important preparation for post-undergraduate work. I hope to one day be able to build on the research I conduct as part of this award or use the knowledge and techniques I learn to help me pursue a different topic in biochemistry. The time I spend on this proposal will only make me a better student, better in a laboratory setting, and will help further many of my scientific goals and interests.

Abstract

Understanding the α-Helical Conformation of the N-Terminus in IA3 Using Site-Directed Spin Labeling and Electron Paramagnetic Resonance

Milshteyn E, Pirman NL, Fanucci GE

Intrinsically disordered proteins (IDPs) comprise a class of proteins that are defined by largely unstructured domains under normal physiological conditions, but still have crucial roles in various biological processes. Many IDPs undergo conformational changes towards a structured state either upon binding to a target, or by chemical induction. In this study, we use site-directed spin labeling and electron paramagnetic resonance (EPR) to monitor the conformational changes in the N-terminus of IA3, a 68 amino acid IDP that acts as an inhibitor of yeast protease A (YPRA) in Saccharomyces cerevisiae. Previously, IA3 has been used as a model to system to study the transition of IDPs toward a more structured state by other biophysical techniques such as nuclear magnetic resonance. Site-directed mutagenesis allows us to incorporate cysteine residues in various sites in the N-terminus, which can be chemically modified by IAP (3-(2-iodoacetamido)-PROXYL), a sulfhydryl-specific nitroxide spin label. By using 2,2,2-trifluoroethanol (TFE) to induce IA3 into an α-helical conformation and collecting X-band EPR data, we can gather further qualitative and quantitative information on the unstructured-to-structured transition of the N-terminus of IA3. The results obtained from site-directed spin labeling and EPR will be compared to those gathered from previous investigations of the N-terminus by NMR, circular dichroism and fluorescence.1,2,3 By providing new EPR analyses of the N-terminus, we can show how site-directed spin labeling and EPR can be used on other IDPs to understand structural information in conformational changes.

References:
1. Ganesh et al., Biochemistry, 2006, 45(45), 13585.
2. Green et al., Biochemistry, 2004, 43(14), 4071.

Personal Statement After Starting Science For Life Award

Working on my research project as part of Dr. Fanucci's Research Group has been an amazing opportunity that has provided immense benefits. Coming into doing research, I did not know what to expect in terms of time commitment or how the process was going to progress, but I have gained valuable insight into these aspects, both from the graduate student I work with, and by observing other members of the group. Furthermore, I have acquired valuable knowledge in the field of biochemistry, especially protein structure, which has become more and more interesting during the year due to how much I have learned. The summer experience gave me ample time to continue reading up on scientific literature and practicing all the techniques and analyses I was taught throughout the course of my research project, such as circular dichroism and utilizing the electron paramagnetic resonance (EPR) spectrometer. I looked at this summer as a culmination of what I was taught since I joined the group. I was able to present my results at the Rocky Mountain Conference on Analytical Chemistry and get insight into other research being done in EPR, giving me another positive perspective on working in research. Consequently, all my work during the summer has given me a new outlook on what research entails, especially what is required of one's self on a daily basis. I have thoroughly enjoyed the research opportunity and I am still considering going to graduate school to earn a Ph.D. in biochemistry, or perhaps a MD-Ph.D. should my research project evolve and prove beneficial to the health professions. I hope to continue finding success in my research project and gaining important knowledge in the field.
Cody Monroe
Freshman
Mentor: Dr. Dave Clark, (Environmental Horticulture)

Personal Statement Before Starting Science For Life Award

The HHMI research award activities would be integrated into my studies at the University of Florida in several ways. The work on tomatoes would encompass 2-3 years of my time in college and teach me various techniques of large scale propagation, nursery management, biochemistry and genetics. During my time at UF, the methods of propagation and nursery management would reinforce my major in Horticulture Operations and allow for hands on experience of class material. Also the research activities would reinforce my studies in Horticultural Operations and allow for prior experience before searching for a job in the breeding industry. Other ways that the research award activities could be integrated beyond undergraduate studies is by reinforcing a graduate degree in Plants, Cells and Molecular Biology through the work I will have to do on biochemistry and genetics. This training will supply me with hands on laboratory experience that will be useful in obtaining a PCMB graduate degree.

Dr. Dave Clark was my choice as mentor for several reasons. His access to both a horticulture laboratory and greenhouse area will allow me to complete my research without searching for equipment or growing space. Also his prior experience in the field of horticulture allows him to mentor me in the techniques and equipment of biochemistry, genetics and large scale growing practices in the greenhouses. This project was selected because I feel that one way to stem the rising trend of obesity and heart related illness is to develop better diets through increased use of fruits and vegetables. Creating a vegetable that appeals to a larger consumer base allows for increased consumption and a healthier population.

This project should run through 2-3 years of my undergraduate experience and involve the first year growing and crossing the inbred varieties with the second year growing the F1 hybrid and extracting volatiles, sugars and acids. The end of the second year and into the third year is when I expect to run taste panels on the fruits and begin to identify and clone genes. I plan to work 40 hour weeks on the project of summer 2009 and 15-25 hours per week in the following fall and spring semesters for the next 3 years. This allows me to balance my coursework and research activities during the following semesters. This project will allow for co-authorship of at least 1 paper after the identification of the genes linked with flavor. If the project goes well, some other aspirations that I have are to visit any other laboratories in the country that are working with fruit or vegetable biochemistry, specifically ones dealing with taste and also to participate in the extramural research activities in either South American, Hawaiian or Dutch laboratories due to their broad range of horticulture and vegetable production.

Abstract

Production of better tasting tomato varieties
Monroe C, Clark D, Schmitt K, Fisher D

The objective of the project is to combine desirable traits from two different types of tomatoes in order to develop a garden variety tomato that excels in production and taste characteristics. By crossing inbred lines of both production and heirloom tomato varieties, the project also aims to investigate how genes influencing taste are inherited in the F1 hybrid fruit. After obtaining the fruit of these F1 hybrids, extensive analysis of volatile biochemistry central to taste and fragrance will be analyzed in order to determine how volatiles are inherited through parental lines. The project began in Spring 2009 by crossing 12 inbred heirloom lines, which were chosen due to varying taste and color characteristics, with a standard production tomato ‘Floradade’.

The project requires three criteria which are genetics, biochemistry and the human components of taste in order to develop a better tasting tomato. The initial crosses and resulting F1 crosses will be the result of genetics and will then lead into our next criteria. After growing out our crop of F1 seeds, biochemistry will be used to test the F1 and parent fruits for volatiles, sugars and acids. This will indicate the dominant gene inheritance of taste characteristics in our plants. A sensory taste panel will be incorporated as the last step in order to judge tomato preference in a human taste panel. Utilizing human sensory panels, we will screen the parents and F1 hybrid fruit for positive and negative contributors to taste. These preferences will then be correlated with biochemical components to identify which sugars, acids and volatiles are critical components of a good tasting tomato. Human preference will demonstrate which important genes and volatiles are necessary for a good tomato and can indicate which genes need to be incorporated into other breeding or academic programs.

Personal Statement After Starting Science For Life Award

Participating in this project has supplied me with much more than an extracurricular opportunity. This project has helped me learn to manage my time more effectively while allowing me to develop as a young scientist and professional. I have broadened my applied learning by being exposed to material before taking the classes. With this project, I could say that I have a rudimentary understanding of genetics and basic inheritance patterns. My project also required me to obtain assistants in breeding, and this helped me develop managerial skills which can be used in the professional world. My abilities have also grown along with the experiment. I have developed technical skills in breeding, using Gas Chromotography, extracting volatiles, and setting up taste panels for consumers. I have strengthened my understanding of the scientific method while learning the approach to drafting a scientific paper. Most of all, I have developed a sense of appreciation that goes into everyday discoveries.

This summer will especially factor into my future plans. While working on breeding to create F1 seed, I was able to work with a proprietary breeding company called Garden Genetics. This experience allowed me to further develop my lab skills while allowing practice in breeding on the tomato plants. This experience in the summer also introduced me to the business side of the scientific world and how it is usually necessary to be able to market your research. This summer definitely started giving me a bigger look at the future of my project as well as what I would like to do post bachelor’s degree. As for non-research related activities I have become a member of the Environmental Horticulture club and attended a horticulture related competition in California.
Personal Statement Before Starting Science For Life Award

Life as an undergraduate researcher at the University of Florida can be rather overwhelming, as the possibilities are endless and the range of exciting and interesting topics are equally limitless. I feel very fortunate to have found my niche on such a large and diverse campus. The HHMI Undergraduate Research Award would open many new portals in regards to my research endeavors and personal growth during my time at UF, and beyond. The program provides an element of structure, bringing therein a series of checkpoints that I believe would enhance and complement my efforts to accrue successful results. Attaining the award would also serve as a foundation for developing many new associations with experienced researchers and would allow me to expand my range of knowledge by being aware of other projects. These features of the program would aid in my research development, but there are other aspects which would deepen my personal development as well; having a platform from which to present my research to others is one of the most rewarding aspects of the program, and would certainly enhance and expand my friendships with other undergraduates experiencing similar obstacles as myself.

Developing my research skills as an undergraduate serves as a testament to my dedication in developing biomedical engineering as my career. I plan on pursuing my Ph.D in gene therapy upon graduation. My interest in genetic engineering is what led me to attempting to become involved in Dr. Ogle’s lab. I had seen one of Dr. Ogle’s lectures on optogenetics, and I was instantly intrigued by such an exciting medical innovation! He allowed me to come volunteer in his lab, which eventually evolved into my status as an undergraduate research assistant. My commitment to the lab ultimately provided me with the chance to have a project of my own. Because I currently go to the lab for multiple hours a day, I have become very accustomed to balancing research with schoolwork and do not anticipate difficulties in maintaining this balance in the future. However, I do believe the amount of research will be greater and I will have to tune my time management skills even further, but I welcome such a challenge. Researchers in the Ogle Lab have said that I will most likely be working on this project until I graduate. This is due to the cloning process being very tedious, as well as the likelihood of other projects evolving along the way.

Contingent upon the success of my research, many other possibilities could potentially arise. I have been told that, if my research contributes to any papers written in the lab, I will be given the chance to be a coauthor. There is also potential to travel to national conferences, specifically the Neuroscience conference which occurs annually. The Ogle Lab has presented posters at this conference in the past, and I may have the opportunity to form a poster of my own. The poster sessions provided by Science for Life would be of definite benefit in preparing for such a national conference by becoming accustomed to presenting research in front of audiences and experts in the field. Having such experience would also prove to be very useful in future endeavors, especially if I have the extreme fortune of landing a research spot in one of my “dream” research labs – The Pasteur Institute. However, I have always wanted to have a research experience abroad, regardless of whether or not I could get a spot in The Pasteur Institute’s undergraduate research program. The encouragement provided by the HHMI Undergraduate Research Award to do research abroad is exceptional, and makes me hope for the award even more! I will certainly be applying for the HHMI Extramural Research Award Program to increase my chances of attaining a research position across our borders.

Abstract

Light-activated chimeric G-protein receptors

Nelson N, Ogle W, Barish P, Gowrishankar R

The field of optogenetics developed on the biological principle that light can be used in place of an extracellular ligand to initiate the activation of intracellular signaling networks. This premise has been capitalized on to control neural firing with light with minimal invasion by manipulating light-activated G-protein-coupled receptors (GPCRs) [1]. One such light-activated GPCR is rat rhodopsin 4 (RO4). Functioning through the Gi/o pathway, RO4 hyperpolarizes the cell membrane in response to blue light and consequently reduces the firing rate of neurons (Figure 1). GPCRs consist of transmembrane loops which form an extracellular ligand-binding region and an intracellular signaling network. To form a chimeric receptor, the extracellular loops from one G-protein can be attached to the extracellular loops of another G-protein, in turn forming an entirely new GPCR. A new chimeric receptor has been developed which combines the extracellular loops of RO4 and the intracellular loops of the µ-opioid receptor, nicknamed the “opto-opioid receptor.” The µ-opioid receptor binds to the Gi/o pathway, which consequently restricts the release of cAMP and related downstream gene cascades [2]. This process then inhibits pain sensations. The opto-opioid receptor has been cloned into a lentiviral backbone from which it will be made into packaged virus to transfect a neural cell line. Calcium and cAMP assays will be performed to hopefully demonstrate that the receptor is effectively activated and deactivated in the presence and absence of light, respectively. Real-time PCR will be run to show gene expression. The opto-opioid receptor opens new realms in the pain-treatment sector. Therapy involving these genes could be spatially precise, require no additional cofactors, and could be locally activated – contrary to current systemic treatments.

References:


Personal Statement After Starting Science For Life Award

I have gained a lot from my time spent in the Gene Dynamics Lab. The experience I’ve acquired by working alongside graduate students is completely invaluable, and has confirmed my desire to persevere my Ph.D. in biomedical engineering. I believe that working in this lab is giving me a jump-start and will allow me to hit the ground running when I (hopefully) am a graduate student! Having an understanding of the entire cloning procedure, cell culturing, and other lab maintenance protocols has also made my comprehension of biochemistry and other scientific principles more thorough and meaningful. Besides science-related skills, I believe I have also become better equipped in my team dynamics, as well as problem solving skills. Not a day goes by without putting my troubleshooting and analytical thinking abilities to the test. I hope to be able to apply the knowledge I’ve acquired to another experiment while I am still an undergraduate. I have been investigating RELs and research abroad programs for the following summer, and would be beyond excited if I could find a program that involves travel and research. All in all, I feel very fortunate to be working in a lab with incredible people who are doing such awesome and captivating work!
My current research project began in the summer preceding my freshman year, and as such, it is already well-integrated into my college schedule. Many of my classes are scheduled in the morning or in the early evening, allowing me to conduct research in the afternoon. I began working in Dr. Maria Grant’s lab during this past summer as a volunteer, under the recommendation of my mentor, Dr. Daniel Purich. Dr. Purich is a close collaborator with Dr. Grant, and he felt that I would most benefit starting there where I could immediately begin with my own project, and would move to his lab once I was a more seasoned researcher. Having both an academic mentor and a laboratory mentor is a great advantage to me; it allows me to gain technical knowledge from two labs, teaches the dynamics of close collaboration, and strengthens my research network.

My research is currently focused on the study of adenosine receptors in CD34+ and CD14-stem cells in diabetic patients. This project entails two main points of interest to me; research into the still relatively unknown field of stem cells, and research into diabetes, which interests me on a personal level, as my older sister is a Type I diabetic.

My current project has already garnered much interest among my laboratory. Some of the preliminary data suggests a newfound correlation between fewer adenosine receptors and Type I diabetes, yet more data is necessary to support this conclusion. The Principal Investigator of the lab, Dr. Grant, has suggested the inclusion of this data into a chapter that she is currently writing for a textbook, and has offered co-authorship to me for supplying this data. I also plan to present this research at an international conference that would lead. This project is one that was never fully set in stone at the beginning but has blossomed due to many unexpected setbacks, delays, and even outright failures. If I am ever asked in an interview what sets me apart from the numerous other potential candidates, I can confidently say that I know what failure is, and that after suffering failure I can pick up the pieces and continue onward.

As I continue my research I keep the following thought in mind. I am told that undergrads who have conducted research for a year either find that it is not at all for them, or that they enjoy it to the extent of wanting to pursue it as a career. I am certainly in the latter group, and have been enchanted by Science to follow it wherever it may lead me.

Personal Statement Before Starting Science For Life Award

My current project has already garnered much interest among my laboratory. Some of the preliminary data suggests a newfound correlation between fewer adenosine receptors and Type I diabetes, yet more data is necessary to support this conclusion. The Principal Investigator of the lab, Dr. Grant, has suggested the inclusion of this data into a chapter that she is currently writing for a textbook, and has offered co-authorship to me for supplying this data. I also plan to present this research at an international conference that would lead. This project is one that was never fully set in stone at the beginning but has blossomed due to many unexpected setbacks, delays, and even outright failures. If I am ever asked in an interview what sets me apart from the numerous other potential candidates, I can confidently say that I know what failure is, and that after suffering failure I can pick up the pieces and continue onward.

As I continue my research I keep the following thought in mind. I am told that undergrads who have conducted research for a year either find that it is not at all for them, or that they enjoy it to the extent of wanting to pursue it as a career. I am certainly in the latter group, and have been enchanted by Science to follow it wherever it may lead me.

Personal Statement After Starting Science For Life Award

Participation in this research project has been nothing short of inspiring, both scientifically and personally. Coming into college, I knew I wanted to pursue a science degree, and already had the intention of going into research. While I was aware of the trials that a researcher must endure, I firmly believe that only those that have experienced those trials firsthand can truly understand them. When I joined the lab in the summer of 2008, I was quickly thrust into routine procedures and technical protocols. Within two weeks I was given a project that I would lead. This project is one that was never fully finished in the past, partly due to some of its innate difficulties in sample acquisition, etc. However, I accepted it and forged ahead. By winter, I had accumulated a foundation of data to serve as an abstract that was submitted and accepted for an oral presentation at an international conference that drew over 10,000 attendees yearly. I was excited, yet petrified to give a research presentation to a room that seated over 300 of the world’s foremost experts on angiogenesis. As I gathered more data prior to the presentation, I was met with numerous setbacks, delays, and even outright failures. If I am ever asked in an interview what sets me apart from the numerous other potential candidates, I can confidently say that I know what failure is, and that after suffering failure I can pick up the pieces and continue onward.

As I continue my research I keep the following thought in mind. I am told that undergrads who have conducted research for a year either find that it is not at all for them, or that they enjoy it to the extent of wanting to pursue it as a career. I am certainly in the latter group, and have been enchanted by Science to follow it wherever it may lead me.
Over the summer, I had the opportunity of attending a medical mission to the Dominican Republic that inspired me to become a researcher. While in the Dominican Republic, I witnessed people living in what we would consider revolting poverty-stricken conditions. I saw children who are malnourished, little babies sleeping on dirt floors veiled with mosquitoes bites. It hurt me to see people in not only such deplorable conditions, but also constantly exposed to mosquitoes that carry such a deadly disease; Malaria. It was indeed a life changing and mind altering experience. It was a call to action that crystallized my desire to commit myself to finding a novel antimalarial drug so that millions of lives may be saved.

I know that the road to finding a cure to malaria is a long and rigorous process but I am ready to take this challenge. I am planning on working on the malaria project for many years to come as an undergraduate student and a graduate student. Ever since I got the research position in Dr. Dunn’s lab, I have been very conscious of the classes and when I take them. I try to maximize the time that I come into lab by choosing a balance of challenging and not so challenging classes. I do not overextend myself by not joining too many clubs and not taking too many leadership positions within the clubs. In addition, I try to have most of my classes in the morning so that I may come in my lab around noon and I would stay there until I complete my task. Research is such a high priority in my life that I even go to lab on the weekends and have stayed there until late in the morning.

Every thirty seconds, an African child dies from Malaria and I feel that there is no time to waste. This upcoming summer, I plan devote all of my time to research. I am not going to take any classes so that I may be in lab at least 40 hours a week. My goal is to conduct as many experiments as possible so I may be one step closer to my dream of finding a novel antimalarial drug to save millions of people.

Malaria, one of world’s most widespread infectious diseases, is responsible for the death of a child every thirty seconds. Approximately, 50% of the world’s population lives in malaria infected areas. Each year, over one million people are fatally victimized. The deadliest form of malaria is Plasmodium Falciparum due to its ability to multiply rapidly in the blood. This species is responsible for approximately 400 million infections annually. Furthermore, P. falciparum is gaining resistance to current antimalarial drugs. Therefore, the development of a novel anti-malarial drug to combat malaria is of crucial importance.

My research project focuses on Plasmepsin 10, one of the aspartic proteases found in P. Falciparum because its function is still unknown. In order to learn more about this potential anti-malarial drug target, this protease must be characterized to determine is structural and biochemical properties. My protocol involves expression, French pressure cell treatment to break open the cells, chemical denaturing of inclusion bodies, refolding of protein by dialysis, and purification of protein by anion exchange chromatography. With a sufficient amount of active and purified protein, kinetic and crystallographic studies will be carried out. Using the information found, new anti-malarial therapeutics can be designed to eradicate the malarial parasite.

Personal Statement After Starting Science For Life Award

I learned that research is about perseverance. In my research, experiments often went wrong. For example, my protein failed to express, my 12% SDS PAGE gel did not polymerize, my solutions were not mixed consistently, etc. Many experiments were unsuccessful but the time invested was not wasted as long I learned why the experiments went wrong and learned not to make the same mistakes again.

I appreciate the opportunity to perform research as an undergraduate at the University of Florida. I got the chance to find out if research is the career for me. I learned that to become a researcher, one must have perseverance. One must also pay attention to minute details, for a small error can cause the whole experiment to fail. When experiments are not successful, one must also have a really good notebook so that one may backtrack and find out where mistakes occurred.

I am so grateful for my undergraduate research experience. I also am so grateful for the opportunity of learning from my lab members. I particularly enjoyed lab meetings because that is where knowledge may be exchanged. I looked forward to discussing current developments in the field of research with my lab members. I enjoy thinking about problems, finding ways to approach the problems, and making discoveries. It is amazing to think that our new discoveries may positively impact and ameliorate the lives of many generations to come.
**Personal Statement Before**

Starting Science For Life Award

I chose to work with Dr. Levey on this chili pepper project for several reasons. I first decided to approach Dr. Levey about a research project when I read about his work while researching individuals for the Science for Life class. Dr. Levey’s projects covered wide areas of study that have long interested me, including a study on how connectivity in a landscape affects genetic variation, the migratory patterns of South American birds, and the evolutionary ecology of chili peppers. The project that I will be working with Dr. Levey on involves an analysis of ecological relationships from an evolutionary perspective, something Dr. Levey and his lab specializes in and I am especially interested in. Understanding how over time interactions between organisms (in this case chili peppers, fungi and insects) drive the emergence of characteristics (in this case spiciness in chili fruits) can provide details on the emergence of species and has conservation implications. Besides gathering details about the specific relationships analyzed in this project, working with Dr. Levey would help me learn how such a study is conducted. This project is also experimental in nature (as opposed to strictly descriptive like many ecological studies), so working on this project I could also learn things about how to approach other more experimental areas of science I might become interested in. Another reason I chose to work on this project was because of the beautiful field location, Seahorse Key. An undeveloped island with a University of Florida research station on it, Seahorse key often houses a fair number of researchers who I could interact with and learn more about field ecology.

For this project, the bulk of the field work will occur during weekends in the fall semester (because that is when the chilies fruit), so I will have find balance between research and regular coursework. Travel to and from the field site takes advanced planning because it is on an island, so weekends will have to be chosen that do not conflict with important exams. I am also planning on enrolling in research for credit during the fall semester so I can earn academic credit for the research.

I view working on this project primarily as a learning experience on how research is conducted and published, but it could also have other beneficial effects on my long term career. Presenting this study at meetings would be a huge step forward for me in meeting people and establishing the social connections necessary to effectively practice science. Publishing this study would probably do more to make a name for myself in ecology and contribute to ecology in the southeastern United States. By letting people know early on that I am serious about science, my chances of getting into graduate school will increase as well.

**Abstract**

Seed Predation of Wild Chilies (Capsicum annuum) on Seahorse Key, Florida

Noss C, Larson K, Prine E, Kleim J

This experiment examined the relationship between consumption of Capsicum annuum fruits by birds and later seed predation by rodents and insects. C. annuum seeds were collected from fish crow (Corvus ossifragus) feces after the birds had been fed C. annuum fruits 24 hours earlier. The Benefit Hypothesis posits that seeds passed through birds (“passed seeds”) will be consumed by granivores at higher rates than those collected directly from fruits (“non-passed seeds”). To test this hypothesis 122 passed seeds and 122 non-passed seeds were matched side by side in 122 separate trials in C. annuum habitat on Seahorse Key, Florida and subsequent predation rates were inferred by marking the presence or absence of seeds. The Benefit Hypothesis was not supported, after one night 25 percent more passed seeds remained than non-passed seeds.

This decreased to 18 percent more after sixteen days (X²=5.541, d.f.=1, p=0.0105). The Insect Granivore Hypothesis posits that insects are the primary post dispersal predator of seeds. To test this hypothesis 80 passed seeds were put through 40 similar matched trials except one seed was caged to block predation (“caged seed”) by rodents but not insects and the other was left open to rodent and insect predation (“exposed seed”). The Insect Granivore Hypothesis was supported. After one night 12.5 percent more caged seeds were present than exposed seeds, however this number dropped to an insignificant difference for the rest of the study (X²=0.463, d.f.=1, p=0.4962). The results suggest that granivores prefer un-passed seeds to passed seeds which may be an additional incentive for fruits to be attractive to birds. They also suggest that the main seed predators on Seahorse Key are insects.

**Personal Statement After**

Starting Science For Life Award

Working on this project taught me several things. First, I learned to be flexible when designing and conducting a research project. My first project had to be discontinued due to a lack of data and this was initially frustrating, but I learned that this is a standard component of scientific research, especially field ecology. Designing this project also taught me how to communicate with scientists in a variety of fields. I learned how to approach potential collaborators and who to ask for help for certain problems. When conducting the actual research for this project I spent most of my time alone on an island in the Gulf of Mexico (Seahorse Key). This experience taught me how to work independently and how to creatively solve unforeseen problems in the field with scientific rigor. Most of all I learned that I really enjoy the process of science, especially conducting field research.
The HHMI Undergraduate Research Award would give me the opportunity to further my research experience at the University of Florida. Having worked for almost a year with my mentors Dr. Moore and Dr. Kamps has given me the opportunity to apply what I learn in my undergraduate courses to a real life scientific setting. I have been able to take what I read out of a Biology textbook and apply these concepts to what I am doing in the laboratory. Being able to receive this award would take my previous experience with research to the next level, and by this I mean to a level of application and understanding that would put me at an advantage in my studies. I have been able to balance my time between research, coursework, and extracurricular activities for most of my undergraduate experience, so I believe that receiving this award would not affect my time management.

I came upon getting involved with my mentor’s research in my freshman year at the University of Florida. I took the Science for Life course IDH3931, which introduced me to Dr. Grosser, a biologist that manages the citrus somatic hybridization program for the University. As a Biology major and a pre-medical student, I found Dr. Grosser’s research to be very interesting, and so I decided to contact him and ask if I could take part in his research. It was unfortunate that I was not able to participate in Dr. Grosser’s research due to the fact that he conducts his work off-campus at the Citrus Research and Education Center in Lake Alfred. I was really fortunate, however, in that he referred me to his colleague Dr. Moore with whom he collaborates. Dr. Moore’s and Dr. Kamps’ research deals with the genetics and molecular biology of plants, and this is perhaps why I took such an interest in this research. In plants one is able to see drastic results when it comes to the genetic aspects of it. I was fascinated by the extent of manipulation of genes in plants. My goal in life is to become a doctor and therefore doing research in plants gives me the opportunity to see how the sciences can be applied to manipulate the pathways and biological processes of living organisms.

Being able to receive this award would make my undergraduate experience memorable, and being able to conduct my own research as an undergraduate provides me with great opportunity to excel in my future endeavors. I want to attend medical school and become a reconstructive surgeon for the U.S military. To achieve this life-long goal requires a lot of experience and scientific knowledge. I am a committed individual that is willing to put forth the time and effort to make my proposed research a priority. I plan on spending a period of a year or longer on the proposed project. Also, if I am given the opportunity to get this award, I would like to have a scientific publication on the research and encourage other undergraduates to get involved in participating on research projects.

Abstract

Biological Effects of Heterologous Flowering Locus T Gene (SFT) in Citrus

Pajon M, Kamps TL, Moore GA

In citrus, the first flowering can normally take up to ten years to occur, and subsequently is influenced by environmental cues. One of these cues signaling flowering to occur is integrated by the FT (Flowering Locus T) gene. The small protein encoded by this gene travels from the phloem, to the apical meristems, where it promotes flowering. This FT protein is also believed to be the long distance flowering signal known as florigen. “Florigen is wide-spread, if not universal, in flowering plants, and that only the conditions that regulate its production vary among the different response types.” (Lang 1965; Zevenaar 1976; Zeevaart 2006). The tomato ortholog of the Arabidopsis Flowering Locus T (FT) gene is SFT (Single-Flower Truss) gene. We are placing the SFT gene behind a constitutive promoter in order to assess if it is better or less effective for inducing precocious flowering than if the FT gene were from the same species that is being transformed; in this case is citrus. In order to perform successful transformations of SFT into citrus, clones will be created by PCR amplification and will subsequently be inserted into a vector which would then be transformed into E. coli. In order to get the tissue infected and transformed with the construct, the clones will be transferred into a new vector and moved into Agrobacterium tumefaciens. In this experiment we will use a genomic clone and a cDNA clone in order to identify differences in flowering and development that could arise from having non-coding sequences of the gene. Our previous research shows that transgenic citrus over-expressing a citrus FT ortholog does in fact produce precocious flowering. The expected outcome of the introduction of the SFT gene from tomato into citrus is a shorter juvenility period of citrus.

Personal Statement After Starting Science For Life Award

After having the opportunity to conduct my own research over the summer, I have come to the realization that research is essential to understanding all aspects of science. By being able to have such a hands-on experience I was able to learn the techniques required for performing molecular research and apply my knowledge towards experiments that would test the projects hypotheses. I learned that research is challenging, and that it takes time, dedication, and a lot of patience to achieve favorable outcomes. From the time spent with my mentors I was able to gain the experience of doing a collaborative project in which we were all able to help each other. During the summer research, we experienced many obstacles and had to learn how to come up with alternate methods of conducting experiments to get past them. I gained valuable knowledge in microbiology, molecular and tissue culture techniques. Over the summer I was able to gain confidence in my knowledge of genetics and laboratory skills as well. This experience has benefited me on an academic and a personal level. I will now be more qualified to apply for medical and graduate school. Also, I will have more experience communicating my ideas and thoughts to others. The HHMI research award is definitely a rewarding experience that gave me the opportunity to gain valuable experience for my future plans.
Anita Patel
Sophomore
Mentor: Dr. Mavis Agbandje-McKenna, (Biochemistry and Molecular Biology)

Personal Statement Before Starting Science For Life Award

I have been interested in the opportunities afforded to undergraduates through the HHMI program since the fall of my freshman year. Dr. Duran was both my chemistry professor, and a member of my Science for Life course. I knew I wanted to follow a path towards clinical research, and the program gave me the resources to find a researcher who would help guide me in that direction. Thanks to the Science for Life program, I was able to find a lab that is truly in line with my particular interests, and has offered me the opportunity to jump into the research field far ahead of time.

I met Dr. Mavis Mckenna through her husband, Dr. Robert Mckenna, after he presented at a Science for Life seminar last year. I spoke with her about my wishes to work in an area applicable to immunology, and that I was strongly interested in studying microorganisms. While I had initially wanted to tour her husband’s lab, I found that the area of research her team deals with was much more in line with my interests. I interviewed with her when she was accepting undergraduates, and was offered a position to work under one of her graduate students, Brittany Gurda. Because Dr. Mckenna was aware of my interest in the Adeno-associated viruses and their applications as possible gene therapy vectors, she gave me the option to choose a topic related to this area to contribute to. I was also aware that AAV6 had yet to be crystallized or reconstructed and analyzed for amino residues, and I was excited to focus my work on this serotype. I now work 11 hours a week in the lab, and with the reconstructions that I have already produced, can be co-authored with any papers written by Brittany Gurda through the Mckenna lab regarding AAV structure characterization.

My project is intended to fill my remaining undergraduate years here at the University of Florida, and is directly applicable to the overall laboratory to clinical translation of the uses of AAV vectors. I hope to pursue an M.D./Ph.D. degree in an area applicable to immunology. Currently, however, with the work I have done in the Mckenna lab, I hope to apply to the University Scholars Program next year to further my ability to work in the lab, and continue my project over the summers. This will also enable me to travel with the research group to the University of California, San Diego, when cryo-EM data is taken at the Baker laboratories.

Abstract
Capsid Structure Characterization and Antibody Response of Adeno-Associated Virus Serotype 6
Patel A, Agbandje-McKenna M

The ability to transfer genes with high efficiency and specificity can facilitate a broad range of biomedical efforts, from basic research to clinical applications. Gene delivery vectors based on adeno-associated virus (AAV) are highly promising due to several desirable features, including a lack of pathogenicity, efficient infection of dividing and non-dividing cells (in vitro and importantly in vivo), low immunogenicity, and sustained maintenance of the viral genome (5). AAV is non-pathogenic (up to 90% of the human population has been exposed to AAV serotype 2) and consequently it may prove to be particularly safe as a vector. All of the steps involved in the course of infection and viral gene expression determine AAV tropism. Of these steps, viral binding to the cell surface is particularly important, and as a result, has been the focus for engineering to alter AAV tropism.

The aim of this project was the purification and structure characterization of AAV serotype 6, and the study of the capsid interaction with the antibodies generated against them. The steps required to achieve these research goals are outlined above.

References:

Personal Statement After Starting Science For Life Award
I began this experience by speaking with Dr. McKenna about my interest in immunology, and how I would enjoy research experience that furthers my education in this area. Today I have been able to produce data that is being prepared for publication, and have had the opportunity to teach others the laboratory techniques I have learned while participating in the Science for Life Program. I have truly enjoyed the opportunity to work in the lab, and to have been able to dedicate myself throughout the year to it. Without this grant I would not have been able to afford this opportunity. My experiences in the lab have translated into my regular course work, and have made understanding experimental methods, and interpreting experimental results easy for me. I have also come to appreciate the amount of time, collaboration, and funding it takes to produce new medical therapies. Overall my experiences in the lab have made me a stronger student, and have helped me think in terms of how my education in the sciences can be applied in the future.
My inspiration to commit myself in researching Microultrasonic Enhancement of Gene Therapy for Alzheimer’s Disease (AD) stems from my interest in neurology, and more specifically, brain disorders that cause long-term memory loss, such as AD. Our lives are essentially a compilation of experiences, created by all the different types of emotions, hardships, sufferings, achievements, etc., which give each individual a unique identity. Remembering these moments is key to defining who we are. Consequently, when the ability to remember our own life is threatened, that is when we truly lose our self-meaning.

So by participating in this research, my purpose is not only to fulfill my desire for academic achievement by earning research experience, although that certainly is an important part of it, but rather, it is to improve the life of those with AD so that they never have to go through the emotional pain of long-term memory loss. As a direct result of this aspiration, I desired to perform research concerning long-term memory loss, which in turn led me to my mentor Dr. Michael King and his research on enhancing treatment for those with inherited AD.

My research project under Dr. King will officially start this summer and last for about two years. I will be doing research full-time (40 hours/week) summer C and part-time (18 hours/week) during the academic school year. Currently, I am doing research part-time this semester in Dr. Jeffery Hughes laboratory. From this experience, I have learned how to manage my time efficiently by prioritizing between my extracurricular activities and my coursework, so that I can make room for about three hours of daily research. I have done this by creating a more flexible schedule, in that, I have decided to take about three-four assembly courses and one flexible online course each semester until the conclusion of my research project. Since I am majoring in Biochemistry and minoring in Business Administration, I have the luxury of taking flexible online courses because most of the Warrington College of Business is available online. I plan to use the same approach when working under Dr. King. So far, this approach has worked for well for me this entire semester, and so I will continue to use it throughout the duration of my research project.

After the conclusion of my research project, which should be around the time that I graduate, I plan to attend medical school and to sub-specialize in neurodevelopmental disabilities. My research is directly correlated to the area that I plan to pursue, in that both are concerned with treating neurological disabilities inherent at birth. This should give me a general idea concerning the various equipment, lab techniques, routine procedures, etc., which a physician could encounter while working in this sub-specialty.

It is important to note that in addition to learning the necessary skills and obtaining the appropriate background knowledge required for my research project, I will also work together with Dr. King to make an intellectual contribution. In effect, this intellectual contribution, which will take the form of problem analysis, identification of possible methods of approach, and recommendations for improvement, will allow me to fulfill the necessary requirement to become a co-author under Dr. King in Molecular therapy: the journal of the American Society of Gene Therapy.

Abstract

Effects of I1PP2A on Amyloid Precursor Protein and Tau Species (Akt, GSK-3b, PP1, PKA, ERK) Patel K, King M

Recent data indicates that the endogenously expressed protein, “inhibitor one of protein phosphatase 2A” (I1PP2A) can stimulate brain pathology that occurs in rodent models of Alzheimer’s disease (AD). Elevated I1PP2A gene expression results in increased phosphorylation of amyloid precursor protein (APP), and several of its processed metabolites. APP is the parent protein of the beta amyloid that is the primary component of extracellular senile plaques, a diagnostic feature of AD. I1PP2A overexpression in vivo also increases the phosphorylation of the microtubule-associated protein tau. This can facilitate the formation of neurofibrillary tangles, the other defining pathological feature of AD, or disrupt intracellular transport and structural dynamics. It is not known how I1PP2A could alter phosphorylation of these proteins, but one likely mechanism relevant to known AD risks involves interference with insulin signaling.

The aim of this project is to induce I1PP2A overexpression in cultured neuron-like cells (currently used in the lab). Immunoassay methods will be used to determine whether the same hyperphosphorylation of APP and tau proteins occurs in these cells as seen in rodent studies. I will then investigate how I1PP2A affects the primary intracellular signaling pathways activated when insulin binds to its cell-surface receptor. These cascades can ultimately alter the activity of kinases and phosphatases that can act on APP and tau species (e.g. Akt, GSK-3b, PP1, PKA, ERK). Cell culture models are especially conducive to direct tests of hypotheses about particular pathways and component molecules, for example, whether I1PP2A expression levels influence phosphorylation of IRS, Akt, or ERK. This project will provide us with excellent opportunities to discover novel mechanisms and potential therapeutic targets relevant to AD.


Personal Statement Before Starting Science For Life Award

My research project under Dr. King will officially start this summer and last for about two years. I will be doing research full-time (40 hours/week) summer C and part-time (18 hours/week) during the academic school year. Currently, I am doing research part-time this semester in Dr. Jeffery Hughes laboratory. From this experience, I have learned how to manage my time efficiently by prioritizing between my extracurricular activities and my coursework, so that I can make room for about three hours of daily research. I have done this by creating a more flexible schedule, in that, I have decided to take about three-four assembly courses and one flexible online course each semester until the conclusion of my research project. Since I am majoring in Biochemistry and minoring in Business Administration, I have the luxury of taking flexible online courses because most of the Warrington College of Business is available online. I plan to use the same approach when working under Dr. King. So far, this approach has worked for well for me this entire semester, and so I will continue to use it throughout the duration of my research project.

After the conclusion of my research project, which should be around the time that I graduate, I plan to attend medical school and to sub-specialize in neurodevelopmental disabilities. My research is directly correlated to the area that I plan to pursue, in that both are concerned with treating neurological disabilities inherent at birth. This should give me a general idea concerning the various equipment, lab techniques, routine procedures, etc., which a physician could encounter while working in this sub-specialty.

It is important to note that in addition to learning the necessary skills and obtaining the appropriate background knowledge required for my research project, I will also work together with Dr. King to make an intellectual contribution. In effect, this intellectual contribution, which will take the form of problem analysis, identification of possible methods of approach, and recommendations for improvement, will allow me to fulfill the necessary requirement to become a co-author under Dr. King in Molecular therapy: the journal of the American Society of Gene Therapy.

Abstract

Effects of I1PP2A on Amyloid Precursor Protein and Tau Species (Akt, GSK-3b, PP1, PKA, ERK) Patel K, King M

Recent data indicates that the endogenously expressed protein, “inhibitor one of protein phosphatase 2A” (I1PP2A) can stimulate brain pathology that occurs in rodent models of Alzheimer’s disease (AD). Elevated I1PP2A gene expression results in increased phosphorylation of amyloid precursor protein (APP), and several of its processed metabolites. APP is the parent protein of the beta amyloid that is the primary component of extracellular senile plaques, a diagnostic feature of AD. I1PP2A overexpression in vivo also increases the phosphorylation of the microtubule-associated protein tau. This can facilitate the formation of neurofibrillary tangles, the other defining pathological feature of AD, or disrupt intracellular transport and structural dynamics. It is not known how I1PP2A could alter phosphorylation of these proteins, but one likely mechanism relevant to known AD risks involves interference with insulin signaling.

The aim of this project is to induce I1PP2A overexpression in cultured neuron-like cells (currently used in the lab). Immunoassay methods will be used to determine whether the same hyperphosphorylation of APP and tau proteins occurs in these cells as seen in rodent studies. I will then investigate how I1PP2A affects the primary intracellular signaling pathways activated when insulin binds to its cell-surface receptor. These cascades can ultimately alter the activity of kinases and phosphatases that can act on APP and tau species (e.g. Akt, GSK-3b, PP1, PKA, ERK). Cell culture models are especially conducive to direct tests of hypotheses about particular pathways and component molecules, for example, whether I1PP2A expression levels influence phosphorylation of IRS, Akt, or ERK. This project will provide us with excellent opportunities to discover novel mechanisms and potential therapeutic targets relevant to AD.


Personal Statement After Starting Science For Life Award

Discounting the time I got bit by a rat while doing behavioral testing, my time working under Dr. King has been some of the best. I have become enlightened by being exposed to knowledge from a diverse array of scientific fields all intersecting at Alzheimer’s disease. I have gained an appreciation for the rigor of research in general and the amount ridding on it. And I have been exposed to new ways of thinking and reasoning that should be part of any scientist’s arsenal. As a prospective physician, I have learned more about certain skills than I ever could have from classes. That’s not to say that classes are insignificant, but rather, research offers a different skill set than that offered by classes alone. I have learned to think on my feet in the face of ever-changing information. In class, what’s taught is known; in lab, what determined is simply hypothetical and still in testing. It’s both frustrating and exhilarating. For the first time in my life, I can put what I learned in class to use, and to be frank, it’s just the coolest thing ever.
Personal Statement Before Starting Science For Life Award

Society as we know it today would not be what it has become without the tireless efforts of people who push the boundary of the understanding of this world. I wish to be a part of those insatiable knowledge seekers whose discoveries benefit all of humanity. The research I will be conducting will be in conjunction with classes pertaining to the field of the life sciences such as biology and chemistry. I have always found bacterial diseases and infections to be a fascinating area, and with this interest in mind I sought to find a research opportunity that would irk my interest. Chlamydia trachomatis fulfilled that want for me. Chlamydia is a gram-negative obligate intracellular bacterium and is the most commonly reported sexually transmitted disease in the United States with 4 million reported cases annually. To maximize the time spent in lab while still learning as much as possible from the courses I am enrolled in, I have planned a rigid schedule that allows me to research for at least 3 hours a day. My project deals with the identification of IncA mutations in Chlamydia trachomatis and will take approximately two years to complete with the potential to carry on with the project and others well into the rest of my undergraduate career. With the HHMI Undergraduate Research award I will eventually be able to travel to American Society of Cell Biology conferences, as well as the Chlamydia Basic Research Society meetings throughout the United States with Dr. Grieshaber. Attending these conferences is an invaluable experience because researchers are able to discuss findings with colleagues, as well as attend symposia conducted by the leading researchers in the field. There are also symposia specifically for undergraduate researchers who attend these conferences where they can present their own projects to peers and researchers, share techniques, and just get to know people who share the same interest in research as you do. An extramural internship might also be possible with collaborating labs at the Rocky Mountain National Laboratories. Dr. Grieshaber has also informed me that with timely completion of this project, a co-authorship in a scientific journal publication is likely. The completion of my current project would also help me gain the necessary experience to conduct a more difficult project in the future. The HHMI Undergraduate Research award will also benefit my lab by granting the funds necessary to purchase reagents and equipment that will allow me to complete my project as quickly as possible.

Abstract

Carcinoma in cured Chlamydia infected 3T3 cells

Patel R, Holyoak C, Grieshaber S

The purpose of my research project is to see if Chlamydia Trachomatis affects cell transformation and therefore brings about carcinoma within. The goal of my research is to find this correlation so that a new awareness for the people infected with Chlamydia can be reached. Neoplastic cell transformation is the product of cells that have been genetically mutated to not undergo healthy cell regulation and therefore propagate uninhibited. The correlation between Chlamydia Trachomatis and carcinoma is due to how Chlamydia disrupts how the cell splits. Chlamydia enters the cell as an elementary body, which penetrates the cell membrane. When inside the cell, the elementary bodies attach to the nearest microtubule by hijacking the motor protein dynein which is used for transportation of vital necessities throughout the cell. The Chlamydia then travels to the microtubule organizing center where it forms an inclusion in which it can proliferate and differentiate into a form that can attack the inside of the cell, a reticulate body. When a normal healthy cell divides it is bipolar, meaning it will split into two cells both with the same amount of genetic material. Chlamydia makes the microtubules clump together and therefore they are not able to perform their vital function in cell division which is to push chromosomes to the two poles. This inability to do so leads to a multiple poles. The chromosomal distribution is therefore compromised and can lead to cancer by affecting the chromosomes that deal with transformation and other processes of intercellular communication.

Personal Statement After Starting Science For Life Award

Participating in my research project has been a great undertaking for me but has given me a new outlook on science. It has made me more meticulous and thorough in the work I do. I have learned many new techniques such as new ways to keep your research sterile and contamination free. Do to the lack of success on my project, I will continue with what I am doing, using new ways to improve the success rate of my work. This is my 7th semester with the Grieshaber lab and I have conducted several experiments, none as meticulous and volatile as this so I have learned that when it comes to a good research project, patience may be the most vital thing one needs. In the spring semester I plan on presenting my work at the Biennial Chlamydia conference which will be held at Redondo Beach, California. Along with the HHMI poster presentation in January, I should have a very complete research project to share with other young researchers. I also am an officer in the Indian Student Association here on campus and will be the Emcee for this year’s Diwali show also known as the festival of lights which will be at the Phillips Center.
Personal Statement Before Starting Science For Life Award

For the past year, I have worked as an Undergraduate Intern in the Transfer-Cell project with Dr. Karen E Koch and her laboratory in the Plant Molecular and Cell Biology Program. I met Dr. Koch through the HHMI Science for Life course, a class that offered me the opportunity to become involved in research at the University of Florida, greatly benefitting my academic career and future goals. I currently manage a twenty-hour work week when classes are in session and a forty-hour work week over the summer. I have thus far successfully budgeted my time, and am confident in my ability to divide my efforts between work for the lab and my courses. I plan to continue work in the Koch lab until graduating in the Spring of 2011.

My current professional goals are to attend graduate school for a PhD in Entomology and Nematology. I intend to focus on evolutionary biology and plant-insect interactions, with special focus on molecular biology and phylogenetics. In the Koch lab, I have already garnered an understanding of what active research involves, and I look forward to continuing such efforts at the graduate and professional levels. Ideally I hope to secure a position as a Professor of Entomology at a research University so that I can be involved in both research and teaching. I thoroughly appreciate the benefits I have personally received from scientific research, and look forward to passing similar rewards on to future students and community members. In addition to research, I actively volunteer in the UF Entomology Department with community outreach in the form of departmental promotions and lectures to local schools. I am a strong advocate of science education for schoolchildren and the general populace, and am proud to have worked hard in helping make the advances by UF known to Alachua County and beyond. Through science, students gain valuable critical thinking skills as well as the ability to understand, evaluate, and communicate with the world around them. This is what I wish to pursue in life.

Abstract

Probing Transfer-Cell Function with Maize Mutants
Paxson MA, Collins JM, de Sousa SM, Avignone WT, Hunter CT, Carballo-Portela V, Taylor CG, Koch KE

Transfer cells are specialized for solute transport and are present in all plant taxa, plus some fungi and bacteria. However, these cells are often difficult to investigate due to their inaccessible locations. The basal endosperm transfer cell layer (BETL) in maize lies at the boundary between maternal and filial tissues. Similarly, giant feeding cells formed by infection with root-knot nematodes (g. Meloidogyne) resemble transfer cells in their structure and composition. These two types of accessible transfer cells offer a unique opportunity to compare and contrast key aspects of their function. Candidate genes for such roles were identified from a 3'UTR-anchored expression profile of the BETL region from developing kernels (20 DAP) after subtraction of genes expressed in adjacent tissues. From remaining candidate genes, key mutants were selected in lines from the UniformMu population and used to generate segregating F2 progeny. Among these genes were: 1) One member of the multidrug and toxic compound extrusion (MATE) family, hypothesized here to transfer as-yet unidentified substrates, 2) A C4-dicarboxylate/malic acid transporter, potentially transferring this metabolite to or from sites of its accumulation in cells surrounding nematode infection, 3) An auxin efflux carrier, implicated in growth of the giant feeding cells, 4) An aquaporin hypothesized to facilitate water transfer to, through, or into transfer cells, and 5) A folate/bioperin transporter potentially important to transfer of this essential nutrient to nematodes and/or developing kernels. Parent lines carrying either the aquaporin or folate/bioperin mutations were found to segregate for small and/or defective kernels. Potential associations between phenotypes and mutant genes will be discussed.

Personal Statement After Starting Science For Life Award

“Happy is he who gets to know the reasons for things.” -Virgil (70-19 BCE) Roman poet.

In the rigorous world of research science, where many things seem entirely dependent on luck (ranging from the success of PCR tests to the actual placement in a lab with a willing and enthusiastic mentor), I feel truly lucky to have experienced the undergraduate research and scientific opportunities of the past several years. As a graduating senior concerned with graduate programs and securing a position in graduate-level research, I am aware of the proverbial “leg-up” the Science for Life program at UF and the Howard Hughes Medical Institute have provided me with. For the past year and a half, I have investigated multiple aspects of maize biology, and look forward to furthering my studies with this interesting plant for the next year. I will be starting my Masters in Entomology (specializing in Beetle Systematics) this Fall at UF with Dr. Marc Branham. Experience in research has taught me that while experiments may not always succeed and hypotheses may need to be modified, the end goal of what science seeks to do makes these efforts worthy.

Science is about what is below the surface of a biological system or chemical equation. By examining not just the “how” of biology, but the “why,” we may better understand how organisms interact. The most rewarding part of science comes after the experimental design and data collection when the researcher may sit with her notes, read from the scientific literature, and amass an answer to a problem or an explanation for an unsolved phenomena. Being able to “know the reasons for things” and articulate these reasons to an interested public is why I want to be a scientist, and why I love what I am lucky enough to do.
Personal Statement Before Starting Science For Life Award

When I first started looking for research opportunities, I had barely decided on a major, let alone a potential career. As I explored, I began thinking long and hard about what really inspired me. I’ve always been fascinated by the idea of balance between mind, body, and spirit and the implications of this philosophy on health. This interest led me to discover Dr. Percival’s lab, whose research focuses on the effects of nutrition on the immune system. I was thus thrilled to discover a subject that piqued my interest more than anything I had come across before. Joining Dr. Percival’s lab made me realize that I had a deep interest in the field of nutrition and fueled my growing passion for integrative health care, a movement that reflects my own philosophy of health as a state of balance.

One thing I enjoy most about working in a research setting is that it affords me with the opportunity to work with other people who share my zeal for learning, especially about nutrition. After gaining hands-on experience with laboratory procedures and techniques this fall, Dr. Percival came to me with a paper on indoleamine 2,3-dioxygenase (IDO) in her hands and very excitedly began telling me about the wide range of applications this one little enzyme has in biological systems. I was then pleasantly surprised to find that I would be the one in charge of determining IDO activity in the blood samples from our lab’s human studies on cranberry juice and aged garlic extract.

This project will carry through the summer and well into the fall of next year, especially since our lab is currently planning another human study for which I will also be responsible for assaying the IDO activity of participants’ blood samples. Dr. Percival and I have developed a great relationship this past year, and she is very understanding when my time in the lab fluctuates due to coursework and other obligations. However, she also expects a good degree of time commitment on my part, and as such I will be working close to 40 hours per week this summer and 10 hours per week next fall, on average. This time will include working on my own project and assisting with our lab’s current human study on aged garlic extract as well as general lab maintenance.

My research on nutrition and immunity has been and will continue to be an invaluable part of my undergraduate experience. It will also be incredibly useful when I leave UF for medical school to study integrative healthcare. This area of research has given me a profound appreciation for the importance of research and is continuously augmenting my interest in and knowledge of the vital role nutrition plays in the development and prevention of disease. My experiences in the lab have convinced me to pursue a combined MD/PhD program as opposed to just an MD. In terms of the remainder of my time at UF, I intend to further my research and eventually write my senior thesis in this area of study. I am beyond thrilled to have found an activity so intellectually stimulating and enjoyable, and I hope that the Science for Life program will give me the opportunity to pursue this venture this summer.

Abstract

Cranberry Extract Enhances the Activity of the Immunomodulatory Protein Indoleamine 2,3-Dioxygenase
Pollard C, Percival S, Montero C, Rowe C

Indoleamine 2,3-dioxygenase (IDO), a heme-containing enzyme, catalyzes the initial and rate-limiting step in the catabolism of the essential amino acid tryptophan. Local depletion of tryptophan by IDO is implicated in various disease states (Johnson, Baban and Mellor 2009). In one sense, IDO acts to prevent pathogen growth by depriving cells of tryptophan and producing biologically active tryptophan metabolites known as kynurenines. On another hand, IDO-mediated tryptophan depletion also suppresses the growth of T-cells, thus creating local immune privilege for tumor cells. In this study, bioactive compounds present in cranberry are shown to increase IDO activity. Preliminary data show an increase in kynurenine production between cranberry-treated and untreated human immune cell lines. These data indicate that cranberry increases IDO activity, although the exact mechanism behind this increase is still being investigated. This result suggests that bioactive compounds in cranberry, known for their efficacy in preventing urinary tract infection (Cunningham et al. 2004), may prevent bacterial growth through increasing IDO activity. Future work will include determining whether cranberry extract acts at the transcriptional, translational, or post-translational level to increase functional IDO activity.

References:

Personal Statement After Starting Science For Life Award

Conducting scientific research has afforded me a priceless opportunity for both academic and personal growth. Dr. Susan Percival, my faculty mentor, has been more instrumental in this process than I can possibly say. Over the past year and some months, I have been blessed with a fantastic relationship with her, our postdoc Cheryl Rowe, and the many graduate and undergraduate students in our lab. I have come a long way as a person as a result of their kindness and am forever grateful to them for it. They believe in me even when I don’t believe in myself, which has given me strength and augmented my self-confidence. My experience in the lab has deepened my understanding of the importance of research, and as a result I am strongly considering an MD/PhD combined degree and a career as a clinical researcher. My understanding of the importance of nutrition has also grown exponentially over the past year, and its influence on disease prevention has sparked an interest in integrative medicine and preventive care that I expect to carry on for many years beyond my undergraduate career. I have also become a more active member of our department and currently serve as VP of Nutritional Sciences for our undergraduate club. In summary, my experience over the past year has been more precious than I can describe here, and I would like to thank the HHMI Science for Life program for helping to make it all possible. I look forward to my continued learning and development in the semesters to come.
Personal Statement Before Starting Science For Life Award

I have been involved in research at Dr. Raizada's lab since spring of 2009. I found him from the Faculty Mentor List on the Science for Life website while taking IDH3931. I was initially attracted to the Physiology department for both the subject matter itself and the wide array of foci available. Dr. Raizada's lab has published papers in a wide range of concentrations, from neurology to pulmonary hypertension. I chose Dr. Raizada to be my research mentor because he has continuously emphasized from day one that there are no limitations to what I can accomplish in the lab. He gave me the same responsibilities, privileges, and opportunities that all of the graduate students and post doctorates in the lab hold. Despite having many other responsibilities, he is a valuable mentor and is involved with my work on a day-to-day basis.

I plan to research in Dr. Raizada's lab for the rest of my undergraduate career. In the past year, researching has taught me so much more than science—it taught me invaluable interpersonal skills, time management, and work ethic. After dabbling in a few different subjects, I narrowed my focus of interest to pulmonary fibrosis. Recently, I have come up with a project involving an anti-cancer drug, bleomycin, and A549 alveolar cells.

Once I complete this experiment, I will be eligible to submit a paper for peer-reviewed scientific publications as a co-author. In addition, Dr. Raizada has expressed interest in submitting abstracts to several meetings (national and international) to present my findings, gain exposure to other relevant findings in the physiology field, and find inspiration for future projects.

In the long run, I hope that I can eventually utilize what I learn in the lab and my classes to help choose a field of study in graduate work that I am truly passionate about. I enjoy my work in the lab so much that I am now strongly considering pursuing a doctoral degree in addition to the medical degree that I have always strived for. Although I have great interest in pulmonary fibrosis, I want to take on at least one more research project in a different focus of physiology before I graduate. Dr. Raizada's lab is involved in several projects in different countries, particularly Japan and Brazil, and I am very interested in applying to the Science for Life Extramural Research award in the near future.

Abstract

The Effects of Diminazene Aceturate in Hypoxic Myocytes and Fibroblasts Pourang D, Raizada MK, Qi Y, Shenoy V

It is known that overexpression of angiotensin-converting enzyme 2 (ACE2) is favorable in preventing cardiovascular disease. Graduate student Lidia Kulemina and Dr. David Ostrov used molecular docking to discover a novel compound called diminazene aceturate (DIZE). In vitro tests showed that DIZE increased ACE2 activity, and in vivo tests used chronic intravenous administration of DIZE to show dose-dependent decrease in blood pressure for both normotensive and spontaneously hypertensive rats. It has also been shown to reduce major pathophysiology associated with cardiovascular disease, such as myocardial fibrosis.

Figure 1: the molecular docking image of diminazene aceturate. In vitro, DIZE (NSC304684) binds to ACE2 and increased its Km and Vmax.

DIZE has the potential to lead an entire new generation of treatment for cardiovascular disease and hypertension. My research is geared towards investigating the mechanism by which DIZE has such novel antihypertensive effects. I will be focusing on cardiomyocytes, which undergo cell death when put in hypoxic conditions, and cardiac fibroblasts, which proliferate and induce myocyte hypertrophy. Upon establishing a protocol for culturing both neonatal and adult rat cardiomyocytes I will induce hypoxia and treat them with DIZE. I expect to see that DIZE will decrease apoptosis in hypoxic cardiomyocytes and decrease cardiac fibroblast proliferation. In addition, I will be involved in a study where the pulmonary artery will be isolated and tested for vasoreactivity.

References:
2. José A. Hernández Prada; Anderson J. Ferreira; Michael J. Katovich; Vinayak Shenoy; Yanfei Qi; Robson A.S. Santos; Ronald K. Castellano; Andrew J. Lampkins; Vladimir Gubala; David A. Ostrov; and Mohan K. Raizada. Structure-Based Identification of Small-Molecule Angiotensin-Converting Enzyme 2 Activators as Novel Antihypertensive Agents. Journal of the American Heart Association. April 7, 2008.

Personal Statement After Starting Science For Life Award

I had been researching in Dr. Raizada's lab for about a year prior to becoming a part of the HHMI Science For Life program. In that year I learned several skills required for being a successful member of the lab—efficiently planning experiments, establishing written protocols, resources to get help, etc. While these are undoubtedly skills that I'll utilize for the rest of my research career, most of my experiments involved foolproof protocols that had already been mastered in the lab. However, this summer was not the same. TUNEL assays, isolating myocytes in adult rats, and detecting cell proliferation are just a few of the protocols that are vital to my project, yet still have several factors that even the post-doctorates in my lab haven't figured out. This summer, the most important thing I learned in the lab was how to deal with failed experiments, both emotionally and professionally. For example, I spent about half of the summer preparing an experiment to test the effects of DIZE on fibroblast proliferation, and in mid-July, when I thought I had everything worked out, the results were the exact opposite of what we expected. I was initially so disappointed in myself that I didn't even want to tell anyone. However, Dr. Raizada taught me how to accept a failed attempt and, more importantly, how to learn and rebound from it. Now I know how to look at an experiment that didn't give the results that I wanted and, rather than get disheartened and write it off as a failure or a mistake, see it as a learning experience while seeking opportunity for improvement. I now know that one of the biggest accomplishments I can make in the lab is to do everything in my power to perfect a second, third, or twentieth attempt with the same persistence that I started the experiment with. I look forward to applying this outlook to not only research, but towards classes, volunteering, and every other endeavor that I undertake in the future.
Before Starting Science For Life Award

When I began looking for a mentor, I decided to comb over ongoing research in the microbiology building to get a better idea of practices salient to my major. My search revealed that Dr. Rice had recently joined this university and was investigating biofilm formation. Her circumstance meant I could play a greater role in the research as opposed to joining a larger, more established research group; furthermore, biofilm studies are distinctly microbiological. She explained safety procedures and the nature of the research, along with preliminary results, over our first few meetings. I was convinced that she would be an excellent choice as my mentor because she not only encouraged direct, involved participation but also clearly explained research techniques and background information on her project.

The HHMI Undergraduate Research activities almost completely overlap with my academic goals. Prior to research under Dr. Rice, I had planned to join a research group and stay with it until the results are published. Dr. Rice told me that data from my work will be included in the final paper and thus I would be co-published. The time commitment outlined by this HHMI award is close to what I have already given to my work: I volunteered in her laboratory near the end of last Summer B for near 40 hours a week and I currently spend around 12 hours a week during the regular school year. Although I am a full time student according to my credit hours, I do not take many credits and my studies do not take up much of my time. If I receive this reward, I will certainly be in the laboratory for 40 hours a week over the summer because I will not be taking any summer classes. Once summer is over, I will be able to meet the 15-20 hour weekly commitment with about 12 hours of class each week. I do not expect this research to last much longer than a year from now.

Publication is not my only goal. I hope to present my published results at both local conferences such as the university’s Undergraduate Research Symposium and national conferences. Once my time under Dr. Rice is over, I plan to further my undergraduate research by applying for summer REUs and HHMI Extramural opportunities. By focusing my undergraduate research on microbiology that has implications for medicine, I will further my career goals of admission to medical schools or MD/PhD programs.

Abstract

Characterization of the Streptococcus mutans LytST Two-Component Regulatory System

Qu MD, Ahn SJ, Oleas J, Roberts E, Burne RA, Rice KC

LytSR in Staphylococcus aureus is a two-component regulatory system that regulates expression of the lrgAB operon (1), genes involved in regulating cell death and lysis. Recently it has been demonstrated that the Streptococcus mutans UA159 lrgAB operon contributes to biofilm formation and oxidative stress tolerance, and is regulated by the LytST 2-component system (homologous to LytSR in S. aureus) (2). Studies in both S. aureus and S. mutans have shown that lrgAB expression is responsive to glucose levels and oxygenation (2-4).

The purpose of this study was to further investigate the role of LytSR in regulating lrgAB expression in response to the signals in S. mutans, as well as characterizing the lytS mutant phenotype. This study compared lrgAB expression in UA159 and an isogenic lytS nonpolar mutant under various metabolic and physiological conditions. Planktonic growth curves and biofilm phenotypes were also measured. Thus far, these results have shown that when grown in the presence of 11 mM glucose, lrgAB expression is dramatically decreased in the lytS mutant compared to wild-type, but is still detectable at levels higher than when grown in the presence of 45 mM glucose. Aerobic growth curves of planktonic UA159 and the lytS nonpolar mutant revealed that the lytS mutant underwent less stationary-phase lysis compared to UA159, but cell viability of both strains was similar. Although no major differences in biofilm architecture between UA159 and mutant strains were observed by confocal microscopy, preliminary data suggests that cell lysis may be impacted by the lytS mutation (measured by release of extracellular genomic DNA) under certain biofilm growth conditions.

Work is in progress to fully evaluate other metabolic and environmental signals that may impact LytS-dependent regulation of lrgAB expression (oxygenation, metabolic acids, antibiotic stress) and cell lysis during S. mutans biofilm development.

References:


After Starting Science For Life Award

Eons ago, when I was just starting my second year, I walked into my mentor’s lab ready to dive headfirst into a field of research that, despite relating directly to my major, was entirely foreign to me. As a sophomore in microbiology, I had not even taken an intro to microbiology class and my previous lab experience had me taking care of busywork. A year after I joined the Rice lab, I can at the very least say that I do not regret taking microbiology as my major. The material my professors cover now constantly seem applicable to my work. The bulk of what I have learned, however, has not come from the textbooks or the powerpoints but rather from the bench and journal articles. The path that science takes from hypothesis to manuscript to publication has been demystified and I now understand the many difficulties in experimentation, design, and documentation that must be addressed in research.

What I have accomplished this summer has allowed me to feel more secure in presenting my work at conferences and adjusted my post-undergraduate plans to perhaps pursue an MD/PhD rather than just an MD, depending on my faith in my own resilience and sanity. At the very least I will continue working with my mentor over the next year or so and try for an REU one of these coming summers.

Besides research, my summer was spent happily not taking classes. What a fragile pleasure; I also had to study for the MCAT, which I just took a couple days ago. Thankfully, I also found some time for tennis and music; wrote some songs, finishing them up over the fall.

References:

The subject of HIV-1 and its devastating effects on people around the world is known by one and all. However, the opportunity to enrich one's educational experience, while also playing a role enhancing the understanding regarding its complexities does not come often. Hence, I feel this research project on HIV is an integral feature of my college career. I hope to gain hands-on skills by working in the laboratory, as well as help out the cause of finding a pharmaceutical cure for HIV in any way that I can. I believe that passionate motivation is a necessity for the production of successful work; and I truly feel that my interest in investigating HIV will fuel the progress of my research.

I have been training in Dr. Ben Dunn's laboratory this semester and hope to expand on what I have learned to develop my own project, concentrating on HIV-I subtype D, through the HHMI Undergraduate Research Award. Since I will be in Gainesville for the duration of the summer, this award will strengthen my commitment to research; not only in terms of conducting, but also presenting data. My ultimate goal is to achieve publication in a scientific journal. Nonetheless, I recognize the path to that aspiration is difficult. Therefore, I hope to yield the benefits of possibly having the chance to present results from my research to others in the scientific community at national meetings, and interact with the brightest individuals of the field. With all these ambitions in mind, I sincerely consider the HHMI Undergraduate Research Award as giving me the best opportunity to accomplish them.

Realizing that making a research project prosper requires time and dedication, I plan to schedule my classes from now on keeping research in mind. Thus, I will take classes at times that allow me to spend sufficient periods in the lab. Additionally, I desire to carry on this project for the length of my undergraduate career. Moreover, in the likelihood that I graduate early (fall semester of my senior year), I would be interested in still conducting research through the spring semester. Overall, I judge HHMI to be a valuable asset to my future plans of becoming a member of the medical field, by allowing me to gain significant research experience on a worthwhile topic, and also broaden my knowledge of the scientific community.

Abstract
Subcloning, expression, refolding, and purification of truncated RV2224c, a probable exported serine-protease involved in the virulence of Mycobacterium tuberculosis
Raj A, Goldfarb N, Sabashvili D, Soni A, Dunn B

My work in the laboratory of Dr. Ben M. Dunn involved subcloning the N-terminally truncated form of Rv2224c into various vectors, such as pGEX-6P-1 and pET-23a, in an effort to purify soluble recombinant protein. The resulting protein will be characterized for substrate specificity and structural characteristics, as well as inhibitor-binding profiles. As Rv2224c contains various sequences that interfere in the expression of the protein, I focused my attention on two shortened forms, SP (Signal Peptide) and short-SP. My project(s) successfully reached the point of having both the SP (Signal Peptide) and short-SP forms in the pGEX-6P-1 vector subcloned and sent off for DNA sequencing. Those experiments are currently trying to be expressed and taken further. In addition, the short-SP form in the pET-23a vector has been sequenced and frozen as a storage cell line for future use.

Personal Statement After Starting Science For Life Award
My experiences in the atmosphere of the research laboratory sharpened my critical and analytical thinking skills, as well as provided me the opportunity to directly apply knowledge gained from my science courses. In addition, I gained a new perspective on the drive to persevere and a keen resolve to learn from my mistakes. Furthermore, research provided me a platform to interact with others in the scientific community and learn about their studies through events on campus. I gained the opportunity to present information on undergraduate research, including my own, at Preview session held for incoming freshmen to the university. With a solid background in research, I hope to carry on what I learned and apply it to my future in health care.
I chose my potential mentor, Dr. Maureen Goodenow, when looking for a professor to interview for the HHMI Undergraduate Science for Life course. Because of my interest in HIV and AIDS, I was looking for a professor that specialized in research based on immunology and pathology. Dr. Goodenow matched the description perfectly. After the interview, I was even more interested in pursuing research in Dr. Goodenow’s lab. Her long-term experience in the field of HIV and AIDS, her world-renowned accreditations, work with pediatrics especially in the Gainesville area, and her collaborations with other professors at both the University of Florida and University of South Florida, are all reasons that working in Dr. Goodenow’s lab will be an incredible experience.

I will begin research this summer, and plan to continue for a minimum of a year. However, as research is a continuous process rather than a predetermined amount of time, I plan on continuing for as long as possible, including the duration of my undergraduate career and beyond. I will integrate research into my coursework by starting my research this summer very rigorously. I will not be taking any classes and devoting 40 hours a week to learning the basics of working in a lab, gaining knowledge on the material, and working on the project. I will then be more prepared to balance both a full time schedule and research in the fall.

I believe that doing undergraduate research, as well as being a part of the HHMI program, would be beneficial for a variety of reasons. First and foremost, I have been interested in pursuing research for the past few years, and I am very much so looking forward to this particular project and topic. In general, undergraduate research will allow me to apply what I am learning in my courses, greatly enhancing my educational experience.

Furthermore, research will give me a better idea of what I am interested in and therefore allow me to make a more educated major, and ultimately, career choice. I am interested in attending medical school after graduation and believe that the research I will be doing will allow me to succeed in higher level education and in the medical field because research in a laboratory is a more professional setting than that of a classroom. Research will also allow me to refine my time organization skills which I will be able to utilize during medical school as well as my career. Lastly, being a part of the HHMI program would be increasingly beneficial to my UF experience and later plans because it enhances my research opportunities, such as extramural research and the opportunity to work with other HHMI professors on related projects.

Abstract

Suppression of HIV-1-Associated Innate Immune Activation

Reist C, Wallet M, Goodenow M

In the progression of HIV-1 infection, depletion of CD4+ cells is the primary mechanism of HIV-1 induced immune deficiency. Previous studies have demonstrated the role of HIV-1 associated systemic immune activation in CD4+ T cell depletion (1,2). Chronic immune activation contributes to immune exhaustion and eventual progression to AIDS (3). HIV-1 associated innate immune activation is also associated with long term illnesses, such as HIV-associated neurocognitive impairment [NCI], including HIV-associated dementia [HAD] (4,5). Initiation of antiretroviral therapy [ART] restores CD4+ T cell number and function; however some aspects of immune activation persist, most notably activation of innate immune cells such as monocytes and macrophages (6).

Protease inhibitors [PI] are a key component of antiretroviral therapy [ART] designed to suppress HIV-1 replication. PIs also may have effects on the host cells that are independent of their antiviral effects. We found that a specific PI, nelfinavir [NFV], has anti-inflammatory properties in vivo, which could be useful in treating HIV-associated innate inflammation. This study was conducted to investigate the mechanisms of NFV’s anti-inflammatory properties ex vivo. The results show that NFV has the capability to inhibit lipopolysaccharide [LPS]- induced macrophage activation, as measured by secretion of the inflammatory cytokine tumor necrosis factor [TNF] (TNFSF2, TNF ). This inhibitory property of NFV was observed in both primary human macrophages and macrophages that were differentiated from the human monocytic tumor cell line THP-1. Inhibition of macrophage activation was unique to NFV as two other PIs, indinavir [IDV] and ritonavir [RTV], did not inhibit TNF secretion. To investigate the mechanism by which NFV blocks inflammation, the signaling pathway downstream of the primary LPS receptor toll-like receptor 4 [TLR4] was studied. We found that NFV mediates its inhibition by blocking activation of the protein MEK 1/2 but not ERK 1/2, p38, JNK or NF B. These novel findings could have a significant clinical impact because NFV’s anti-inflammatory properties may be useful in treating HIV-associated inflammation as well as other inflammatory illnesses.

Personal Statement After Starting Science For Life Award

Participating in my project this summer and continuing into the fall has been an extremely enriching and fulfilling experience. The people I have learned from and the knowledge I have gained are incomparable to any educational experience in the past. Every individual in the lab has contributed in my training, which is something that I have greatly appreciated about this lab in particular. This past summer has greatly benefitted my education as a whole because I have seen how information from every science and math class I have taken at the University of Florida thus far is incorporated into a scientific environment. Because of my positive experience this summer, I wish to continue doing research throughout my undergraduate years, and continue it throughout my higher education. Among other future plans, I am most interested in performing research outside of the University of Florida so that I can have experiences in other labs outside of the one I am currently in to learn new techniques and be a part of new projects.

The past few months I have learned a tremendous amount about the immune system and Type 1 Human Immunodeficiency Virus. Also, I have learned lab techniques that I would not be able to do in class labs as a sophomore, such as working in the hood, culturing and maintaining a cell line, and running ELISAs. Furthermore, I have acquired techniques in the design of experiments, as well as data analysis. All of this would not have been possible if it were not for my amazing mentors, Sofia Appelberg, Dr. Mark Wallet, and my PI, Dr. Maureen Goodenow.
Personal Statement Before Starting Science For Life Award

If granted this research opportunity, I plan on devoting my summer to work full-time on determining the effects of stem cells on brains who have suffered from hypoxia. When the fall term starts up again, I hope to plan research around my schedule and on weekends. I have so far been able to manage my schedule around doing research with Dr. Brandi Ormerod. This past summer, I not only took two summer courses but I had a summer job and did research in the lab. In addition, I have been able to continue doing research while maintaining a full course load including three design projects for my classes. I understand the amount of work that is needed in order for an experiment to be successful and plan on managing my time in an efficient manner. I hope to devote the remainder of my time at the University of Florida on this project. The project should take about twelve months to complete including a publication if my research proves successful. I welcome any opportunity to further my research and shed light on an area that affects thousands of people every year. I have spoken to Dr. Ormerod about the amount of work that goes into getting a publication and intend on working very hard to achieve that.

I am interested in Biomedical Engineering and feel this award would give me the opportunity to gain more experience in an area that I would like to pursue. Currently I am in my third year of Materials Science and Engineering and intend on specializing in biomaterials. When I complete my Bachelor of Science I plan on pursuing a Doctor of Philosophy in Biomedical Engineering and furthering the research I am proposing. I chose Dr. Brandi Ormerod as my mentor because her lab is doing research in stem cell research. I chose Dr. Brandi Ormerod as my mentor because her lab is doing research in stem cell research. I have already learned so much. Also, I felt working in Dr. Ormerod’s lab would allow me to experience an aspect of Biomedical Engineering that I have always been interested in.

I selected this project because I am interested to see what effects, if any, stem cells have on the brain. In addition, stroke is something that has affected my family. My grandfather, who is one of my role models, has suffered from several minor strokes. It has greatly affected his movement and his general demeanor. It is painful to see a man who not only has a Civil Engineering degree but a law degree and who has sung opera professionally at the Chicago Lyric Opera House slowly lose function of his own body. Furthermore, my father was recently hospitalized with high blood pressure. If it had gone unnoticed he could have suffered a stroke. Thousands of people suffer from strokes every year and have to live with the effects of it. Furthermore, stem cell research is an area that still needs plenty of attention. There are many theoretical benefits for stem cells but not enough research to prove that stem cells can work in reality. Stem cells have the ability to differentiate into just about any cell. The research I am proposing hopes to see if these cells can replace dead cells and repair a damaged brain.

Abstract

Developing a microelectrode array model for investigating how neural progenitor cell addition influences recovery from oxy-glucose deprivation (stroke) in cortical neurons

Rocher CM, Stephens CL, DeMarse TB, Ormerod BK

Transplanted adult neural stem cells could potentially repair brain tissue damaged by hypoxia, for instance, in victims of stroke. However, the effect of adding new cells to damaged brain networks has been difficult to interpret because the extent of injury and recovery can vary in subjects. Here we develop a biologically relevant in-vitro model of stroke, in which microelectrode array (MEA)-plated neurons are exposed to oxygen and glucose deprivation (OGD) before the addition of neural progenitor cells or conditioned media. The MEAs permit us to examine the electrophysiological changes that occur following stroke in 60 locations within the culture. In a preliminary experiment exposing fetal rat cortical cells to OGD (glutamax free DMEM and incubation in 1%O2 and 5% CO2) or maintained under normal conditions for 1, 2, or 3h, we determined that 3h of OGD exposure was optimal in that it produced 50% cell death. We then plated dissociated corti-
Personal Statement Before Starting Science For Life Award

As a student assistant in Dr. David Oppenheimer's lab since the beginning of the Spring 2009 semester, I have been exposed to a variety of molecular biology laboratory techniques. My hands-on experiences with many of these tools have allowed me to gain subtle insight into the basics of their research methodology. Through the HHMI Science for Life program, I hope to gain even more wisdom in the scientific research process. Dr. Oppenheimer's lab incorporates my interests in using cell biology research as an instrument to medical progress. I hope to receive a more in-depth view of science as it pertains to the real world.

The HHMI Science for Life program will enable me to grasp a more accurate view of the academic research world. It will enlighten my perception of the process of scientific research and set the foundation to my future endeavors. My aspirations involve bridging the gap between research and medicine through translational research. I realize the major time commitment the HHMI Science for Life program entails, and I am both excited and prepared to take on the challenge. I plan to allocate a certain amount of time each week to scientific research and to my coursework activities in order to fulfill both obligations.

The HHMI Science for Life program will provide me with an in-depth, hands-on understanding of the scientific research process and will abet my scientific and career oriented pursuits after undergraduate school.

Abstract

RPA1, a novel regulator of plant actin depolymerizing factor (ADF)/cofilins, is required for normal actin organization in plant trichomes.

Roney J, Grey PH, Oppenheimer DG

Actin cytoskeletal remodeling underlies many cellular processes including intracellular motility and membrane trafficking. Actin assembly and disassembly depends on the interactions of actin monomers with various other proteins. Actin-depolymerizing factor (ADF)/cofilins are a family of proteins that bind actin monomers to initiate the severing of actin filaments. Members of the ADF/cofilin family play a central role in the regulation of actin dynamics. However, the mechanism of ADF/cofilin regulation remains poorly understood. Here we show the impact a novel Regulator of Plant ADF (RPA) has on the actin organization in plant trichome shape mutants. Fluorescence confocal microscopic analysis of the actin cytoskeleton in rpa1 mutants shows grossly aberrant F-actin distribution in developing trichome cells. In the later stages of development, we observed the presence of an “actin knot” with many actin rings near the nucleus, suggesting that the absence of the RPA1 protein leads to an over accumulation of F-actin. Our findings demonstrate the importance of the RPA1 protein in the actin organization in plant trichome cells.

Personal Statement After Starting Science For Life Award

Over this past year as an undergraduate at the University of Florida in the HHMI Science for Life program, I found myself passionately engaged in the expansive world of cell biology and genetics research. I enjoy the thought processes involved in the research experience and its implications to the real world. Through the HHMI Science for Life program, I have developed new perceptions of what research is really like. I have witnessed that scientific research is not all about making groundbreaking discoveries. Rather, scientific research can more accurately be depicted as a process with many setbacks; setbacks that all researchers come face to face with on a daily basis. I believe that these setbacks are what define scientific research. However, the great ability to navigate around these setbacks enables researchers to make those big discoveries in time. It is to this perspective that I wholeheartedly embrace today as a new member of the scientific research community.

The HHMI Science for Life experience has positively impacted my life at the University of Florida. Both personally and professionally, I have gained a lot from this program. I have sincerely enjoyed every moment in Dr. David Oppenheimer’s lab. I went into this program only hoping to uncover the untold stories of the research world. However, this experience has provided me with more than words could ever express. I have deeply explored the many facets intimately woven within the undergraduate research process and have been able to think more critically when confronting tasks both inside and outside the laboratory. Although I have not grasped the practice in its entirety, I look forward to the breadth of scientific research that lies ahead.
I am a second year pre-medical student pursuing a major in Neurobiological Sciences, an Interdisciplinary Study and I plan to integrate the HHMI Undergraduate research award into my school curriculum. The Science for Life (SFL) research program can give me the opportunity to work with a faculty mentor on a research project of my interest. The SFL program can also act as a supplement to my education outside of the classroom. In addition, I believe the SFL program will provide both research experience and professional skills development that can last a lifetime.

My goal after graduation is to attend medical school and I am considering pursuing a dual degree (MD/PhD). For my research mentor I chose Dr. Brent Reynolds because of his research interests. I am mostly interested in performing research on the cellular and molecular level, particularly pertaining to the study of the nervous system and having a potential application in the field of medicine. The project that I will be working on focuses on tumor cells with neural stem cell properties that exist within central nervous system tumors, primarily in grade IV glioblastoma multiforme. Furthermore, I plan on working on this research project for the next two years until I graduate. I also plan on working on my research project during a summer at the University of Florida. This way I will be able to devote more of my time to focus on the project and learning what it is like to be a scientific researcher working full time. In terms of opportunities, the SFL program can offer and an abundant amount of opportunities to present my research at national meetings and potentially publish a peer-reviewed scientific paper. I believe a program such as the SFL research program can benefit my education and open many doors for me to learn about science and research. It can also benefit my long term career plans by helping me become a better rounded professional in the future.

Abstract

Neuronal Sparing and Repair after Hypoxic-Ischemic Encephalopathy in an in vitro model of the Developing Brain

Salgado AD, Azari H, Rossignol C, Reynolds B, Weiss MD

Although major advances have been made in understanding the cellular mechanisms of brain injury, neuronal sparing and repair after Hypoxic-Ischemic Encephalopathy (HIE) remain a significant problem in neonates. 1. 2. Treatments targeted to interrupt the ischemic cascade have shown mixed results in animal models and unpromising results in clinical trials, with the exception of hypothermia demonstrating improvement in neurodevelopmental outcomes in neonates with mild to moderate HIE. 1. Stem cell therapy offers a potential regenerative approach to replace damaged neurons and glia, and provide diffusible (neurotrophins) and non-diffusible factors (cell-to-cell contact guidance) in rebuilding neural circuitry in the developing brain. The proposed research project has two specific aims: (1) establish an in vitro model of HIE and (2) investigate the potential regenerative characteristics of an isolated population of neural stem cells (NSCs) in an in vitro model of HIE. Challenges in using NSCs for transplantation exist however, and problems that will be addressed in this proposal are cells dying post-transplantation and an inability to isolate true stem cells. To avoid these issues, we will use a method developed by the Reynolds lab for the generation and enrichment of neurons from a mixed population of NSCs, allowing for these cells to be isolated in culture, expanded, and their progeny characterized in promoting endogenous cell survival post-transplantation. In collaboration with the Weiss lab, oxygen-deprivation chambers will be used to reproduce HIE in vitro and various degrees of injury in mouse primary neuronal cultures and NSCs will be characterized and studied. Transplants of isolated NSCs will be used at each degree of injury and the concentration and timing of transplantation will be two variables under assessment. The results will assist in narrowing the clinical variables allowing for a well designed focused in vivo experiment utilizing an in vivo model of HIE for future studies. These future in vivo experiments will verify the power of the in vitro model in predicting in vivo results. The potential if a parallel is proven is powerful since performing experiments utilizing many variables in an animal model is logistically prohibitive.

References:


Personal Statement After Starting Science For Life Award

Conducting research during my undergraduate years has been an extraordinary experience and participating in research programs such as the HHMI Science for Life program has allowed me to complement my curriculum with a rigorous and engaging research project that has furthered my interest in conducting research as I pursue a career in medicine. Working on my senior thesis this past year has given me a sense of independence and accomplishment that I never would have received from solely taking classes in my undergraduate coursework. Along the way I have gained a better understanding of the biology of neural stem cells and their application in improving brain function in various states of injury and disease. In addition, I have learned exciting lab techniques including tissue culture, flow cytometry, neurosphere assay, LDH assay, and immunocytochemistry. As an IDS and pre-medical student, I hope to use these lab techniques along with the critical thinking skills I have attained from conducting research in the future in my medical career. Moreover, I plan on conducting research after I graduate and prior to attending medical school, as I believe this will be a great opportunity to gain further research experience and potentially explore other research interests of mine. I believe my experience in the lab and participating in SFL has not only benefited me but other first-year students interested in conducting research, as I have had the opportunity to talk and interact with many first-year students living on campus about my research project, due to the fact that I am a resident assistant in the residence halls. There is no greater satisfaction than helping and guiding others that share common academic and research interests with me and I hope to continue doing so throughout my life and in my career. I am grateful for the support of HHMI and my two faculty research mentors, Dr. Reynolds and Dr. Weiss who have provided me with guidance and leadership. I’d also like to thank Hassan Azari, Candace Rossignol, and Maria Caldeira for their assistance in helping me conduct this project.
I plan to be involved in biomedical research even after I graduate from the University of Florida. During my undergraduate career, however, I will write a research thesis, create a poster presentation of my project, co-author on a peer-reviewed publication, and possibly travel to various national meetings and conferences where I can present my poster.

Initially, finding an area of research and a research mentor compatible with my interests was very difficult. I e-mailed my résumé to a number of primary research investigators and I got a few interviews. My first prospective laboratory allowed me to work in the lab for a week before I decided. Throughout this trial week I interviewed with Dr. Paul Reier in the Department of Neuroscience. Dr. Reier and Dr. Lane’s laboratory facilities as well as the area of research, Spinal Cord Injury (SCI), impressed me. When I emailed my résumé to Dr. Lane, I stated that I was specifically interested in glial and astrocytic response to SCI. During my interview, Dr. Lane stated that he had tissue ready if I wanted to begin. I knew that Dr. Reier’s lab was the perfect lab for me.

Dividing time between research and coursework activities during the school year is a difficult task. When I joined Dr. Reier and Dr. Lane’s team it was very important that I commit at least 10 hours a week to the lab. Dr. Reier’s lab was looking for a committed undergraduate that would be able to write a thesis paper and co-author at least one scientific publication. I reassured both Dr. Reier and Dr. Lane that although I could only commit the minimum 10 hours a week, summer semester would allow me to devote an absurd amount of time to my project. Amused, they decided to give me the opportunity to be a part of SCI research in their lab. By committing 40 hours each week in the summer, my research project will generate the momentum necessary to accomplish both coursework and research activities during the regular academic school year. Furthermore, the Fall I plan to do research for credit, allowing me to devote needed time to my paper and poster presentation. My hope is to expand the paper that I will be writing in the summer and fall semesters into a thesis paper.

When I arrived at UF I decided that I would be a History Major with a French Minor in the Pre-med track. I have completed all the science pre-requisites with the exception of Physics II (which I plan to take in the summer) and Biochemistry. I also plan to take many of the extra science electives, like Genetics and Physiology. Other than science, my passion lies in history. I plan to concentrate on contemporary European history. I have a particular soft spot for Soviet Russia. Moreover, my French minor allows me to become fluent in the language and learn French culture and history as well.

Abstract

Astrocytic Response to Contusion Injury
Sanchez D, Lane M, Reier P

Following a spinal cord injury (SCI), glial cells become activated and migrate to the site of injury site. Accumulation of astrocytes at the lesion edge forms a scar sealing off the injury site (see Figure 1). In the process, however, scar formation also represents a physical and molecular barrier to regeneration of the spinal cord (Reier and Houle 1988; Eng, Reier, and Houle 1987; Reier 1986). This research project examines the extent of astrocytic activation in an adult female rat after a lateralized contusion in the cervical spinal cord (neck region) and whether a combination transplant/ drug delivery treatment can attenuate scarring. This treatment capitalizes on 1) results by our laboratory (Howland et al. 2010; Reier et al. 1988; Reier 2004) and others (Nikulina et al. 2004; Lepore et al. 2005), showing that neural progenitor transplantation can promote recovery of respiratory activity following cervical injury and 2) the use of an FDA approved drug – Rolipram – shown to have reparative effects following SCI (Beaumont et al. 2009; Hannula and Filbin 2008; Pease et al. 2004; Nikulina et al. 2004). I will be using a range of immunocytochemical techniques to examine the distribution of astrocytes after injury and the expression chondroitin sulphate proteoglycans (Lemons, Howland, and Anderson 1999) associated with the glial scar. The results from these experiments will establish the extent of astrocytic accumulation in a clinically relevant injury model and will effectively evaluate the ability of two promising treatment approaches to reduce glial scarring.

References:

I believe that the Science for Life HHMI Undergraduate research program at the University of Florida is an exquisite program for up and coming undergraduates. Through the hard work and dedication required by this program I hope to contribute to the scientific community and increase our understanding of the complex world we live in. The knowledge and skills that I learn working in the lab will carry throughout my undergraduate career and far beyond. The in-depth research that I perform will be the stepping stone for my career in the field of medicine & medical research. What I learn from working alongside doctors, PHD’s and PHD students will be invaluable for my goals and aspirations in life, which is to obtain a combined MD/PHD degree and make my indelible mark on society.

The process of finding a research mentor all started during the summer of my freshman year when I began looking into undergraduate research on the honors website. I was struck by the enormous amount of research opportunities that were available to me. Almost each and every science based research opportunity that I found intrigued me. At one point I felt almost overwhelmed, but then I found out about the research that Doctor Chan was conducting. His research seemed interesting and thought provoking and was in the field of medical science, which is exactly the field that I wanted to work in since that is where I see for my future career. The research in his lab has the potential to have a resounding effect on the way we screen, detect, and treat autoimmune diseases such as cancer, lupus and arthritis.

I plan on working on this research project for approximately one year or more and hope this project will expand my skills and increase my proficiency of lab techniques, so that I can continue to do research in doctor Chans lab at least until I finish my undergraduate studies and possibly for PHD research as well. Overall, I am already accustomed to time restraints and balancing my academics with extracurricular activities. I am very well organized and plan most things in advance. I have already balanced doing research in doctor Chan's lab since the middle of last semester along with my academics and the activities of a pre-health club quite proficiently. I am a self motivated person and have an innate drive to do the best that I can at anything I put my mind to. Thus, my grades will continue to be consistent and conducting this research will only help to further my academics.

If all goes well with this research project doctor Chan is confident that there will be future research opportunities available to work alongside PHD students with the potential opportunity to co-author scientific papers. All in all, I believe that this research project will be an amazing opportunity to learn new invaluable lab techniques, be part of the scientific process, and contribute new scientific knowledge to society that has the potential to create new diagnostic tests for autoimmune diseases and possibly even treatments.

Abstract

NANES Antinuclear autoantibodies Study on First U.S. Representative Population Sample
Simmons B, Chan EKL

Antibodies are an integral part of the immune system with an estimated 1x10^9 possible different antigen specific antibodies they pose as a powerful defense against would be foreign pathogens such as viruses and bacteria. However, when antibodies go awry and mistakenly target the body's own tissues for destruction by lymphocytes then they are deemed as autoantibodies. If the body continues to produce autoantibodies then the condition is deemed as an autoimmune disease. Many diseases such as Rheumatoid Arthritis, Lupus, and cancer are caused by an autoimmune response or express an autoimmune component.

The NHANES project is the first of its kind; to test 5000 individual’s sera from across the United States to determine whether autoantibodies are more frequent in the general population than what is previously suspected and whether there is an increased correlation to these autoantibodies with an increase in age, and if these autoantibodies are more prevalent in females and minority ethnic groups.

To accomplish these tasks immunofluorescent tests for antinuclear antibodies will be used to test all sera samples. Then titers will be determined for the high intensity samples, and will be tested using Immuno-precipitation (IP) test, and by western blotting to determine common bands of proteins within samples. Finally, ELISA and Luminex will be used to identify autoantibodies within high intensity samples. The preliminary results show that there is an increase in autoantibodies within the general U.S. population. However, continued screening of the remaining sera is required before a clear indication can be made as to the prevalence of the various autoantibody patterns and an overall assessment of the U.S. population can be made. From introspection of the data, there appears to be a higher prevalence of autoantibody patterns in the general population, but the data is currently undergoing statistical analysis by the NIH to determine if the results are statistically valid.

Personal Statement After
Starting Science For Life Award

Through participating in this project I have learned that what ends up in our textbooks has taken a lot of time and effort to get to where it is. I have gained a new appreciation for research and the scientific process. For instance to create one immunofluorescence picture of a cell with only a two color staining takes approximately 4-5 hours to accomplish. If you want to do a Western Blot to look at proteins within a sample the whole process can take up to 3 days to accomplish that's not including the time for interpretation of the data. Thus, I’ve learned that it takes a tremendous amount of time and effort to unearth new discoveries in science and increase humanities knowledge.

Thus far I have learned multiple lab techniques and the science behind them. I learned how to do immunofluorescence and the preparation required to turn a patient’s sera into a beautiful florescent image. Recently, I have learned how to make a cell lyses used to run gels. In addition, I have successfully learned the Western Blotting technique to determine similar protein banding patterns within patient’s sera. This experience over the summer has benefited me greatly, now I have an intimate understanding of the many cellular structures within cells, what they do, and what they look like under a microscope. In addition, I have honed valuable lab skills to work successfully not only in the research lab, but these skills will be able to help me greatly in my advanced microbiology labs that I will take in the future. As of now my experience this summer has gave me a taste of the world of research and has given me insight to what a career in research might be like if I wish to pursue that career path.
Personal Statement Before Starting Science For Life Award

I was given the opportunity to conduct research during the summer of 2008 at the University of Florida’s Student Science Training Program (SSTP), a seven-week intensive research program that pairs high school students with distinguished UF faculty members. I was able to share my independent research with each student and faculty member by giving a final oral presentation, creating a poster, and writing a paper. I was rewarded the “Best Paper” at the end of the program. During SSTP, I worked under the direction of Robert McKenna, PhD, in the department of Biochemistry and Molecular Biology. While there, my laboratory skills were fine-tuned as I learned new techniques such as setting up and running SDS-1D protein gels, centrifugation, protein purification, and crystal tray preparation. I worked on the isolation and purification of the secretory enzyme human carbonic anhydrase VI in order to solve its structure.

The molecular weight of the protein I purified was close to the molecular weight of α-amylase, and the sample was determined to be inactive with respect to carbonic anhydrase, leaving us with the hypothesis that instead of hCA VI, I actually purified α-amylase. Even though my results were inconclusive, I left UF that summer understanding that groundbreaking results aren’t what research is all about.

Abstract

Effect of Combined Temperature Stress and Oxidative Damage Induced by Xenobiotic Juglone on Survival in Caenorhabditis elegans

Breanna Sipley
Freshman
Mentor: Dr. David Julian, (Zoology)

Organisms respond to stress on the cellular level by way of enzymes that repair and protect cellular macromolecules from injury. For example, cytosolic superoxide dismutase, which catalyzes the dismutation of superoxide into oxygen and hydrogen peroxide, consequently protecting cells from superoxide toxicity, is upregulated in response to oxidant stress (Adler et al., 1998). Significantly less is understood about the effect of interactions between multiple abiotic stressors on these stress responses or organismal health, in general, however. To address whether multiple abiotic stressors interact, we test for possible interactions between temperature stress and oxidative damage induced by Juglone, a xenobiotic oxidant-producing chemical, on Caenorhabditis elegans survival. The purpose of this preliminary study is to develop maximum and minimum stress tolerance boundaries that will become useful in future experiments investigating how gene expression may regulate cellular defense to stress. Preliminary data indicate a synergistic interaction between temperature stress and oxidant-producing Juglone concentration (Figure 1).

Figure 1: Effect of Increased Juglone Concentration in Combination with Temperature Stress on Survival in C. Elegans. 2 h & 15 min stress exposure to ~ 10 individuals/50 μL/well in 96-well plates; washed with Bio-Tek 8 way head strip Plate Washer after exposure; SYTOX added at 2.5 μL & incubated for 20 min at 20°C (control temperature); imaged with inverted epifluorescence microscope; ratio of unstained/total worms taken and presented as survival.

References:

Personal Statement After Starting Science For Life Award

I’ve mentioned previously that I like the challenge of embarking into unknown territory, of making discoveries and mistakes, of realizing that everything we think we know could be wrong. I’ve claimed that for these reasons I have such a strong affinity towards scientific research. This is, without doubt, still true, but the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

It’s safe to say that many times my experiments have not panned out, culminating with some unforeseen problem rendering collecting meaningful data seemingly impossible. For instance, Tim Crombie, a graduate student in my lab, and I have been stumbling this summer to begin working with C. elegans, a new model organism for our lab. After finally becoming comfortable culturing and synchronizing C. elegans, getting dependable fluorescent staining for death, and setting up our robot to handle them for high-throughput screening, we decided it was finally time to set up a fully factorial experiment to test for interactions between multiple stressors on survival in C. elegans. We were pretty excited to finally plan an experiment to get meaningful data, but, of course, it didn’t exactly work out as planned: we couldn’t get reliable staining of death from combined oxidative and temperature stress exposures. We ran a handful of different experiments to try to figure out why, and just when we thought we figured out the problem and fixed it, another would arise. Murphy’s Law rang true: anything that could go wrong, did.

You could imagine this might get quite discouraging. Admittedly, I’ve had a few existential crises and debated why I was subjecting myself to such torture, consistently setting myself up for failure. Countless times I’ve pondered simply throwing in the towel and exclaiming, “I’M DONE!” Eventually, though, after many exhausting days ending with, “I guess it’s back to the drawing board,” we would catch that glimmer of hope. Although sometimes ever so faint, that glimmer reminded me of my ultimate goals, both professionally (to obtain a Ph.D.) and personally (to answer my own questions first-hand through research).

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.

Every new problem I ran into, I was fueled with that much more fervor to overcome it. I’m more aware than ever that I pine for that challenge. I firmly believe that at every new setback, at every new question asked, lies the possibility of realizing something new. Because of this, I’m largely grateful of my remarkable failure to find my own path. Despite the fact that research isn’t just fun and games nor particularly glamorous, for that matter, has been beaten into my head pretty brutally this summer.
Brittany Sorenson
Sophomore
Mentor: Dr. Nicholas Simpson, (Medicine)

Personal Statement Before Starting Science For Life Award

“Here, want some cookies?” I asked Lauren, a fellow pre-medical student that I had just met at a friend’s house. “Sure,” she replied, “let me just pull out my FlexPen. Those look really good.” After injecting herself with the insulin contained in the FlexPen, Lauren was free to enjoy the food that all of us took for granted. While researchers have made many advances in lessening the effects of diabetes, serious complications still frequently occur, including eye, kidney, and heart disease. While man-made regulation of blood glucose levels can closely mimic the body’s natural regulation, it cannot match the precision of the endocrine system.

For this reason, I was excited to hear Dr. Nicholas Simpson speak to my Science for Life class about his research in creating a bioartificial pancreas. I was even more excited when, for Summer 2009, I was accepted as an undergraduate researcher in his lab. For the past year, I have been learning what research is all about. My project dealt with determining mitochondrial function of various cell lines using indicator dyes and Microplate readers. I learned many skills essential to performing research, including sterile techniques, mammalian cell culture, protein assays, and flow cytometry use. The research process has continually emphasized the beauty and complexity of the human body. I have also learned that research is a meticulous process. The fruit of labor often does not come for years. However, this makes the fruit even sweeter when it finally arrives.

As a pre-medical student, I know that research is key to furthering our understanding of the complexities of the human body. Research is essential to the progression of medicine. For this reason, I hope to continue to do research after my undergraduate career. I plan to attend the University of Florida medical school, where the importance of research is highly emphasized. By doing research now, I am learning techniques essential to the furthering of my future career.

The opportunity for research is one of the main reasons I chose the University of Florida for undergraduate studies. UF offered not only a fantastic science curriculum, but a plethora of opportunities to perform research, with a teaching hospital just down the hill from campus. Doing research in Shands is not only a priceless opportunity, but extremely convenient. As a sophomore, I plan to continue to do research in Dr. Simpson’s lab for the rest of my undergraduate career, and possibly into medical school. The bioartificial pancreas project that I will be working on is showing exciting progress, and I plan on working on this project for the duration of my undergraduate career at the least. If the project continues progressing at its current pace, a co-authored publication on our findings is possible in the near future.

Over the past year, I have fine-tuned many of my time-management techniques to be able to include research in my schedule. While this requires sacrifice and planning, it is worth the opportunity to gain this priceless experience. While the HHMI Intramural Research Program will require even more of my time, it will also provide even more opportunity. I am excited at the prospect of presenting posters to share the advances of my laboratory with other members of the scientific community. I plan on scheduling my classes to leave a few large blocks of time dedicated to the research lab. I am also excited about the prospect of applying to the Extramural Program in a year. Dr. Simpson collaborates with a lab at Georgia Tech in Atlanta, and I would love to be able to see another facet of research at the laboratory there.

In conclusion, I am very dedicated to the research that I will be performing in Dr. Simpson’s lab, and am excited about the work that I will be doing with the bioartificial pancreas construct. I would greatly appreciate the opportunity to experience all the HHMI Undergraduate Research Award has to offer.

Abstract

Development and optimization of a bioartificial pancreatic construct

Sorenson B, Simpson NE, Beveridge MJ, Meelem S, Corrado M

The goal of my research is to develop a bioartificial pancreatic construct as a means to reverse hyperglycemia in animal models. The eventual aim is to implant this construct into human patients with type 1 diabetes mellitus in order to maintain normoglycemia in these patients.

For current research, the construct (Fig.1) is implanted into the peritoneal cavity of female C3H/HeN mice. This bioartificial pancreatic construct consists of insulin-secreting TC-tet mouse cells enclosed within bioinert materials. The cells are entrapped in beads made of 2% low viscosity, high mannuronic-content alginate (LVM). These beads are then gelled into a polydimethylsiloxane (PDMS) ring using 2% low viscosity, high guluronic acid-content alginate (LVG). This combination allows for good cell growth, containment of cells, NMR monitoring of cell viability, and no host immune response. After implantation, the cells within the construct sense the recipient’s blood glucose levels and respond by secreting insulin in appropriate amounts. Our in vivo studies have allowed us to optimize the construct’s efficacy through management of cell numbers, construct materials, and other controlling factors.

Figure 1: The bioartificial pancreatic construct with its top layer removed. Beads that could contain insulin-secreting cells are stained blue.

Personal Statement After Starting Science For Life Award

Participating in research has been one of the most fulfilling and beneficial activities that I have participated in while at the University of Florida. After being in Dr. Simpson’s lab for a little over a year, I now feel like I have my own “research family.” When I first began, I knew very little about approaching research scientifically. I did not know much about the research process, methods, or even how to work steriley. I have learned so much about science over the past year.

In particular, over the last summer as an HHMI Scholar, I learned that research can be intense and exciting or slow and methodical, often within the same week. I acquired many skills that will transfer not only to my future medical career, but also to life in general. Whether completing simple tasks like recording data in Excel or performing an exciting surgery, I am so grateful for the set of skills that I have learned through research.

Even more important than the acquired skills are the approaches to problem-solving that research has taught me. Research taught me to question and observe much more than any of my lecture classes ever did. Research does not only ask “How?” but “Why?” Interacting with Dr. Simpson and the other members of the lab helped me to understand scientific questioning.

I also enjoyed the social aspect of being in a lab. Interacting with professionals in the field was not only enlightening, but fun. Whether playing musical instruments at lab get-togethers or doing lab work, I really enjoyed interacting with my fellow lab members.

I am so excited to continue my research over the next year. As a member of both the Science for Life Program and the Junior Honors Medical Program, I will be presenting a poster as well as writing a thesis. While this will be a challenging task, I am looking forward to facing the challenge with the invaluable knowledge that I have acquired through research.
Personal Statement

Before

Starting Science For Life

Award

I had always intended on participating in research while completing my undergraduate degree, but I never imagined that I would already be comfortable in a professional lab this early in my schooling. When registering for courses before my first semester, I overheard people discussing the Science for Life course and knew it would be one of my top choices. I considered this the perfect way to find out about and get myself involved in research on campus. This assumption was the best one I could have made.

As I scrolled through the different HHMI mentors, I tried to choose ones that were doing research that interested me, in hopes of finding a laboratory that I could happily work in for the rest of my time here at UF. Dr. Chen was the third mentor I interviewed with. The research being completed in his lab caught my attention and throughout our interview he seemed excited about my interest in his work and was very open and willing to have me join him in his research. I felt very welcome and comfortable in the lab and was definitely able to envision a long-term work experience there. I was impressed with the achievements many of his students have made.

Dr. Chen’s research concerns plant biochemistry and proteomics, which is of great interest to me. Although my major is Chemical Engineering, seemingly unrelated to this topic, I love biology and plan to continue my schooling through a Ph. D. in Biochemical Engineering. With this, I hope to perform research concerning environmental sustainability. In my opinion, the skills I am acquiring in this lab will be of immense use to me as I progress through future schooling and work. The research is also of great importance to agriculture and human health. In this lab, we are determining the functions and correlations of several proteins within plant material. There are many plausible applications of this knowledge. I believe I will be working with similar materials and equipment for the much of my laboratory career.

It can be difficult to arrange a comfortable schedule around classes, schoolwork, and working in a lab. Thus far, I have had no great trouble; it is just a matter of sorting priorities and keeping a good line of communication with your HHMI mentor. I generally go into the lab about four to five days each week and, for the most part, I can decide at what times and on which days. If there is ever a conflict I cannot come in, I am always free to speak with Dr. Chen and work out an alternative schedule. He is extremely understanding when it comes to exams and schoolwork as long as I do my part and accomplish what I need to.

I can efficiently and effectively complete most of the laboratory protocols by myself at this point and am doing much of the experimentation for this research, which is necessary to become a co-author when it comes to publication. If the research goes well, which is highly likely, it will lead to presentations at scientific conferences and publications in professional journals. We currently have an abstract prepared for presentation at the 1st International Conference on Analytical Proteomics in Portugal from September 29th to October 3rd 2009. I feel confident that I will be successful in my lab research, and I do have thoughts of competing for Science for Life extramural research opportunities in the future.

Abstract

Cloning and Functional Characterization of Thioredoxin Systems in Guard Cells

Strul JM, He Yan, Pang Q, Chen S

Guard cells (GC) are highly specialized epidermal cells that border tiny pores called stomata on leaf surfaces. GC rapidly change volume and shape so that the pores open or close in response to environmental signals, thus regulating CO2 uptake and water vapor loss. CO2 uptake is the starting point for all plant biomass production, including that for food, shelter, and biofuel production. During drought, the phytohormone abscisic acid (ABA) triggers GC responses that inhibit stomatal opening and promote stomatal closure, thus minimizing plant water loss. It is known that ABA and other phytohormones such as jasmonic acid (JA) regulate stomatal movement through reactive oxygen species, which can lead to oxidative stress. Our proteomics data indicate that guard cell thioredoxins are responsive to the oxidative stress. However, our knowledge of the detailed function of thioredoxin in guard cells is very limited.

To fill in this important knowledge gap, we have cloned three genes encoding different types of thioredoxin proteins, i.e., thioredoxin m, f and h, as well as a NADPH thioredoxin reductase (NTRC) in Brassica napus guard cells. The genes were cloned into PET28a vectors using PCR and sequenced to confirm fidelity. Then, they were transformed into an E. coli strain BL21 for expression. The culture conditions for optimal expression of each of the proteins were obtained. Next, I will purify the proteins from E. coli for functional studies, including determination of thioredoxin regulation of novel target proteins. Since I have successfully purified thioredoxin-m from Arabidopsis, I expect no technical problems in the purification of these proteins from B. napus. A major reason for using B. napus instead of Arabidopsis is because we have set up to isolate large quantities of guard cells from B. napus leaves. The purified thioredoxins and NTRC will be incubated with the proteins extracted from guard cells, and the redox changes will be determined using reducing and non-reducing gel electrophoresis, followed by mass spectrometry characterization. The contribution of this project is expected to be a detailed understanding of the regulatory mechanisms of the thioredoxin systems in guard cell functions. This contribution is significant because the results will not only fill critical knowledge gaps, but also will create important stepping stones towards potential biotechnological applications in crop yield improvement and stress resistance. Here I will present my recent progress in this exciting project and discuss future experiments and perspectives.

Personal Statement

After

Starting Science For Life

Award

Participating in this project has been one of the most fulfilling experiences of my college career, thus far. Working in a botany lab has given me greater insight into the biological processes of plants through molecular biology and proteomics. I have learned many research techniques and methods, from isolating chloroplast to cloning genes. And my mentor has taken a great concern in making sure I understand the purpose and scientific reasoning behind the procedures I perform. I have attended an international mass spectrometry meeting and often present my progress, along with new methods of approaching our topic at weekly lab meetings, furthering my understanding and investment in the research topics. Published papers are always at my fingertips, and I feel that I have been able to understand more and more of their contents as this experience has progressed. In fact, I am a co-author of a paper published in Plant Cell Physiology this past July. The understanding of the inner workings of a lab, provided by this project, have strengthened my plans for the future. I have become more invested in my desire to continue gaining knowledge through further research and am considering making a career out of it, after earning a Ph.D.
Crisanna Tang
Sophomore
Mentor: Dr. David G. Oppenheimer, (Biology)

Personal Statement Before Starting Science For Life Award

I plan to integrate the HHMI Intramural Undergraduate Research Award into my future career goals in biology research. The award will provide me a valuable experience in performing research and improving my science skills including honing valuable critical thinking and time management skills, performing experiments in an efficient and organized manner, and taking initiative. The experience I receive from the award will prepare me for graduate school in the biological sciences and to analyze biology beyond a textbook. For example, I will learn the difficulties and failures that come with research that are not seen beyond a published paper. I anticipate working on my project throughout the summer and fall semester. I plan to divide my coursework activities and research by focusing on my research during the day when I am not in class and studying for my class during evenings and weekends.

I chose my research mentor, Dr. Oppenheimer, based on my current research experience in his lab and parallel interests in the field of molecular biology, including learning more about actin regulator proteins based on performing experiments on Arabidopsis. I chose this project based on my desire to contribute to the goals of the Oppenheimer Research group.

In order to become a co-author of a scientific publication, I will need to spend as much time and effort as possible working on my project. Dedication and patience will also be needed as publications do not happen overnight. Instead, they merely represent progress reports as scientific research is never fully completed after the results are found and more experiments are performed to answer the questions that are created from previous results.

Abstract

Function and localization of a novel regulator of actin dynamics in living plant cells

Tang CW, Grey PH, Oppenheimer DG

Eukaryotic cell shape and membrane trafficking rely on the actin cytoskeleton, which includes actin filaments and protein that regulate the actin. RPA11 is a member of the RPA protein family, which regulates the actin depolymerization factor (ADF) in plants. As one of the members of the family that has signal sequences, the goal was to determine the location and function of RPA11 (http://www.cbs.dtu.dk/services/SignalP/; Emanuelsson et al. 2007). Usually signal sequences are found on proteins in the Endoplasmic Reticulum, which allow the proteins to be sorted to other organelles in the cell or secreted outside of the cell. However, since actin is usually not contained in organelles, I am testing the hypothesis that RPA 11, through signal sequences, is found in specific membrane compartments. Using Arabidopsis thaliana as the model organism, I am attaching a yellow fluorescent protein (YFP) to RPA 11. Observation of the YFP using confocal microscopy will be used to identify the location of RPA 11. To determine the role of RPA 11, I will compare it to RPA 1, which was previously determined to play a role in cell shape.

Reference:


Personal Statement After Starting Science For Life Award

Participating in the HHMI program this summer was an eye-opening and life changing experience. With only one previous semester of training under my belt, my summer research experience helped me refine my lab techniques, learn new ones, and truly appreciate the challenges, successes, failures, and hard work that real-world research has to offer. I have also learned more about the process and planning that goes into experiments even before picking up a pipette, including creating master lists and strategies. Being able to spend forty hours a week in a laboratory setting has allowed me to learn more research skills than I would be able to in a typical academic fall or spring semester. My research experience has concreted my goal of pursuing a career as a medical researcher and confirmed that I belong in my biology major.

However, the impact of Science for Life also goes well beyond research. I have learned to be more persevering and patient in future pursuits while also improving analytical thinking skills. Furthermore, I am very grateful for the excellent mentorship and support I received from all the members of Dr. Oppenheimer’s lab. Through all the mentorship I have received, I have gained knowledge that I would not have learned anywhere else. Although the summer has ended, I will continually develop my passions for research, learning, and scientific curiosity throughout life.
Personal Statement Before Starting Science For Life Award

Acquiring the HHMI Undergraduate Research Award would enable me to expand on my current research experience by allowing me to gain practice in using general and specific research techniques and experience presenting my research and possibly participating in research abroad. I plan to integrate this award and my current research activities with my course work in the sciences, particularly Microbiology, to form a foundation of research experience and knowledge that I could use in my future professional studies and career. Upon completion of my undergraduate studies, I plan to apply to a MD/PhD program.

I chose Dr. Ronald Mandel as my research mentor based on my interest in his work on Parkinson’s disease and other neurodegenerative diseases. I was highly interested in Neuroscience and the inner-workings of the brain and in learning research techniques from various fields, such as gene therapy, vector-insertions, behavioral testing to study biochemical pathways, etc. I found out about his research interests by searching through the various research mentor lists available through the University of Florida website. My current project caught my attention in that I did not know much about Parkinson’s disease and wanted to explore its causes. Working on various symptom-relief treatments and gene expression control also attracted me to the project.

I have already contributed two semesters of work to this project and I plan to continue to work in this research lab during my undergraduate career. I follow a schedule in which I balance out time for coursework and research. In fact, the nature of my coursework greatly contributes to my understanding of techniques used in my research and vice-versa. Thus, this research not only solidifies my understanding of my current coursework but also will thoroughly prepare me for a career in medical research by allowing me to learn and practice research techniques and use technologies that are used in the field.

At the completion of this project, assuming we acquire solid results, my research mentor and I have discussed a co-authorship on this paper. I may present this research at symposiums here at the University of Florida and around the nation. I definitely plan to work with our collaborating lab and I plan to compete for the Science for Life extramural award to work with our collaborators abroad.

Abstract

Recombinant adeno-associated virus mediated regulated striatal L-dopa expression in the parkinsonian rat model

Thomas A, Manfredsson FP, Mandel RJ

Parkinson’s disease (PD) is the second most common progressive neurological disorder characterized mainly by a degeneration of the nigrostriatal dopamine (DA) pathway. Current treatments focus on increasing DA levels, yet the beneficial effects seem to wane over time possibly due to the intermittent supply of levodopa (L-dopa), a precursor to dopamine. Gene therapy is a potential alternative delivery method that would provide site-specific continuous L-dopa in the striatum. Here, we used the rat model to test the effectiveness of this method. We performed 4-site 6-OHDA lesions and, four weeks later, delivered two separate recombinant adeno-associated viruses (rAAV) encoding tyrosine hydroxylase (TH) or tetracycline-regulated guanosine triphosphate cyclohydrolase 1 (GTPCH1) into the striatum. The initial post-vector delivery amphetamine-induced rotational test, where no animals received doxycycline (DOX), showed a highly significant decrease in motor asymmetries in all animals. A cross-over study was undertaken to demonstrate regulation by the Tet-off system. When the diet was switched, the group that received normal food remained decreased in rotational behavior, while the group that received DOX returned to pre-vector baseline levels. Cylinder test data supported the rotational behavior data by showing similar corrective effects on paw use in the absence of DOX. Upon switching the DOX diet again, the group that received normal food, which thus turned GTPCH1 expression on, reduced amphetamine-induced rotational behavior and increased corrected paw-use. However, the other group which began receiving DOX did not alter their behavior. Over the next two months, subsequent DOX diet cross-overs revealed the same pattern. One group continued to demonstrate regulated L-dopa by changing their behavior in the expected pattern, while the other group remained in a corrected state regardless of DOX treatment. Thus, it appears that the regulated L-dopa system may function properly but this is still under investigation.

Personal Statement After Starting Science For Life Award

The Howard Hughes Medical Institute’s Science for Life scholarship has awarded me numerous opportunities in the scientific community. Participating in research and becoming involved in Science for Life events has allowed me to gain professional experience in the field, on a national level. During my time in Dr. Mandel’s lab I have learned various techniques in behavioral and immune histological testing, have participated in poster sessions, and will be attending a national neuroscience conference.

Outside of research, I am heavily involved with the local community. I participate in community service both individually and with the pre-health service honor society Alpha Epsilon Delta. Within this organization, I have been appointed director of Health Extern, a division that provides members with various healthcare opportunities, such as shadowing professionals in their field of interest, and Healing Animals, where we provide aid in animal welfare. In the years to come, I plan to apply to medical school and continue serving my community.

Ashley Thomas
Sophomore
Mentor: Dr. Ronald Mandel, (Neuroscience)
When I was fourteen years old, I entered my first biology class. This was when my teacher, Mrs. Daart, explained that biology is the “study of life.” Somehow, this description struck me. The “study of life” seemed to imply endless possibilities, and I could not think of a broader, more encompassing field with a greater potential to help understand the world around me.

Almost six years have passed since that day, and while I have changed in many ways, I still see the reality and elegance in biological sciences. My fascination with the investigative process of biology has evolved into a deep curiosity in the techniques, innovations, and significance of scientific research. As I have learned more about biology, my focus has shifted to genetics. Genetics is an extremely important field that explains the methods through which all living organisms have evolved, as proven by the notion that a simple change in the DNA of an individual can result in drastic changes to their overall structure and function.

The topic of evolution and modification of specific genes over time has always interested me, and so when Dr. Charles Baer agreed to let me into his lab, I was thrilled.

Under his guidance, I hope to work on a project that examines the rate of mutations in microsatellites of the model organism Caenorhabditis elegans. This is done in order to determine the effect that the rate of mutation has on the molecular processes of organisms. This data can hopefully be utilized in order to decipher broader questions regarding the roles of mutations in disease susceptibility, for example. This research deals with molecular biology and genetics, and because I am deeply passionate about these fields, I plan on devoting a great deal of time and effort in the pursuit of my investigations. I understand that being a co-author of a scientific paper requires a large commitment, and I want to emphasize the fact that I embrace this. As an undergraduate working in Dr. Baer’s lab, I wish to learn as much possible about the techniques and methods involved in evolutionary genetics research and contribute to this work with my own ideas. I plan for my research project to span at least one year, as collecting all the statistics will take at least a whole semester and analyzing the implications of the data will take several months as well.

If my research goes well, I hope to help write a scientific paper describing the results and significance of the experiment. However, I would also love to be given the opportunity to present my findings in other forums.

The HHMI/Science for Life undergraduate research award will allow me to do just that, as I will be able to present my research at competitions and conferences. It would further give me the opportunity to apply for other awards, such as the Extramural Research Program, in which I would be able to perform my research abroad while learning new laboratory techniques and methods of analysis. Our lab frequently collaborates with researchers at other universities nationwide, and I would be thrilled to have the opportunity of spending a few weeks in a new location expanding my knowledge on topics relevant to my experiment, and possibly even using the results of the experiments conducted at these universities to gain insight into new projects that I can participate in my senior year.

Human genetics has always fascinated me, and since it is so interrelated with biochemical processes, I hope to one day become involved in physiological investigations that bring the two together. I am certain that the techniques I learn in Dr. Baer’s lab will help me accomplish this goal, and the HHMI/Science for Life research award will help prepare me for a future in research where I can contribute to the knowledge bases of the scientific and medical communities.

Abstract

Effective mating systems on the evolution of mutation rates
Tolani A, Baer C, Salomon M

In order to study genetic variation, it is important to take into account the effects of spontaneous mutations. Mutations are simply changes in the sequence of DNA within a cell’s genome. Deleterious mutations, however, decrease the overall fitness of organisms and can therefore cause unfavorable changes in phenotypic traits over the course of many generations. These mutations are usually removed from the gene pool through natural selection, while beneficial mutations are passed along within a species. It is thus clear that the dynamics of the mutational process are nearly always confounded by the effects of natural selection, making it difficult to study the effects of mutation in isolation from natural selection. One way to ensure that the efficiency of selection is lessened as much as possible is to make use of the mutation accumulation (MA) method. This method requires maintaining populations at a reduced effective population size from many generations by passing each population through successive bottlenecks and allowing mutations to accumulate in the relative absence of natural selection. The model nematode, Caenorhabditis elegans, is being utilized as a result of their relative simplicity to conduct studies upon despite being a multicellular eukaryotic organism. In addition, it can be cryopreserved for long periods of time while remaining completely viable and it reproduces at a surprisingly rapid rate. Dr. Charles Baer set up mutation accumulation (MA) lines of several closely related species, with several genotypes per species (Caenorhabditis remanei, C. brenneri, and species 5) of gonochoristic nematode worms, as part of a larger initiative to investigate the evolution of mutation rates in nematode worms. The project that I am working on attempts to compare the molecular mutation rate, among and within, MA lines of three outcrossing species of nematode worms (Caenorhabditis remanei, C. brenneri, and C. species 5) and a strain of the hemaphroditic species C. elegans (fog-2) with an introduced mutation that eliminates its ability to generate sperm, thus rendering a hemaphroditic effectively a female. The Baer lab has recently shown that these three outcrossing species decrease in fitness fastest, compared to the fog-2 C. elegans, which is consistent with a higher mutation rate in the outcrossing species, but this is yet to be shown at the molecular level. The molecular mutation rates of this experiment were measured through the use of dinucleotide microsatellite repeats. Microsatellites are particularly useful to work with as a result of their high mutation rate, high copy number, and wide spread distribution throughout the genome. These advantages will allow us to study mutation rates at a level that cannot be matched from other classes of loci. Furthermore, each side of the tandem repeat consists of a flanking region that will allow for the development of locus specific primers to amplify the microsatellites. Through this research in nematode genetics is investigating how variations in mutation rate are reflected in levels of standing genetic variance (through the use of molecular and phenotypic data), the findings gathered in this experiment can undoubtedly provide valuable information about how the way mutational properties influence other organisms, including humans.

Reference:

Effective mating systems on the evolution of mutation rates

Figure 1: C. Elegans nematode in adult (1110-1150 μm) stage

Personal Statement After Starting Science For Life Award

Spending the summer in Dr. Charles Baer’s lab has proven to be one of the best experiences of my undergraduate career. Taking part in genetics research alongside friendly peers and experienced mentors has not only enriched my lab technique and application skills, but has also taught me about the importance of scientific research in general. I learned how to successfully perform a series of polymerase chain reactions and how to run gel electrophoresis, which are some of the most widely used techniques in scientific laboratories. I was able to work with graduate student Matt Salomon, who not only helped me improve upon these basic laboratory skills, but also taught me a wide array of specialized techniques, such as designing microsatellite primers based on genome sequences of the different nematode species. Being part of a research group has also given me the opportunity to overcome more responsibility, as it took a group effort to meet deadlines for the various fitness assays conducted over the past months. Events such as lab meetings brought forward the aspect of teamwork, as members would elucidate any problems that were experiencing in their respective projects over the past week, allowing the lab group as a whole to come up with a solution. Though I originally felt that applying to medical school and obtaining a medical doctorate degree was my overall goal, I am now looking into possible MD/PhD programs in order to continue research and have the satisfaction of conducting experiments in topics that will ultimately prove highly beneficial to the scientific community.

Amit Tolani
Sophomore
Mentor: Dr. Charles F. Baer, (Biology)
Richard Walroth
Sophomore
Mentor: Dr. Lisa McElwee-White, (Chemistry)

Personal Statement

Before Starting Science For Life Award

While in the organic chemistry teaching laboratory, I was particularly fascinated by an experiment involving ferrocene. The idea of a metal bound to the pi system of a ligand was entirely new to me, so when my TA told me her research involved these kinds of complexes I decided to inquire further. I read about Dr. McElwee-White and the research projects her group was working on. All of them seemed to be very intriguing, so I asked my TA if there were any spots available in the group for undergraduates. She said there might be and set me up for a meeting with Dr. McElwee-White. In the meeting she explained more in detail a particular research project involving organometallic complexes as catalysts for electrochemistry that could one day be used to power electronics. She than offered me a chance to work in the group, and I happily accepted.

Thus far incorporating my time in a research lab with a full load of classes has been challenging, as several of the experiments require long hours of preparation and workup as well as consecutive days of work. Though it has been highly time consuming, I have still found the experience to be very rewarding and fully plan on continuing in this research lab throughout my time as an undergraduate at UF. Looking to the future, the necessity of taking other requisite lab courses will probably pose the greatest challenge, as these take up large slots during the day which are normally ideal for working in the lab otherwise. But this time will not be entirely wasted as most of it will involve chemistry and will serve to provide me with skills necessary to conduct the more advanced experiments further down the line in my current research plan. The kind of experiments I will be doing will enlighten me to the kind of work which is behind the theories I will be learning in class. I do not see my time as being divided between class and research, but rather I see these two as being equal parts of my education here at UF.

After I have finished my undergraduate studies at UF I plan on pursuing a career in medicine. The human body is largely a chemical factory and medicine is increasingly relying on the understanding of the chemical reactions which take place inside of it. Conducting this research will in the short term aid in my acceptance to medical school, but in the long term it will allow me to have a far deeper understanding of chemical reactions in general than the average student. Also, though I primarily plan on being a clinical doctor, I do also hope to be involved in the conducting of clinical trials of novel drugs. As many of these drugs are organic molecules, having an understanding of the chemistry involved as well as the processes involved in their synthesis will allow me to be able to anticipate possible complications as well as any possible impurities which may be harmful.

I am fully expecting to be able to publish my research at some time in the future.

I am already several steps into the synthesis of a class of organometallic compounds which I am hopeful will be useful as catalysts for the electrochemical oxidation of ethanol. After I have completed the synthesis I will be able to test their potential as catalysts, at which time I should be ready to submit my findings for publication.

Abstract

Electrochemical Oxidation of Ethanol using Organometallic Catalysts

McElwee-White L, Goforth S, Walroth RC

Fuel cells already exist which utilize hydrogen to produce electricity by its conversion to water. Hydrogen gas, however, poses substantial challenges in its production, storage, and transport. If similar electrochemistry can be done using alcohols as a fuel then these problems would be avoided. The use of alcohols requires new catalysts to run the chemistry effectively without generating side products. The McElwee-White group has already developed heterobimetallic catalysts for the electrochemical oxidation of methanol, and it is proposed that the two different metals work cooperatively to react in ways that one type of metal alone cannot. Methanol, however, is toxic and not easily biorenewable. Using ethanol as a fuel would solve some of the problems of using methanol, but oxidation all the way to carbon dioxide provides more challenges for electrochemical catalysis as it requires cleaving a carbon-carbon bond.

The work I am doing with Dr. McElwee-White involves the synthesis of a new catalyst to be used in this sort of electrochemistry. These catalysts would involve a heterobimetallic system containing Ru and Rh, or other late transition metals. In the past the McElwee-White group has used Ru in catalysts which successfully oxidized methanol and ethanol. In the case of ethanol, bulk electrolysis yielded acetaldehyde as one of the products, though complete oxidation to CO2 was not observed. This problem could be potentially solved by using Rh as the second metal as it has been reported in the literature to decarboxylate aldehydes.

References:

After Starting Science For Life Award

So far research has been an interesting learning experience. I had expected it to be more like ordinary laboratory courses at UF, but quickly realized that actual research has a very different pace. Each experiment could yield the desired result, but whether or not it will is completely unknown. This has proven to be at once both frustrating and motivating. I have definitely benefitted from participating in a research lab in many different ways. I now have a greater appreciation for the scientific process, and have learned to question the concepts I learn in class. Also, working full time in a lab over summer provided me with a glimpse of what life as a researcher could potentially be. It seems now more than before to be a viable alternate career path, though my main goal continues to be medical school. Outside of the research lab I continued to be active in my fraternity, holding the office of vice president.
Personal Statement Before Starting Science For Life Award

Once selected for the HHMI Undergraduate Research Award, I hope to share and enhance my skills in molecular biology and genetics. I am anxious to delve into the world of molecular genetics on a more personal level.

I know that I can handle the extra workload because for the past year and a half, I have worked diligently in Dr. Dave Clark's laboratory, developing my skills researching genes in the petunia plant. For the past two semesters I have worked closely with the Petunia MYB5d8 gene, I want to continue researching within the MYB family because it seems to play a vital role in the Shikimate volatile pathway.

Once I graduate from the University of Florida, I hope to pursue a graduate degree in Plant Science focusing on molecular biology and genetics and then go on to get my PhD. I am eager to continue my involvement in state of the art research within the horticulture department wherever my future plans take me. I chose to work in Dr. Clark's Floriculture and Biotechnology lab because he is well versed in the plant world. He is known academically and throughout the horticulture industry. With Dr. Clark as my faculty mentor, I will gain valuable knowledge and have unprecedented opportunities with labs throughout the world.

I know that I will be working hard in the lab every day, usually from 9 a.m. to 5 p.m. outside of class. Still, I am prepared to devote my free time to lab work because the experience I will gain is going to pay off in the long run. I hope to eventually compete for the extramural science for life award to gain valuable insight into the procedures done at other labs. This is an incredible opportunity; therefore, I will work hard, manage my time efficiently, and devote my time to my project in the lab for the remainder of my time at the university so that I can be a coauthor on a peer-reviewed scientific publication.

Abstract

PhMYB4 fine tunes the Floral Volatile Emission of Petunia through suppression of PhC4H

Wedde AE, Colquhoun TA, Kim JY, Clark DG

Sequences with similarity to Arabidopsis thaliana R2R3-MYB transcription factors were gathered using public databases; NCBI, SGN, and the 454 petunia database, along with personal communications with collaborators. The resulting sequences were used to construct a petunia nucleotide “Quasi-Contig” representing PhMYB4. Sequences were assembled and primers were designed approximately 80-100 nt 5’ and 3’ of the deduced 777 nt coding region. Replicates of the expected, approximate 1000 nt product were amplified using Advantage® 2 Polymerase Mix from gene transcript pools of MD tissue, and purified using QIAquick™ Spin Columns. Amplicons were ligated into pGEM®-T-easy vector, transformed into One Shot®Mach1™ –T1R Chemically Competent E. coli, multiple clones were isolated and sequenced to at least a 6X coverage eliminate errors.

The translated sequence was 258 amino acids and predicted to be nuclear localized. Using blast (tblastn) analysis on the non-redundant nucleotide collection at NCBI, the predicted, petunia protein was aligned with highly similar amino acid sequences from varying species. The petunia amino acid sequence shares 66.1% and 55.9% identity with Solanum lycopersicum TH27 and Arabidopsis thaliana MYB4, respectively. Since the predicted petunia amino acid sequence shares the highest identity to AtMYB4 compared to all 124 other Arabidopsis R2R3-MYB sequences, and petunia follows Arabidopsis nomenclatural style; the petunia coding sequence was named PhMYB4 (HM447143).

Personal Statement After Starting Science For Life Award

Involvement in this research project under the direction of Dr. Dave Clark and Dr. Thomas Colquhoun has been extremely beneficial to me. I am on a path to reach my career goals and I have the support of two renowned faculty. The amount of scientific knowledge I have gained in the past year is exponential. I have begun to think like a scientist; using critical thought and searching for empirical evidence in every aspect of my life. I feel comfortable as a leader in the lab, because I am well trained and experienced in most experimental techniques in our Genetic & Floriculture Biotechnology lab. I know that I will become a valuable asset in the molecular biology industry; knowing this has helped build my confidence as a budding plant-based medicine scientist. Overall, I know I can effectively transition into graduate school as a product of the Clark lab.
I am a second year undergraduate majoring in both physics and mathematics at the University of Florida. With my positive experience thus far within the academic community, I definitely plan on continuing into graduate school, specifically in a physics doctorate program. Throughout my first academic year and over the past summer I worked with the Compact Muon Solenoid (CMS) experimental group for the LHC here at UF. After my exposure to the experimental part of physics I chose to transition into and pursue work in theoretical high energy physics. It is this area that I plan to continue on in my career in physics.

My knowledge background concerning physics and mathematics includes most of the undergraduate curriculum as well as more advanced topics that I have chosen to focus on in my research. Mathematically, I have completed my undergraduate curriculum and am currently taking first year graduate classes in analysis, topology and algebra this year. I hope to carry on in my mathematics studies in these areas while I am still an undergraduate, especially in differential geometry and topology as there is a profound intertwining with these areas and the physics research I partake in. I am currently completing the core undergraduate physics curriculum as I am taking quantum mechanics this semester. Rather than leave early due to completing the bachelor’s degrees early, I plan to enroll in as many graduate courses as possible over the next two years and focus more on research in the semesters to come.

From August 2008 till July 2009, I worked for the CMS group in various projects here at UF under Professor Ivan Furic. I was first involved with analyzing cosmic muon data in Fall 2008. Over the Spring and into Summer 2009, I became more involved in the CMS framework and my project was to create, run and test algorithms for a modified environment known as the Super LHC. During Summer 2009, I received the University Scholars Program scholarship which funded my research on initial studies on combining CSC and Tracker information for an Upgraded L1 SLHC Trigger. I am currently completing a paper on my results which is to be published in the Spring. My work in the CMS group required me to be fluent in a variety of programming languages including C, C++, Python and the ROOT system.

Starting in Fall 2009 I switched from working with the CMS group to becoming fully involved in theoretical high energy physics research. I work under Professor Pierre Ramond of the Institute for Fundamental Theory and began my preparation for theoretical research in the Fall. For this, I took Quantum Field Theory with Dr. Ramond as well as taking part in numerous research projects. Primarily over the Fall semester, I conducted studies in group theory and its applications to physics. My work consisted of weekly readings as well as meetings with my professor where I presented my findings. Towards the end of the Fall semester, I began to work on applications of the light-cone formulation in various low dimensional quantum field theories. My main objective, which I am working on now, is examining the Thirring model in 1+1 space-time dimensions. I am also in contact with Professor Charles Sommerfield of UF who did groundbreaking work with this model in the past, and he has helped me with any questions or concerns that I have had. This semester I am primarily focusing on Supersymmetry and its perturbative applications in the Standard Model, and in the more formal non-perturbative aspects of the field. This Summer, and indefinitely, I plan on focusing on a specific model for Graphene and a possible supersymmetric generalization of the model. This theory has both theoretical applications to high energy physics and also obvious experimental applications to areas of condensed matter and material sciences.

As stated, I plan on earning my Bachelor’s of Science degrees in Physics and Mathematics at UF. I hope to apply for a theoretical physics position at a graduate school and conduct work in order to earn my Ph. D. As a career goal to set for myself now, I would like to one day become a professor in physics at the university level. My great interest in physics and mathematics will always keep me intrigued to work on and put all my effort into my projects.

---

Abstract

Anyons: Field Theory and Applications

Williams B, Ramond P

My research deals with the concept of anyons and how they arise in $d = 2+1$ physical theories. Classical properties are briefly discussed, but the main applications are a consequence of the quantum nature of these strange particles. Anyons are particles that occur in planar physics which carry neither integer (bosons) or half integer (fermions) spin. In fact, they can carry any positive real number spin and this paper shows how this manifests. The main physical application addressed is the fractional quantum hall effect (FQHE). Problems with the non-relativistic formulations of anyons is motivation to come up with a relativistic field theoretic way of treating anyons. I look at Chern-Simons theory from various perspectives and offer few different methods of quantization, each of which have some advantages and disadvantages. Lastly, we will look into the somewhat ill-understood realm of fractional supersymmetry and how this could possibly be used to construct a relativistic field theory of anyons.

---

Personal Statement After Starting Science For Life Award

I applied for the HHMI undergraduate scholarship because I needed funding to stay in Gainesville over the past summer to continue doing research with my professor Pierre Ramond. The scholarship means a lot to me because it has allowed me to carry on with my work that I was involved in during the Spring 2010 semester, and I was able to waste no time in producing new results. This was my first summer in doing this type of theoretical physics research and the scholarship I received allowed me to learn a lot about what is involved in this subject. I will take from this summer many lessons on the importance of individual motivation and how I must push myself to become a better researcher in this field. Moreover, this summer has helped me decide that I want to continue in this field and has definitely affected my decision to pursue a graduate degree in either math or physics. In all, I am very grateful for the opportunity granted to be by the HHMI undergraduate scholarship, and I can only hope to find other programs like this as I go further in my career.
Soon after enrolling in the Science for Life seminar my freshman year, I decided two things; I was going to be involved in research in any way I could, and I was going to learn about the brain. If measured by the simple criteria of volunteering in a neurosurgery lab, it could be said that I have met my goals. But I would not go so far as to say that; meeting my goals is a process, and I have only just begun.

I met my mentor, Dr. Mocco, who is a neurosurgeon with the Department of Neurosurgery, at a Neuroscience Fair. Dr. Mocco’s research on stem cells and stroke therapy immediately captivated me and I was fortunate to be able to volunteer in his research lab. Currently, I am working on a project studying the contribution of hematopoietic stem cells to recovery following stroke. What I hope to learn from the research is the potential deleterious effects of the current treatment for acute stroke. I am excited by this research because of its potential to impact current stroke therapy.

I am completing my second semester of volunteer work in Dr. Mocco’s lab, and the experience has definitely solidified my interest in stroke and brain research. I have thoroughly enjoyed participating in the research, learning new techniques and obtaining data. Thus far, I have learned how to apply the following techniques: immunohistochemistry, immunocytochemistry, western blots, tube formation assays, and sterile tissue culture techniques to obtain data. These tasks have shown me what it takes to run a lab and conduct research to obtain sound data. I feel that lab research experience will better prepare me for a future in Medicine and Research. My lab experience has also taught me how to effectively manage my time so that I can balance lab work and coursework, for example, many of the experiments require long incubation periods, so I begin the experiment early in the morning, and then attend class or study during the incubation period.

This summer, I will devote significant time to my research project, as I will not be enrolled in classes. In the fall of 2010, I will enroll in research for credit to be able to spend more time working on my project. I intend to earn credit through research for the rest of my undergraduate career so that I can continue to develop my research skills. I am especially motivated by the possibility of this project going to publication. Dr. Mocco and I have also discussed my goal of co-authoring the publication. We have agreed on the time I must devote to co-author a publication, and I am on track to meeting that goal.

In February 2011, I expect to present my findings with a poster at the Annual Conference of the joint section on Cerebrovascular Disease of the AANS/CNS. This meeting focuses on trends and advanced techniques in surgical and endovascular treatment of cerebrovascular disease. It would be a privilege to present at this conference, and this goal continually motivates me.

Since my ultimate plan is to attend medical school, I feel that participating in research now is an integral step towards that plan and my future career as a physician. I am confident that the research I am conducting under Dr. Mocco’s mentorship and its clinical applications, will aid in the successful preparation for the future I envision for myself.

Abstract

Hematopoietic Stem Cell Mobilization Following Stroke

Wolfe A, Afzal A, Ansari S, Mocco J

Background: Stroke is the third most common cause of death in industrialized nations and the single most common reason for permanent disability. Each year approximately 795,000 Americans experience a new or recurrent stroke. 1 Hematopoietic Stem Cells (HSC)/Hematopoietic Progenitor Cells (HPC) are circulating bone marrow derived mononuclear cells that promote repair in areas of injury. 2 Methods: Animals underwent a murine intraluminal filament model of focal cerebral ischemia.3 Animals were divided into 4 groups (n=5 each): 4 hours sham surgery, 4 hours post reperfusion, 24 hours sham surgery, and 24 hours post reperfusion.

HSC/HPC were enriched using nanoparticles tagged with LIN negative and SCA1 positive markers and counted on a hemacytometer.

Results: Bone marrow showed an increased production of HSC/HPC at 4 hours (106±26%) and significantly higher at 24 hours (272±35%). Mobilization of the HSC/HPC was slightly higher at 4 hours (167±26%) and significantly higher at 24 hours (940±91%; p<0.05).

Conclusions: Stroke led to increased mobilization of HSC/HPC from the bone marrow to the blood.

References:
Due to my commitment as a scholarship athlete on UF's gymnastics team, I was afraid that I would not have the opportunity to become involved in undergraduate research. This changed when Dr. Miller, who will be my research mentor, approached me after class and asked me to assist in her lab. Dr. Miller's work appealed to me because I could grasp the goals of her projects despite my undergraduate level of knowledge and because she wanted me to become involved in every aspect of her projects— from study design to behavioral trials to critiquing papers which were being submitted for publication. I began working in the Miller Lab in January 2009.

As an upperclassman who has almost finished my degree program, I feel that I will be able to devote the required time to conduct my own research project this fall. This summer, Dr. Miller and I will refine our research ideas and my project design. I will be studying primary literature in my research area to provide background information for the study. The actual study will occur in the fall semester of 2009 and should be completed near the end of the semester. If the project proceeds as planned, the results will be significant and publishable, and I plan to use the spring 2010 semester to compile my results and prepare my work for publication. I will be the co-author and hopefully will have the opportunity to present my results at a conference.

The HHMI Award will be used to defray the cost of my research project and the expenses associated with traveling to a meeting at which I will present. My research experience will deepen my understanding of the scientific process and expose me to the research process. Many medical schools (indeed my top choices) emphasize a research project as a requirement for graduation. Undergraduate research should make me more attractive to medical schools and prepare me to understand medical research more thoroughly when I am a physician. I hope to be involved in clinical research during my professional years.

Abstract

The Effect of Polyandry on Reproductive Output in the Cactus Bug Chelindea Vittiger
Zaiser R, St. Mary C, Miller CW

Although mating can be costly to female insects, polyandrous mating is observed in many insect species. Since polyandry has remained in the mating system, polyandry must confer benefits to females that outweigh mating costs. This study investigates the effect of polyandry upon the fertility and fecundity of females of the cactus bug species Chelindea vittiger. We compared the egg yield and hatching rate of females in three mating treatments—1) females who were contained with one male for six days, 2) females who were held with three males for six days, and 3) females who were held with three males for six days, but with only one male at a time. We found that females who were given the opportunity to mate with only one male showed significantly higher egg production, though hatching rates were similar across treatments. We concluded that factors other than reproductive output may be responsible for the preservation of polyandry in mating systems and suggest more investigation of the benefits of polyandry.

Figure 1: Females paired with one male produced more eggs than females grouped with multiple males (Means + S.E.)
I chose to come to UF because it is an excellent research institution, and am excited to get involved with research right away. Of course, that requires that I first find a lab that matches my academic interests. After interviewing several different professors and even working in a behavioral neuroscience lab for a semester, I know that the work that Dr. Dawn Bowers is conducting in her lab is what I want to be involved with during my undergraduate time at UF. I enjoyed her lab environment when I attended a recent lab meeting, and after corresponding with her through email, I also feel as though she is genuinely interested in having me be a member of her lab.

I know that I will be able to balance time between research and my other academic and extracurricular activities because I am currently receiving two credits in a research laboratory, which entails six hours of work a week. Despite all of my commitments, I am able to get all of my work done and still have time to relax and recharge. Dr. Bower’s lab requires more lab time each week, but I believe that I will be capable of handling this workload both over the summer and during my Sophomore year.

My current plan for the future is to apply for the IDS major in Neurobiological Sciences next year, and the application requires a description of the current research that I am doing. Being a member of Dr. Bowers lab will allow me to already be involved with neuroscience research, so I will be a competitive applicant for that major. Graduate members of her lab also have the opportunity to travel to the International Neuropsychological Society conference, which was held this year in Atlanta. Possibly after several years of experience, I too would be able to attend the conference and present my research. Dr. Bowers also said that coming up with my own project or collecting data for a current lab project could merit being a co-author on a peer-reviewed scientific publication, and that working with off-campus collaborators is certainly a possibility for the future.

I also would like to apply for the Undergraduate Extramural Research Program next year or to an REU, with the hopes of traveling either to Europe or to another University in the United States so that I may experience a new research environment during the summer. The extramural program will also enable me to travel to a new place and make contacts all over the world. My long term plan is to apply to medical school, and I know that getting involved early is extremely important in order to be successful as an undergraduate.

**Abstract**

Resolving Interference Resolution and Investigating Far Transfer of Working Memory Training

Braun T, Reuter-Lorenz

Dr. Patricia Reuter-Lorenz leads University of Michigan’s Cognitive and Affective Neuropsychology Lab. One of her many research interests pertains to training regimens designed to improve a specific aspect of cognitive control and whether improving one process of cognition can be transferred to different, independent processes of cognition. This summer, she was testing whether improving interference resolution in working memory can be transferred to episodic and semantic memory as well. Graduate student Kristin Flegal was my mentor as well during the summer and was the main graduate student involved in this project.

Subjects were recruited for ten consecutive weekdays of training. The first day, subjects performed transfer tasks that included a backwards digit span task to test working memory, verb generation, paired associates and item recognition with words. All of these transfer tasks were designed to require interference resolution on some trials but not on other trials. During the eight training days, the tasks included an n-back task with words, recent probes with letters and recent probes with faces. All of the training tasks required working memory and a high level of interference resolution. On the last day, subjects performed the transfer tasks again.

The purpose of this experimental design was to see if training a specific executive process (in this case, working memory) would transfer to other, unrelated cognitive processes. The transfer tasks involved working memory, semantic memory and episodic memory. If the ability to resolve interference in these tasks was improved post-training, then this method of training interference-resolution in working memory is able to transfer to other cognitive processes.

**Personal Statement**

**Starting Science For Life**

**Award**

The lab that I work in at UF is a Cognitive Neuroscience Lab. This summer, I worked in an Experimental Psychology lab, so I learned a lot about Cognitive Psychology and the methods used to perform research in the field. Since I have not yet taken a Cognitive Psychology class at UF, much of the learning occurred through reading research papers, or through participating in and learning about the memory tasks that we gave to participants in the lab. I was also able to apply the knowledge that I learned in my Methods in Cognitive Neuroscience class that I took at UF in the spring in order to understand the imaging aspects of the research.

It was also interesting to participate in a different lab environment that had a unique system for organization and scheduling. By interacting with the undergraduate research assistants and the graduate students in the lab, I learned how to create new experiments and even how to apply to graduate school and choose a program that is best for my own personal interests. My mentor for the summer, Patricia Reuter-Lorenz, was also very helpful and offered at the end of the summer to stay in touch and to write a recommendation letter for me if I apply to graduate school in Psychology.

Being in Ann Arbor was also a fantastic experience. I was on my own in a new town, and arrived knowing absolutely nobody. Over the course of the summer, I got to know my roommates, my colleagues and the town of Ann Arbor very well. I gained more independence than I have ever had and enjoyed the freedom to explore a new part of the United States. At the end of my stay in Michigan, I even took a road trip around the Midwest, exploring Chicago, Nashville, Louisville and Atlanta on my way home to Tampa.

This summer was really amazing and I would like to thank Science for Life and the Howard Hughes Medical Institute for funding an amazing research experience over the past few months. As for my future plans, I am still going to explore other fields of Psychology before I choose which topic I would like to dedicate myself to during graduate school. This summer has definitely helped broaden my knowledge of Psychology research, and I look forward to finishing my Psychology major at UF in order to learn even more about the field and narrow down my interests before I graduate.
After interviewing with Dr. Brian Harfe during my first semester at the University of Florida as a student in the HHMI Science for Life Seminar, I began work in his laboratory at the College of Medicine’s Department of Molecular Genetics and Microbiology. Focusing on the patterning of the intervertebral discs in the developing embryo, I have spent my time as a SFL Intramural Scholar undertaking a project aimed at using avian retroviral vectors to track cell migration during the resegmentation of the somites as they give rise to the vertebral column and am also investigating the rostral half-sclerotome giving rise to the avian intervertebral disc.

In January 2010, I was honored with an invitation to spend the summer as a visiting scholar at the University of Minnesota’s Department of Genetics, Cell Biology, and Development. Dr. Chen, a collaborator of Dr. Harfe’s, has research interests focusing primarily on developmental genetics and microRNA, and has published several papers in the field, including one on the role of microRNA in embryonic development. Majors in the field of developmental biology, including Dr. Lihsia Chen, were eager to explore the roles of C. elegans orthologues of the TMEM16 family of genes in development. Additionally, after creating the MosDEL constructs as the first step of the project, I learned how to use recombinase technologies to create targeting vectors, honed the subtle nuances in PCR that lend themselves to optimal cloning success, and gained the ability to use several bioinformatics technologies employed in nearly all lab practices. Additionally, after creating the MosDEL constructs and successfully cloning it into the plasmid, I was able to perform recombinase experiments to create targeting vectors, honed the subtle nuances in PCR that lend themselves to optimal cloning success, and gained the ability to use several bioinformatics technologies employed in nearly all lab practices.

Throughout the summer, I not only became familiar with a new model organism system, but also improved my skill in a variety of molecular biology techniques used in creating transgenic organisms. Specifically, I learned how to use recombinase techniques to create targeting vectors, honed the subtle nuances in PCR that lend themselves to optimal cloning success, and gained the ability to use several bioinformatics technologies employed in nearly all lab practices. Additionally, after creating the MosDEL constructs and successfully cloning it into the plasmid, I was able to perform recombinase experiments to create targeting vectors, honed the subtle nuances in PCR that lend themselves to optimal cloning success, and gained the ability to use several bioinformatics technologies employed in nearly all lab practices.

I believe this experience will benefit my long-term career goals in providing perspectives in additional fields of molecular biology. I will be attending UF’s College of Medicine as a member of the Class of 2015, and plan to pursue a combined M.D./M.S. to practice as a physician-scientist. My experiences in Minneapolis not only fortified my interest in molecular biology, but also equipped me with tools that will continue to prove useful in my scientific career.

Abstract

Fate-mapping indicates that the rostral half-sclerotome gives rise to the avian intervertebral disc.

Bruggeman BJ, Harfe BD

The deterioration of the intervertebral discs is an unfortunate consequence of human aging and has serious implications for individual mobility and the health care system. Such deterioration is the result of proteoglycan breakdown in the nucleus pulposus and tears in the annulus fibrosus. Current treatments for disc disease include palliative anti-inflammatory drugs and artificial implants, which do not target disc deterioration directly. Thus, knowledge of the developmental pathways underlying the development of the IVD is important for devising advanced therapies that restore normal disc function.

While the developmental origins of the mammalian disc have been studied, recent work in our laboratory has shown that in the chicken model system the disc is structurally different from that of the mammals. Past studies have provided explanations of which tissue populations give rise to the avian disc, however these are few in number and offer conflicting results. The purpose of this investigation was to definitively determine whether the sclerotome ultimately forms the avian disc, and if so, which specific cell population within the sclerotome is responsible.

We used the lipophilic fluorescent tracers DiI and DiA to create a fate-map of cells derived from the sclerotome. We first performed single-labeling experiments in the early sclerotome and subsequently detected fluorescence in the IVD. Next, injecting two labels into different cell populations within a single somite resulted in the presence of only the rostrally-injected label in the IVD. From this data we concluded that cells originating in the rostral half-sclerotome are responsible for contributing to the avian disc.
Mohammad Ehsan  
Junior  
Mentor: Dr. Jack Beauchamp  
California Institute of Technology

Personal Statement Before Starting Science For Life Award

Delving into the practical applications of my academic focus is something I am particularly fortunate and grateful for because it has made my experience as a biochemistry major much more enriching. I took an introductory chemistry course with Dr. John Eyler during my first semester at UF. His course was the only science-related one I was taking at the time, so I asked him about any prospective research fields that would be appropriate for an undergraduate student. As chair for the Physical Division of the Department of Physical Chemistry at the University of Florida, Dr. Eyler ran a lab that specialized in Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometry of biological molecules. I started my first project during the spring semester of my freshman year, which was a spectroscopic study of bis (2-methoxyethyl) ether, more commonly known as diglyme. Currently, we have completed several rounds of experiments and validated our results for reproducibility. The purpose of this project was two-fold; the first was to develop a more medically applicable research project, preparing me for a career as a physician scientist, and the second was to develop the necessary critical thinking and intellectual curiosity essential for academia. background that I will need for my future plans. The HHMI award provides the necessary funding to augment and perpetuate my undergraduate research career.

As previously mentioned I have aspirations to become a physician scientist, which can ideally be achieved by matriculating into an MD-PhD program. By developing a research background during the formative years of my undergraduate experience, I will be well prepared for the rigors of such a demanding graduate education and future career. This area of study also necessitates that an individual have an affinity for education. I thoroughly enjoy mentoring my students both at UF and youth in the Muslim community of Gainesville. This penchant for academia will serve me well as I enter the academic community.

Abstract

Fundamental Studies of Chemical, Biological, and Environmental Processes in Levitated Droplets using Field Induced Droplet Ionization Mass Spectrometry

Ehsan MU, Beauchamp JL

Incorporation of field-induced droplet ionization with a novel airborne analytical system is the objective of this study. The ionization method presents a alterative to methods such as electrospray ionization (ESI) and provides the user the ability to observe different charge states of analytes of particular importance, such as peptides and other amino acid based structures, as a result of droplet formation, time needed for it to become quiescent, and droplet shape. The levitated droplet reactor (LDR) is advantageous in that it helps eliminate the primary drawback of miniaturization analytical techniques, which is the unfavorable surface-to-volume ratio of analyte to reactor. The LDR will be predicated upon an acoustic levitation method. Submicroliter samples will be levitated in the nodal points of a standing ultrasonic wave generated by a piezoelectric sandwich transducer in conjunction with a metal reflector. This study seeks to apply the aforementioned setup to preliminary experiments using hydroxyl radicals, which are generated by UV exposure of a sample of ferric chloride dissolved in both methanol and water, and the resulting chemistry with a peptide of sequence AARAAAXAA, where X will be substituted with different amino acid groups, particularly methionine, proline, and phenylalanine for their greater reactivity with hydroxyl radicals. A more environmentally pertinent application of this technology will be our extension of such technology to study polycyclic aromatic hydrocarbons (PAHs) as organic components of levitated aerosols. The chemistry will be further assessed with mass spectrometric technology. Implementation of these techniques have far-reaching applications in proteomics, surface chemistry, and atmospheric chemistry by providing researchers with miniaturized, wall-less reactors for real-time manipulation of sample conditions coupled with a variety of other bioanalytical techniques such as mass spectrometry, fluorescence imaging, and kinetic assays for enzymes.

Personal Statement After Starting Science For Life Award

Working as an Amgen Scholar at the California Institute of Technology was the most academically and personally rigorous experience of college. Through these difficulties, I developed the necessary skills for transitioning into an effective, creative, and independent scientist. I had these characteristics from my research at UF but only at a rudimentary level. The level of expectation that I was exposed to was very different from my research at the University of Florida for there was a momentous emphasis placed on problem solving. For the first time in my academic career, I was reading papers consistently to increase my breadth of knowledge so that I could improve my own creativity. Much of my research at UF consisted of using instruments that had already been developed, such as our Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometer, but working in Dr. Jack Beauchamp’s group with the other summer undergraduate students gave me a chance to collaborate on ideas and manifest them into reality. That was the highlight of my experience at Caltech—I helped develop a novel levitated droplet reactor system and a field induced droplet ionization mass spectrometric setup that incorporates photoysis technology. Finally, I learned the importance of being an independent investigator. One of my weak points I was cognizant of before my Caltech experience was my over-dependence on my PI and co-mentors. Being at Caltech helped eliminate that. Dr. Beauchamp emphasized this principle for his PI decades ago had a similar approach of promoting independent study. Now, I am taking charge of my own projects with much greater independence, and a perfect example of this is this is regarding one of the manuscripts we are preparing on a spectroscopic study of intramolecular proton bridges. Since I came back to UF, I have been reading a multitude of papers on the topic, interpreting our old data to provide new insights, looking into other model systems, and proposing my own set of conclusions that I want to include in our paper. My research adviser, Dr. Eyler, has thoroughly been impressed by this transformation—he agreed with all the new ideas I had and has taken a more secondary stance in my research but still providing a helping hand if I ever get stuck.
**Personal Statement Before Starting Science For Life Award**

The word “science” conjures images of objectivity and methodicalness. However, without the motivation of personal interests, the wave of scientific breakthroughs may not have attained the momentum that it carries today. Likewise, my own passion for biomedical research has acted as my academic compass since high school. As part of the science research program, I investigated the antioxidant properties of cerium oxide nanoparticles on adrenal cortical cancer cell growth under the mentorship of a UCF materials professor. I fell in love with designing and conducting experiments, which required an analytical and inquisitive nature. The vast world of scientific inquiry became my calling to satiate an intellectual curiosity and interact with the scientific community.

So, during my first year at the University of Florida, I joined Dr. Brian Song’s research team in the biomedical engineering department. I worked in the lab on designated days of the week to examine inflammatory responses induced by lipopolysaccharide-encapsulated poly(lactic-co-glycolic acid) in the tissue of nude mice with funding from the HHMI Science for Life Award. I also learned to quantify the fluorescently labeled leukocytes that had streamed out of the blood vessels using intravital microscopy imaging techniques. As part of the analysis, hemoglobin saturation maps were generated from the data to indicate the oxygen levels in the blood vessels. After attending the 2009 HHMI Arts & Sciences Poster Session and meeting other young scientists who shared my fervor for research, I decided that I want to learn more about the variety of innovative projects in biomedical engineering.

One of the many areas that resonated most with my interests was tissue engineering. To me, it is a field of delicate complexity with many potential applications. Dr. Jonathan Butcher employs techniques of tissue engineering for his specialization in cardiovascular development at Cornell University. One of his current projects involves creating biosynthetic scaffolds from decellularized chick cardiac extracellular matrix (ECM), which is believed to provide mechanical cues that direct heart development. Thus, a critical experiment involves optimizing the decellularization protocol and reseeding the ECM with embryonic stem cells to observe differentiation. This summer a REU will allow me to explore an unfamiliar territory. As a result, I am looking forward to learning much new knowledge and new lab techniques that can be integrated with my current project at UF. I believe the experience will further affirm the joy I find in conducting research and help with my decision in selecting graduate school programs.

**Abstract**

3D Self Assembly of an Embryonic Heart Abstract

Goude M, Butcher J

The heart functions as a result of the interplay between its biochemical and mechanical components. Soluble induction factors and genetic pathways constitute the role of biochemistry within the heart. Meanwhile, the cardiac extracellular matrix (ECM) defines the structure and provides mechanical cues for development. Ultimately, we seek to understand the effects of matrix biomechanical properties on differentiation of heart progenitor cells. Chick embryos from HH26 to 36 were decellularized using 0.001%, 0.01%, and 0.1% concentrations of sodium dodecyl sulfate (SDS) detergent at various perfusion times (flow rate). Results indicate that the amount of residual cells decrease with longer perfusion time and higher concentration. The extent of decellularization was also shown to vary between stages and organs. Most importantly, we have confirmed that tissue density was preserved during decellularization. Future studies involving reseeding the decellularized scaffold with embryonic stem cells will provide insight into the role of ECM biomechanics in embryonic heart development.

**Personal Statement After Starting Science For Life Award**

My participation in the Cornell Center of Materials REU this summer has broadened my outlook on the possibilities of biomedical engineering. I have come to realize that in order to successfully combat diseases, we need to develop better treatments by advancing our understanding of biological mechanisms. Ten weeks of full immersion in research has also helped reaffirm my goal of pursuing a doctorate degree in biomedical engineering, especially in areas of biomaterials and tissue engineering. I have also grown as a scientist. I have developed more appreciation for the groundwork required to launch a project from paper to lab and learned to incorporate more creativity into the research process, especially in prototype designs.

Most importantly, I was able to explore the field of biomedical engineering and connect with diverse individuals during my summer at Cornell. Working in the lab daily from 9 to 5 (even on some weekends) and submitting an abstract to the BMES conference have provided me a realistic view on the demands of graduate school and research. This challenge, I believe, has further equipped me with the problem-solving skills that will help me succeed in graduate school.

I believe a well-rounded experience is key to becoming a good scientist, who is versatile and resourceful. Therefore, I am continuously searching for opportunities to expand my horizon. My experiences, as well as my summer at Cornell, have taught me how to tackle challenges with a multidimensional approach. And I plan to pursue a PhD in biomedical engineering upon graduation in preparation for a research-based career in areas that involve biomaterials, polymers, drug delivery and tissue engineering. After completing my degree, I would like to work in a bioengineering firm first to compound my academic learning with practical skill sets developed from a corporate setting. Then I intend to fulfill my aspiration of acquiring a biomedical researcher position at the National Institute of Health with a solid foundation of academic, research, and work credentials.
Abstract

Regulation of Hox genes in hematopoiesis

Jing L, Heyliger-Fonseca P, Wells LM, Zon L

The project I have ceased momentarily in Gainesville, due to my trip to Boston, is the creation of a DSAAT computer growth model for Arabidopsis thaliana, more detailed information of this can be found in the reference below.

It is well documented that homeobox (Hox) genes play essential roles during hematopoietic development and adult hematopoiesis. The poor expression of Hox genes in blood cells causes various hematopoietic malignancies including leukemia. However, the regulation of Hox genes in hematopoiesis is poorly understood. My project at Dr. Len Zon’s lab at Children’s Hospital Boston is to study the mechanisms that regulate Hox gene expression during developmental hematopoiesis.

In order to identify new pathways and small molecules that regulate Hox gene expression, we are operating a small molecule screen in zebrafish embryos for the expression of Hox genes. Briefly, the zebrafish embryos were treated with compounds from Children’s hospital chemical library (2400 chemicals) and examined for Hox9 and Hoxb4 genes in each embryo, two essential Hox genes during hematopoiesis and leukemia progression, through in-situ hybridization. The intention of this project is to identify drugs that alter the expression of Hox genes in hopes of revealing new pathways that are being blocked through the treatment. The success of this project could also provide new targets and treatments for the therapies of leukemias, through later pharmaceutical creation.

In addition, we plan to use the same chemical library to simultaneously screen all 39 human Hox genes in human hematopoietic cells (K562) using the new nanoluid technology-based qPCR array systems. The previous trial with this technology from Fluidigm Inc. in the lab demonstrated very variable qPCR results. The problem could reside in mRNA and cDNA preparation. I am in the process of testing and refining the condition for the synthesis of cDNA using a Biotrove preparation kit and testing the OpenArray system from another company Biotrove Inc.

It is known that the fibroblast growth factor signaling (FGF) molecules regulate hematogenic genes such as gata1. However, the precise underlying mechanism is not clear. Available evidence suggested that FGF signaling might regulate the expression of Hox genes. We are operating on the assumption that FGF signaling affects the Hox family of genes to regulate the gata gene, which in turn produce globin through this process. To investigate this hypothesis, I am testing the effects of the drugs SU5402 and PD17304, which are both well documented FGF inhibitors, on Hox family gene expression. I have found the optimal concentration and time to treat the embryos with the two drugs and I saw consistent reduction of both Hox genes and gata1 in the same embryos. We are in the progress of testing if Hox genes can rescue gata1 in FGF signaling diminished embryos, if this holds true, we will study how gata1 signaling regulates Hox gene expression. Below are pictures of the staining results of hox9, the control in the first row is of normal expression, while the second row are overexpressed, the third row have arrested development, and the fourth and fifth are underexpressing the genes.

References:

Personal Statement Before Starting Science For Life Award

My belief is that the HHMI Undergraduate Research Award will help me first and foremost by funding the lab for this summer. I have been offered a salary, but it is a toll on an already strained lab. I would also much like to take this opportunity to establish myself more prominently in the UF scientific community, as well as the scientific community as a whole. I also understand that as a member of this esteemed program, I would have access to far more resources than I would otherwise, despite being in the same position. I find that the requirements of the program are actually goals and expectations I had set for myself regardless, and have no problems with upholding the set standards.

I have chosen my research mentor mainly by her project. I found a publication of hers from a few years prior, read it, and was literally enraptured. I find the concept of terra-forming mars, as well as creating self-sustaining biospheres with plants amazing. The fact that this is even possible made me want to pursue a degree in this field, and I found that this holds true, we will study how FGF signaling regulates hematopoiesis. I have been offered a salary, but this experience will benefit me greatly in many ways, even if I end up in a lab that has nothing to do with this project, I am far more comfortable, confident and cheery in the lab, and know well how to budget my time evenly, and especially knowing that just because a project doesn’t seem to take up a lot of time, that doesn’t mean it will not. This full-time research at Harvard was definitely an enlightening experience; I am surer than ever that I want to earn a PhD in molecular genetics, though I’m starting to strongly think I may need some computer skills in addition to my biological knowledge. Being in a new environment has also helped me to appreciate the differences that being in one area of the world can have when compared to another, the development of the Longwood medical area stands in sharp contrast to Gainesville, and the resources easily available reflect that. I am also relieved to have been guaranteed publication rights in the future, which will be an excellent addition to future letters of recommendation, and should be a boost into graduate school. I feel my goal towards attaining membership in the EXROP program has been furthered as well.

My biggest gain, however, was definitely the ability to contribute considerably to human progress and development as a whole. There are few feelings as moving as being part of something as influential in the course of mankind as scientific research.

Personal Statement After Starting Science For Life Award

As a researcher, I feel that I have grown enormously in this past year. This experience has provided me with a diverse environment where I can interact with several successful individuals and to learn from them. It was also very enjoyable, very constructive, and I feel more confident about my potential as a future graduate student. I have a deep passion for research, and raising organisms has become a hobby of mine.

Outside the research field, my tenure as vice president of the UF society for viral studies has been completed, and I have wrapped up my involvement with my dormitory council, as well as numerous other clubs and extracurricular activities.

This experience will benefit me greatly in many ways, even if I end up in a lab that has nothing to do with this project, I am far more comfortable, confident and cheery in the lab, and know well how to budget my time evenly, and especially knowing that just because a project doesn’t seem to take up a lot of time, that doesn’t mean it will not. This full-time research at Harvard was definitely an enlightening experience; I am surer than ever that I want to earn a PhD in molecular genetics, though I’m starting to strongly think I may need some computer skills in addition to my biological knowledge. Being in a new environment has also helped me to appreciate the differences that being in one area of the world can have when compared to another, the development of the Longwood medical area stands in sharp contrast to Gainesville, and the resources easily available reflect that. I am also relieved to have been guaranteed publication rights in the future, which will be an excellent addition to future letters of recommendation, and should be a boost into graduate school. I feel my goal towards attaining membership in the EXROP program has been furthered as well.

My biggest gain, however, was definitely the ability to contribute considerably to human progress and development as a whole. There are few feelings as moving as being part of something as influential in the course of mankind as scientific research.

Co-authorship of any publications resulting from my research has been assured to me, and essentially depends on the data that result. We are hoping for very interesting data, for our mutants to show direct, drastic correlations between their phenotypic growths, and their genotypic mutations. Additionally, we intend to make a poster of the results to be hung in the facility, have discussed presentations for NASA and international conferences, namely any at University of California at Berkeley, as this is my ideal graduate school. I would also be very interested in competing for the science for life extramural research opportunity at some point in the near future, and any grants I find.
An HHMI Undergraduate Research Award will give me a rapid start in research as well as an opportunity to begin exploring areas of study in neuroscience very early in my undergraduate education.

Because of my interest in research and my goal to pursue a career in medicine, I looked for a mentor who is a physician-scientist. I would like to observe how science and medicine are balanced professionally and how they inform one another. Dr. Nadeem Shafi, who is a physician in Pediatric Critical Care Medicine as well as a scientist, is an exact match. Dr. Shafi’s research focuses on neuroregenerative mechanisms and neuroplasticity. The underlying potential of this research include the ability to promote recovery of the neurological deficits associated with spinal cord injury. Dr. Shafi’s collaborations with other investigators such as Paul J. Reier, Ann and Oscar Lackner Professor in the Department of Neuroscience and MBI, and Dr. Arun Srivastava, Chief of UF Pediatric’s Division of Cellular & Molecular Therapy, will allow me to see inter-laboratory partnerships. By participating in undergraduate research especially in an area that interests me, I will be able to gain in-depth understanding of neuroregenerative mechanisms and neuroplasticity and gain insight into the way experimental data are acquired, processed, interpreted and presented in the scientific community.

During the course of my research, I expect to learn various experimental skill sets. These include assessment of protein expression with Western blotting, RT-PCR and immunohistochemistry; light and fluorescence microscopy; animal surgical skills; and tissue fixation and sectioning techniques. These techniques are widely used, making my research experience broadly applicable. Furthermore, I anticipate exposure to several aspects of biological sciences, including neuroregenerative science and stem cell biology, neurodevelopmental biology and viral vector biology.

As a microbiology and cell science major, my curriculum will include additional science courses that will complement my research. I firmly believe that by participating in undergraduate research with HHMI Undergraduate Research Program will also strengthen my personal skill sets. As I have discussed with Dr. Shafi, participating in research while challenging myself with heavy course load will be difficult. I have always welcomed challenges and turned it into motivation. I intend to devote approximately 10 hours per week during the school year and at least 40 hours per week during summer semesters to the lab work for the next 2 to 3 years. I will not only gain experimental skill sets but also develop myself as an individual in terms of discipline, organization, communication and the ability to think critically.

The results of the studies will likely be presented at various national meetings and assist in my application to the HHMI Science for Life Extramural Research Award. If the results are as significant as anticipated, they will be published in peer-reviewed scientific journals and I will have the honor of co-authorship.

My deep interest in the neuroscience and the implications it has on clinical practice as well as its potential for personal development will keep me motivated throughout the experience. As I learn more about medicine, I may find another field that would appeal to me more. However, the research experience that I will gain under the support of HHMI program coupled with the ways in which it will help me to grow personally will certainly make me a better future physician-scientist.

Abstract

Dietary Modification to Improve Vein Graft Patency
Jiang T, Ozaki KC

Inflammatory pathways have been associated with vein graft failure. Short term high-fat feeding induces a proinflammatory state in perivascular adipocytes, but the longer-term impact of such dietary induced dysfunction on clinically relevant vascular events is unclear. We directly tested the hypothesis that the inflammatory phenotype resulting from diet induced obesity (DIO) drives accelerated vein graft failure (increased intimal hyperplasia, enhanced negative wall remodeling). Methods Male 9 week old DIO mice (n=5; 3 weeks of high caloric diet) and controls (n=5) underwent an isograft (IVC from same diet donor) unilateral carotid interposition vein graft with a focal mid-graft stenosis (to hemodynamically create areas prone to intimal hyperplasia). Perfusion fixed vein graft was harvested 4 weeks later while the mice continued their respective selected diets post surgery. DIO/control mice also underwent blood, spleen, and adipose cell harvest for immune profiling (flow cytometry). Results Despite a 40% larger body size, DIO mice had 34% smaller residual vein graft lumens (p=0.02). Lumen loss was not due to accelerated intimal hyperplasia, or other differentials in wall thickness (all layer thicknesses and intima to media ratio were equivalent), but rather acceleration of overall negative wall remodeling (cross sectional wall area 47% smaller, p=0.03; outer vein graft perimeter 19% shorter, p=0.01). Resting blood and spleen immune cell profiles were similar; DIO fat held significantly more NK, macrophage, and dendritic cells. Conclusions These findings highlight negative wall remodeling as a factor leading to vein graft failure, and provide direct evidence that short term dietary alterations in the mammalian metabolic milieu can have lasting implications relating to acute vascular interventions.
Personal Statement Before Starting Science For Life Award

My ultimate goal is to have a career in molecular genetics. Molecular genetics is the key to sustaining a healthy planet and human population. Molecular genetics research and the subsequent biotechnology that is derived from it has and will continue to increase yield and quality of crops, both food and ornamental. This work will also aid in decreasing the use of harmful chemicals to control hindrances to plant growth. It is my ambition to be a part of this movement and give our growing population everything it needs to sustain itself while also protecting our resources and environment.

Molecular genetics is so fascinating because it opens up a microscopic, precise world that few get the opportunity to see. The inner workings of the transcriptional, translational, and regulatory processes within each and every totipotent cell of a plant are so exact. Molecular genetics research must be done in order to better understand these processes and manipulate them towards a greater good.

After three years of research in molecular genetics, I am very excited and well-prepared for a graduate program and future career in this field by the time my schooling and research at UF has ended. Molecular genetics is rapidly growing in importance, and I believe I have the critical thinking skills, creativity, and passion to succeed. It is my goal to work for either a university or a plant biotechnology company, such as Monsanto, to study plants important to our world and improve them for better use.

Abstract

An Acyl-Activating is Required for Benzenoid Biosynthesis
Marciniak DM

Max Planck Institute for Chemical Ecology in Jena, Germany and Lytle Preserve, UT

The compounds trans-β-farnesene and trans-β-bergamotene are sesquiterpenes. These are defensive compounds produced by many plant species. One in particular is Nicotiana attenuata. The volatiles are produced at very minute levels in undisturbed plants, but after attack by a herbivore, they are produced in vast amounts. To derive these sesquiterpene compounds the herbivore attack sets off the jasmonate signaling pathway, which feeds substrate to the mevalonic acid pathway which ends in the production of trans-β-farnesene and trans-β-bergamotene. The rate-limiting enzyme in the mevalonic acid pathway is thought to be 3-hydroxy-3-methylglutaryl-Coa Reductase (HMGR).

There are three HMGR genes. It is uncertain which is responsible for the inducible response. Through virus-induced gene silencing, volatile chemical analysis, microarray, and quantitative RT-PCR, we have been able to find a candidate for the inducible response. Further stable transformed lines will be carried out, and a paper is projected to be submitted in Fall 2011.

Personal Statement After Starting Science For Life Award

My ultimate goal is to have a career in molecular genetics. Molecular genetics is the key to sustaining a healthy planet and human population. Molecular genetics research and the subsequent biotechnology that is derived from it has and will continue to increase yield and quality of crops, both food and ornamental. This work will also aid in decreasing the use of harmful chemicals to control hindrances to plant growth. It is my ambition to be a part of this movement and give our growing population everything it needs to sustain itself while also protecting our resources and environment.

Molecular genetics is so fascinating because it opens up a microscopic, precise world that few get the opportunity to see. The inner workings of the transcriptional, translational, and regulatory processes within each and every totipotent cell of a plant are so exact. Molecular genetics research must be done in order to better understand these processes and manipulate them towards a greater good.

After three years of research in molecular genetics, I am very excited and well-prepared for a graduate program and future career in this field by the time my schooling and research at UF has ended. Molecular genetics is rapidly growing in importance, and I believe I have the critical thinking skills, creativity, and passion to succeed. It is my goal to work for either a university or a plant biotechnology company, such as Monsanto, to study plants important to our world and improve them for better use.
As an international student at UF this program is a once in a life time opportunity I wish to seize, as it will allow me to become a well-rounded, young scientist who will open many doors leading to numerous experiences and deep insights in the world of genetics and integrated biological research in the future. I believe that I am ready for the HHMI Undergraduate Research Program!

Abstract

The Examination of Frequency Dependant Selection for a Spontaneous Beneficial Mutation in Saccharomyces cerevisiae

Masannat J, Lang G, Botstein D
Frequency Dependant Selection (FDS) is the maintenance of multiple genotypes within populations. A previous long-term study in the Botstein lab identified 50 populations undergoing this dynamic. Using this collection of populations I pursued a series of experiments to understand the dynamics and biological basis of FDS.

Using high-throughput Flow Cytometry and a mating-specific fluorescent reporter we were able to determine the fraction of sterile cells in our populations. Furthermore, expression microarrays were used to compare the variation patterns of gene expression in the sterile verses the non-sterile populations. Our results clearly indicate the suppression of genes involved in mating pathways, such as GPA1, FAR1 and MFA2. Moreover, we observed other changes in gene expression similar to those seen in other long-term evolution experiments involving phosphate, glucose, sulphur, and metal uptake.

We conclude that the dynamics of such selection are beyond simple, and believe our current analysis will provide a better understanding of genetic variation backgrounds and the mechanism of interaction between the two populations.

Personal Statement After Starting Science For Life Award

During this past summer (June 12th – August 13th, 2010) I was working at the Lewis-Sigler Institution for Integrative Genomics, Princeton University, in the David Botstein lab. David Botstein is one of the pioneer researchers who developed statistical methods for analyzing microarray data. My mentor Greg Lang, a post-doc, and I worked together on understanding the phenomenon of Frequency Dependant Selection for a beneficial mutation in Saccharomyces cerevisiae using long term evolution and microarray analysis.

Very different form my previous research here at UF, my experiment at Princeton allowed me to do hands on work with robotics in order to run hundreds of sample dilutions every morning within a few minutes only. I also became familiar with large machines such as the Flow-cytometry and FACS sorting machines. Greg had showed me how to run the machines a couple of times, before he completely handed the experiments to me. In the beginning I was nervous, but he had told me: “I have faith in you, you work like a grad student!” This helped increase my confidence in my experimental skills and understanding of the work I was doing.

Half way through the summer, we started running gene expression microarrays, and have my own kit to work with, as this facility is not available at UF. Not only I ran the RNA extraction, hybridization, and labeling, I was taught how produce neat image results for my poster, using programs such a Puma, Java Tree and Multiple Experimental Viewer.

In this Molecular Biology Summer Undergraduate Research Program, students were required to present their work using a power point slide show, and a chalk talk to their peer students. Greg also gave me the opportunity to present my summer work in two lab meetings. Being the first time I present in lab meetings, and especially in front of Dr. Botstein, I was nervous, but it was not difficult after all. Dr. Botstein seemed to be impressed and congratulated me on my hard work and results. I was the only student to be chosen to work at his lab from the ninety other students.

At the end of the program, Greg and I were happy of the data we have produced. Though it will require intense further analyzing by Greg, his collaborator at Harvard, and I in the coming months, the work I have done formed a clear big picture about the phenomenon. Greg will recognize my work in his next published paper on this work, as I was the primary data analyzer for this part of the large-scale experiment.

This experience was a life changing one. I was able to prove myself in front of high profile scientists and researchers. I got advising form Dr. Botstein about future academic and career plans. And confirmed to myself that research is definitely what I see myself doing in the future.
Personal Statement

Before Starting Science For Life Award

Sometimes, students join labs purely for general "research experience" or because it has become a necessary step in gaining admission into certain graduate schools. However, I believe that there is much more knowledge and value that can be gained from working in a lab than simply learning some common techniques or adding another line to a resume. Like many other undergraduate researchers, I plan on pursuing a career in health care. Working on a research project is an extremely useful way to learn the kind of problem-solving skills and innovative thinking that is needed for such a profession, and it also exposes the researcher to an abundance of information on their specific topic. Because of the degree of specialization that is required, my top priority is to be interested in my research project. If one is not engrossed in their work, it is much harder to find the motivation to learn all of the material and read up on past articles, and the level of output will be lower. There are almost endless opportunities for undergraduate research at the University of Florida, and thankfully I have found a lab whose research captivates me and that I feel very comfortable in.

I initially contacted Dr. Jacqueline Hobbs through the Science for Life course website, and after learning a bit about her research on neuro-parvovirology, we began to outline a research project that I could work on. A large portion of her lab deals with parvoviruses and neuropathogenesis, involving diseases from cancer to psychological disorders. While I am undecided on my exact future field of work, I have seriously considered both oncology and psychiatry, and thus the interests of this lab clearly correspond to my own. If I end up choosing either of the two fields, I will bring with me valuable preliminary knowledge that I will have gained from the research I do in Dr. Hobbs’ lab.

My specific project will focus on the hypothesis that B19 infection plays a role in the pathogenesis of thyroid cancer. Once an association between the presence of B19 and thyroid cancer is fully established, the mechanism by which B19 plays a role in tumorigenesis can be studied in order to create new forms of treatment for thyroid cancer and non-cancer disease. The techniques and information that I will learn while conducting this research will not only help me in my future career, but also in my classes. I am a biochemistry major, and a lot of what I will learn in the lab will be relevant to my course work as well. Not only will I have the advantage of previous background on some of the topics covered in class, but I will be able to look at the material with a more open and educated perspective.

One of my goals while working in the lab is to co-author an article. The criteria to attain co-authorship status includes doing a significant portion of the experimental work, understanding the objectives of the overall work, being able to answer general questions about the paper, and being involved in the editing during preparation and revision of the manuscript. I understand that it takes time and dedication in order to achieve such status, and I plan on doing work in the lab for the duration of my undergraduate years. As an undergraduate, it is less likely but still possible to attain first authorship, at which point the research could potentially be presented at a national meeting. As far as other off-campus activities go, I would definitely utilize any opportunity to visit a collaborator’s laboratory, as has one student in Dr. Hobbs’ group who has had the chance to work with researchers at Yale University. On campus, I will be able to discuss my work at poster presentations.

To conclude, I hope to make the most of the many available opportunities both on and off campus to gain important knowledge that can be integrated into both my undergraduate studies and my future career. By working on a project through the HHMI Undergraduate Research Award program, I will be able to gain insight on not only the topic being researched, but on the fundamentals of the scientific method itself.

Abstract

Genetic Requirements for Capsid Assembly in Minute Virus of Mice

Polcz M, D’Abramo A, Tattersall P

Parvoviruses are common pathogens that infect a variety of organisms from insects to mammals, and are among the smallest DNA-containing viruses that are able to do so. Parvoviruses can be separated into two groups, the autonomous parvoviruses and those of the genus Dependovirus. In contrast with the autonomous parvoviruses, members of this genus require the aid of an unrelated DNA virus to complete their life cycle. Because parvoviruses are so small in size, they must employ strategies to increase the efficiency of their short genomes. Adeno-associated virus (AAV), a member of the genus Dependovirus, encodes a novel protein in an alternate open reading frame nested within the cap gene. This assembly-activating protein (AAP) cotransports newly synthesized capsid proteins to the nucleolus and aids in capsid assembly. All members of the genus Dependovirus have been found to encode a homologous protein. This project was aimed at determining whether the SAT gene of minute virus of mice (MVM), an autonomous parvovirus, encodes a protein of similar function to AAP. Two vectors were created, one containing the entire sequence for VP2, and the other, designated VP2-less (See Figure), deleting the N-terminal regions of VP2 and SAT, such that VP3 translation begins at the original VP2 initiation codon. These were transfected into A9 cells, and fluorescent staining with antibodies specific to either unassembled capsid proteins or assembled capsids were used to determine whether assembly had occurred. Assembly take place in those cells transfected with the VP2less plasmid, implying that neither the N-terminus of the VP2 nor SAT gene product is required for assembly and furthermore pointing out another possible difference between the autonomous and dependent parvoviruses.
I decided to pursue a research project during my undergraduate years because I wanted to know if research was suited for me. My ultimate goal was to have a career in medicine by first receiving a M.D degree and possibly a PhD as well. This possibility is what first sparked my interest in getting involved in an undergraduate research project, so I could have the proper knowledge of research and what it entails. I have always been interested in neuroscience and chose my research mentor, Dr. Roger Reep, because his lab studies the circuitry of hemispheral neglect and its recovery. After spending a full semester and summer on my research project, I have realized that I would like to incorporate research into my career plans.

My current research project focuses on the underlying neural circuitry of directed attention in rats because it can address very fundamental issues of neglect and its recovery. Through functional imaging studies, neglect in humans has been determined to be caused by damage to neural networks of interconnected cortical and sub cortical regions. It has been found that damage to these subcortical areas have more severe and long lasting symptoms of neglect, and recovery being dependent on spontaneous factors rather than effective treatment. Understanding some of the key components of the neural circuitry studied in my research project has opened my interest in the research directly involved in recovery of neglect. This research involves behavioral research techniques that are not readily available here in my home institution.

Dr. Reep has continuously collaborated with Dr. James Corwin at Northern Illinois University, where the behavioral research and the neural circuitry has been studied here in the University of Florida. I intend to be able to go to Northern Illinois University and integrate complimentary research on hemispheral neglect and recovery through the Extramural Undergraduate Research Award. I intend to continue my research until my expected graduation in spring 2011, and become a co-author on a peer reviewed scientific publication on my research. Potentially, I will prepare a poster with the results of my research from my home institution and from the extramural program to present at a national meeting. All my research will contribute to my neurobiological sciences major, and will be included into my undergraduate thesis. The coursework needed for my major will contribute to understanding the more intricate details of my research. I intend on finishing most of my coursework at my home institution, but would also like to take one or two courses at the participating extramural program institution.

Abstract

Unilateral Neglect Lesioning Techniques and Behavioral Testing
Stiep T, Corwin J

Unilateral neglect is a neuropsychological disorder that occurs after a stroke which affects a patient’s ability to respond, report, or orient to a new stimulation presented on their contralesional side. A rodent model of neglect has been developed and studied by Dr. Reep and his colleagues, which has direct relevance to human patients with neglect. My summer research project focused on learning how to test animals with unilateral neglect and how to quantify the results. In addition to testing for unilateral neglect, the surgical techniques necessary for lesioning the medial agranual cortex (AGm) were also very important in studying its behavioral effects.

The surgical techniques included ablation of the AGm using a vacuum, and photothermal/sclerosis of the AGm by injecting a photosensitive dye and using a specific wavelength laser to cause occlusion of the blood vessels. The combination of the surgical techniques and the subsequent behavioral testing gave me a further understanding of the neuropsychological disorder and how it relates to the underlying neural circuitry.
My proposed research project in Dr. Xingming Deng's laboratory at the University of Florida requires a time commitment of at least one to two years, at which point the investigation will be further expanded to a more in-depth analysis of the role of the Bcl-2 family proteins in regulating cell death. I chose Dr. Deng as my faculty mentor because his research is dedicated to integrating the experimental side of cancer treatment and prevention to medicinal applications. Originally a medical doctor himself, Dr. Deng is able to train and educate his undergraduate students with an interdisciplinary approach to cancer research. This particular project appealed to me because of the potential long term significance for the treatment of non-small cell lung cancers, which accounts for approximately 80% of all lung cancer cases.

Currently, there is considerable debate between the correlation of autophagy and apoptosis and the potential effects that these cell death mechanisms have on the development of tumors. At the center of such discussions are the Bcl-2 family proteins, like Mcl-1, for which the apoptotic and autophagic effects are currently unknown.

As my faculty mentor, Dr. Deng’s expectations for my research includes a time requirement of a minimum of 15-20 hours a week, which is necessary for completing most routine molecular biology experiments, such as SDS-gel electrophoresis, western blotting, and cell tissue culture. Thus, I plan to arrange my schedule accordingly, attending classes in the mornings and working at the University of Florida Cancer/Genetics department in the afternoons. For the spring 2009 semester, I am currently enrolled in 15 credit hours, a course load that is manageable with the work necessary for productivity in a research laboratory. Dr. Deng has expressed confidence in my ability to work diligently and efficiently in order to obtain results that will allow me to become a co-author of a publication.

The HHMI Undergraduate Award presents an excellent opportunity to expand my research experiences as an undergraduate student at the University of Florida. The summers between the academic semesters represent the ideal time to dedicate my full attention to research at Dr. Deng’s laboratory without concerns for my coursework. Throughout my college experience at UF, I hope to become involved in a variety of programs such as Science for Life that encourages student research. As an example, the University Scholars Program would allow me to present my results at an annual symposium and publish my work in the Journal of Undergraduate Research.

My experiences from participating in this research project will aid me in the pursuit of my future career goal of becoming an oncologist. I realize that research allows the possibility to surmount all challenges. Thousands of diseases today still require cures that can be revealed through interdisciplinary research efforts. I trust that only through such endeavors will the world ever see a future without obesity, cancer, AIDS, or aging-associated diseases. Thus, every attempt that I make to understand the mechanisms controlling the proliferation of cancer cells will ultimately aid the ability of medical professionals to treat and cure this disease.

Abstract

Targeting Bcl-2 for Enhanced Anticancer Efficiency of Ionizing Radiation and Chemotherapy
Wang T, Liu Y, Park D, Deng XM

Accumulating evidence suggests that the relative ratios of pro- and anti-apoptotic Bcl-2 family proteins determine the sensitivity or resistance of cells to apoptotic signals. The pro-apoptotic Bcl-2 family members like Bax, Bak and BH3-only members induce the release of mitochondrial apoptogenic molecules into the cytosol leading to caspase activation and apoptosis, whereas anti-apoptotic Bcl-2 family proteins like Bcl-2, Bcl-XL and Mcl-1 inhibit this event to promote cell survival. Many of the current methods of cancer treatment such as ionizing radiation (IR) and available chemotherapy drugs often lead to resistance after a prolonged period of use through yet to be defined molecular mechanisms. Preliminary data by Western blotting in lung cancer cells indicate that treatment with IR or the widely used anticancer drug Cisplatin increases the protein levels of Bcl-2 and/or Mcl-1 at certain doses (Figures 1-2), suggesting that the enhanced anti-apoptotic Bcl-2 family proteins may activate survival pathways and compromise the effectiveness of these cancer treatments. These results also suggest that a combinational therapy with agents that suppress the pro-survival side effects of these treatments may be more effective in lung cancer cells. To this end, lung cancer cells were pre-treated with increasing doses of an experimental drug, BI 366, which acts primarily as a Bcl-2 inhibitor, and then exposed to IR. Immunoblot analysis shows that the proteins levels of Bcl-2 and Mcl-1 decreased noticeably in a dose-dependent manner (Figure 2). Taken together, these observations suggest that sequential treatment with Bcl-2 inhibitors has the potential to increase the effectiveness of radiation therapy by reducing the anti-apoptotic behavior of cancer cells. Thus, a better understanding of the regulation of drug resistance with respect to the Bcl-2 family of proteins after treatment of cells will allow for more effective cancer treatment.

Personal Statement After Starting Science For Life Award

I started conducting research in Dr. Xingming Deng's lab at the University of Florida in the fall of my freshman year. I had always been interested in research, but this was my first experience working in a molecular biology lab studying the mechanisms of lung cancer drug resistance. After Dr. Deng moved to Emory University last year, I transferred to Dr. Chen Liu's lab in the College of Medicine, where I started studying the pathogenesis of liver cancers. This past summer was a great experience for me because I was able to travel to Atlanta with the HHMI Science for Life Extramural Award to continue my research with Dr. Deng, working full time in the lab. This coming year, I plan to incorporate many of the elements of my project from the summer into my work in Dr. Liu's lab so I can hopefully continue to progress with the work that I have done so far. In addition to research and taking classes, I am a member of the University Symphony Orchestra and play the viola as part of a chamber music group. I also fence with the UF women's club foil team and work as a teaching assistant for Dr. James Horvath's General Chemistry II course CHM 2046, which allows me to lead a discussion section once a week. I am also very excited to have been accepted to the Junior Honors Medical Program at UF, which offers me admission to the medical class of 2015. I hope in the future to work extensively on directly translational research, which I believe is crucial for taking treatments from the lab bench to the bedside. Overall, receiving the Extramural Award was an amazing opportunity for me to broaden my knowledge and experience great science. Working in Dr. Deng's laboratory has helped me realize the intricacies, commitment and creative thinking involved in conducting research. I believe that this knowledge and experience will be crucial in the future for my pursuit of a career in medicine.
Graduate Teaching Assistants

Graduate students continue to be a fundamental part of the Science for Life program. Each year, they are dedicated to serving as undergraduate mentors during their roles as teaching assistants in the Undergraduate Core Laboratory (UCL), Science for Life Seminar course, and the Assessment Team led by UF faculty.

The talented graduate students in the Undergraduate Core Lab worked closely with lab coordinator, Gabriela Waschewsky, in order to translate the ideas of the course designers’ visions into tangible learning experiences to advance the undergraduates’ knowledge. The graduate students were able to break down the course designers’ written procedures and successfully construct these pieces into workable courses, which was no easy feat. As new UCL course offerings are added over the years, these students have the unique opportunity to aid in the design of a lab and some even get the chance at autonomy if they design an entire lab themselves. Through the work of these students, they were available to help undergraduates stay on top of the rigorous curriculum by helping them understand their course material, quizzes, discussion questions, and demos. The graduate students’ other responsibilities have included grading laboratory reports and quizzes, setting up and taking down experiment materials, and supervising and assisting undergraduates as they perform the given day’s experiment.

Twelve graduate students from the UF Interdisciplinary Program in Biomedical Sciences (the IDP of the College of Medicine) assisted Dr. Ben Dunn with the Science for Life seminar class in the fall and spring semesters. These students aided with video recording each presentation, grading student reports, and managing the class sign-in attendance lists.

The graduate students involved with the Assessment team aided professors Luis Ponjuan, Ana Puig, Troy Sadler, and Pilar Mendoza with collecting both quantitative and qualitative data regarding the progress of the Science for Life program. Quantitative data was collected through administering surveys to students, while qualitative data was collected through conducting individual interviews with the undergraduate Science for Life awardees and Core Laboratory students. It is anticipated that the graduate students’ work will lead ultimately to publications, research manuscripts, and presentations at national conferences.

The involvement and dedication of the graduate students who participate in various aspects of our program have been gaining recognition among graduate students across campus. As a result, this has translated into an increased number and quality of graduate students who are willing and eager to participate as research mentors and teaching assistants for undergraduate students in our program.

Core Lab Graduate Teaching Assistants

Elisa Livengood

Elisa is a Ph.D. student in Interdisciplinary Ecology with the School of Natural Resources and Environment. Her dissertation focuses on the overall sustainability of the ornamental “aquarium” fish trade by examining the economics, health and quality of fish in the trade, and associated environmental education. She works in South Florida on aquaculture fish farms and internationally at her field site in the Meta region of Colombia. She came to teach the HHMI Science for Life program by working as a Biology Teaching Assistant for the HHMI Accelerated Undergraduate Biology Lab. This lab has been one of the most challenging and rewarding teaching experiences for her at UF. Developing the curriculum for the lab to incorporate chemistry and physics concepts into the biology lab has been a challenge, but has resulted in labs that require the students to think about biology from many different perspectives. The resulting concepts and experiments done with the students involve cutting edge equipment and advanced techniques for an undergraduate lab.

Her lab is an aquaculture lab here at UF, and in addition to the research conducted on ornamental fish, research is also done on sturgeon and caviar production. The image shows her holding one of our shortnose sturgeons that she works with and takes care of in her lab.

Lan Hoang-Minh

Lan Hoang-Minh is currently a Ph.D. candidate in the Biomedical Engineering Department at the University of Florida, working in the neural stem cell laboratory under the supervision of Dr. Brandi Ormerod. Her dissertation research focuses on investigating the factors which impact neural progenitor cell proliferation and differentiation, particularly those related to the circadian cycle. Throughout the past three years in the Ormerod stem cell lab, she has supervised the research of five high school and undergraduate students (three of whom were HHMI fellows), in projects ranging from investigating the role of microglia and astrocytes in neurogenesis to neural progenitor cell cycle differences across the circadian cycle. Lan has also served for the past two years as a teaching assistant for the accelerated physics with calculus lab, a part of the HHMI Science for Life Undergraduate Core Laboratory at UF. She plans to continue working with undergraduate students as she completes her dissertation and in her future career. Her hobbies include spending time with friends and family, playing tennis, soccer and cooking.

Seminar Graduate Teaching Assistants

Jennifer Gurland

Jennifer was born and raised in Miami, Florida. She graduated from the University of Florida in the Spring of 2009 with a degree in Political Science and a certificate in Public Leadership from the Bob Graham Center for Public Service. Jennifer is currently serving her fourth semester as a teaching assistant for the Science for Life Course.

Her campus involvement includes serving as a two-term Senator, Chairperson of the Student Conduct Committee through the Dean of Student Affairs and is an active member of Florida Blue Key. Gurland is a longtime advocate for social justice issues and worked with the Florida Immigrant Advocacy Center (FIAC) where she advocated for immigrants’ rights and has worked with the Children’s Movement of Florida, a citizen-led non-partisan movement to make Florida’s children our state’s highest priority.

This Spring, she will earn her Masters in Public Affairs and has focused her research on immigration policy analysis. Gurland has an interest in politics and her desire to understand how to shape public policy prompts her to become a political analyst upon graduation.
Annet Kirabo

Annet is a Ph.D. candidate in the laboratory of Dr. Peter Sayeski, Department of Physiology & Functional Genomics at the College of Medicine. This lab is interested in investigating the function of the tyrosine kinase Jak2 and its role in the pathogenesis of human disease. Her hobbies include singing, dancing, laughing, talking, smiling, and reading.

Andrew Tebbenkamp

Andrew received a B.S. in cell and molecular biology from Bradley University in the spring of 2005. He began graduate work at UF that fall in the Interdisciplinary Program for Biomedical Research. In 2006, he joined the lab of Dr. David Borchelt studying neurodegenerative diseases. His specific project was to identify molecular mechanisms that contribute to the neuropathology and toxicity of Huntington’s disease. While in Dr. Borchelt’s lab, he was a co-author or author on seven peer-reviewed publications, and attended conferences around the world. During his last year of research, he was a TA in the HHMI Science for Life class. He received his Ph.D. in the summer of 2010 and began a postdoctoral position in the lab of Dr. Nenad Sestan at Yale University in the fall of 2010.

Additional graduate teaching assistants that were not pictured:

Ji Young Kim
Christine Stracey-Richard
Richard Warren, Jr.
David Anastas
Austin Evans
Sunny Ferreos
Pengcheng Guo
Andrew Horan
Michelle Hwang
Jennifer Kielczowski
Mansi Parekh
Sarah Szarowicz
Student Awards

These awards recognize excellence in graduate students who are able to mentor their undergraduates to a point where the undergraduate achieves co-authorship in peer-reviewed publications. During the 2010 academic year, the UF-HHMI Science for Life program named nine Graduate Student Awardees. These graduate students represent nine different academic departments university-wide and have published research with fourteen different undergraduate students while mentoring far more. The award continues to consist of a $500 prize, a certificate and recognition at the annual reception at the UF President’s House, as well as acknowledgement at UF commencement ceremonies.

The 2010 CASE (Creativity in the Arts and Sciences Event) was a resounding success, with entries growing by 55%, 149 of which were students involved in the sciences. Students were awarded prizes totaling $6,000. The event was hosted at the UF Cultural Plaza, which includes three venues: the Phillips Center for the Performing Arts, the Harn Museum of Art, and the Florida Museum of Natural History. In each of the venues, we had scientific posters and 2D and 3D art exhibits displayed, as well as dance, theatrical, and musical performances. Students from several universities including Furman, Morehouse, Emory, and Louisiana State University, our partner HHMI Institutions from the southeast United States, were invited to participate by showcasing their research posters. This event was held jointly with the College of Fine Arts and their students were encouraged to present artwork and performance pieces that embody some connection to the world of science. Awards were given to top scientific posters, which were judged by the students themselves, as well as art exhibits and performances. These awards will be used to fund future travel to national conferences or meetings and will also go towards purchasing laboratory or art supplies. This event provides an excellent bridge to the arts community and further enhances the recognition of the Science for Life program at the University of Florida, which has gained recognition both nationally and internationally.

Allowing students to conduct research in faculty laboratories early-on during their undergraduate careers has provided time to allow projects to mature and result in successful submissions to scientific journals. At the commencement of its fourth year, the Science for Life program has provided a total of nearly 250 awards to early undergraduates in the intramural program and more than 60 awards to the extramural program. We are pleased to report that since the inception of our program, Science for Life Awardees have contributed to more than 70 research projects that have resulted in publications in major peer-reviewed journals.

Graduate Student Awards

Yan Chen

Yan Chen is a PhD candidate in the Department of Chemistry under the supervision of Professor Weihong Tan. Her research focuses on the development and applications of Fluorescence Correlation Spectroscopy (FCS) for live cell measurements. She received her HHMI-GSA award based on her work in the instrumentation development and cell membrane receptor studies with the undergraduate student Michael Mavros, which resulted in the publication “Mapping Receptor Density on Live Cells Using Fluorescence Correlation Spectroscopy” in Chemistry, A European Journal. Later on, Yan and Michael continued to work together to update the FCS set-up into a three-channel Fluorescence Cross-Correlation Spectroscopy (FCCS), a state-of-the-art technique with single molecule detection sensitivity for intracellular gene expression studies.

Adam Mecca

Adam Mecca is a M.D.-Ph.D. student in the College of Medicine in his fifth year of the physician scientist training program. His doctoral dissertation is titled “Targeting the ACE2/Ang-(1-7)/Mas axis for cerebroprotection during ischemic stroke.” Adam’s dissertation research focuses on activating endogenous biological pathways in the brain to prevent or treat stroke. His research has led to the discovery of a novel cerebroprotective action of the endogenous peptide, Angiotensin-(1-7), during ischemic stroke. In addition, Adam is a Co-Director of the Equal Access Clinic, a student run free medical clinic in downtown Gainesville that serves the under-insured populations of Gainesville and Alachua County. He became interested in medically under-served populations as an undergraduate volunteer at the Equal Access Clinic in 2002. Since then, Adam has worked passionately with faculty and student volunteers across the University of Florida health professions to establish and expand the patient services offered by the Equal Access Clinic. Adam aspires to be an effective physician scientist, educator, and healthcare provider and use these skills to assist patients and health professional students.

Paul Perrin

Paul Perrin is a PhD candidate in the Department of Psychology under the supervision of Dr. Martin Heesacker. He also works as a pre-doctoral fellow in the Rehabilitation Outcomes Research Center at the Malcolm Randall Veterans’ Affairs Medical Center under the supervision of Dr. Maude Rittman.
His project examined the mental health of ethnically diverse stroke caregivers, and the relationship between caregiver mental health and stroke rehabilitation. He received his HHMI-GSA award based on his work primarily with one undergraduate, Catherine Utthe. The publication that resulted from their work was “Identifying At-Risk, Ethnically Diverse Stroke Caregivers for Counseling: A Longitudinal Study of Mental Health,” published in Rehabilitation Psychology. This project was also featured in an article in the Monitor on Psychology, the flagship magazine of the American Psychological Association which is read by hundreds of thousands of psychologists nationally. Catherine continues to perform research with Paul on culturally sensitive stroke rehabilitation, and she hopes to enter medical school to study psychiatry.

**Steffen Rebennack**

Steffen Rebennack is a PhD candidate in the Industrial & Systems Engineering department at the University of Florida. He got his diploma degree in 2006 in mathematics from the University of Heidelberg, Germany. His thesis is guided by Prof. Pardalos and deals with energy systems research. Steffen investigates certain aspects of hydro-thermal energy systems and their optimal operation when taking into account uncertain fuel prices and CO2 emission prices. He earned the HHMI-GSA for his work with Josh Grasso which lead to the paper “Short-term Electricity Price Forecasting: Time Series and Neural Network Benchmarking.” More broadly, Steffen’s research interests are in power systems modeling and optimization, stochastic programming, global optimization, integer programming and combinatorial optimization.

**Yoko Tanimura**

Yoko Tanimura is pursuing her Ph. D. degree in the behavioral neuroscience program (Psychology) under the supervision of Dr. Mark H. Lewis. Her dissertation research focuses on the neurobiological mechanism associated with the development of restricted repetitive behaviors in neurodevelopmental disorders using an animal model. She received the HHMI-GSA award for her work with an undergraduate student in her laboratory.

Sasha Vaziri, which resulted in a co-authored publication in Behavioural Brain Research in 2010 entitled “Indirect basal ganglia pathway mediation of repetitive behaviors: Attenuation by adenosine receptor agonists”. This work elucidated that the expression of repetitive behaviors is associated with altered activity of cortico-basal ganglia circuitry and pharmacological manipulation to normalize this activity ameliorates repetitive behaviors in our animals. This work may suggest a novel therapeutic target for the treatment of abnormal behaviors in autism and related neurodevelopmental disorders.

**Joanna Tucker Lima**

Joanna Tucker Lima will receive her Ph.D. in Interdisciplinary Ecology in May 2010. Her dissertation evaluated the ecology of native oil-producing palm species in the Brazilian Amazon and their potential as a regional source of biofuels. This research evolved as a collaboration with professors and students at a local university in Brazil—the Federal University of Acre (UFAC). She was awarded the HHMI-GSA for her work with Brazilian undergraduate student, Anelena Lima de Carvalho. During two years of fieldwork in Brazil she mentored Anelena, serving as co-advisor on her senior thesis committee. Under Joanna’s guidance, Anelena published work from her senior thesis as first author in Acta Amazonica, a Brazilian peer-reviewed scientific journal. This co-authored work entitled, “Floristic and structural comparisons among palm communities in primary and secondary forest fragments of the Raimundo Irineu Serra Environmental Protection Area – Rio Branco, Acre, Brazil”, examined the impacts of tropical forest fragmentation on palm tree diversity and survival. Our results exposed the threatened status of palm tree species within the area, and serves as an example for further research on other plant and animal species conservation within peri-urban protection areas.

**Myung-Heui Woo**

Myung-Heui Woo is a Ph.D. candidate in Environmental Engineering Sciences department working in the laboratory of Dr. Chang-Yu Wu. His project and has a manuscript entitled “Divergent GW182 functional domains in the regulation of translational repression”. Bing enjoys research and working with other undergraduate and graduate students.

**Creativity in the Arts and Sciences Awards**

**Matthew Neu**

Matthew Neu is a 1st Prize Winner – Science Section. Matthew Neu was born in Gainesville and has lived here his entire life. He began fencing competitively in the second grade. He has continued the sport and now competes both nationally and internationally. He is a member of UF’s fencing team, and is the defending US collegiate club champion in Men’s epee. He also enjoys rock climbing, electronic music, and video games.

He is currently conducting research on Endothelial Progenitor Cells and how they are related to the pathogenesis of Diabetic Retinopathy. Next summer he hopes to spend six months in France at the Curie Institute studying cellular migration from a biochemical perspective and learning advanced microscopy techniques that he could apply to his project here at UF.

He hopes to use the award money to help fund his travel to and stay in Paris next summer as part of a SFL extramural fellowship. He has already contacted a researcher, Dr. Daniela...
Medical Institute. discovered at the University of Florida and with new advances to finding a cure for diabetes, this conference with the goal of maximizing the around the world. Corrado specifically chose approximately 10,000 researchers and doctors from annual Meeting and Expo, an event that brings ap-p- Undergraduate Award to present these new, cure diabetes. Corrado plans to use the HHMI of the lab’s bioartificial pancreatic construct to have him work there.

Michelle Corrado

First Tier Prize Winner – Science Section

Michelle Corrado is a sophomore at the University of Florida, with a major in Nutritional Sciences and a minor in Family Youth and Community Sciences. She plans to attend medical school and complete the MD-PhD program. Currently, Corrado works in Dr. Nicholas E. Simpson’s lab, searching for a cure to type 1 diabetes. Recent experiments have controlled animals’ blood glucose levels for an extended time and show the potential of the lab’s bioartificial pancreatic construct to cure diabetes. Corrado plans to use the HHMI Undergraduate Award to present these new, exciting strides at The Endocrine Society Annual Meeting and Expo, an event that brings approximately 10,000 researchers and doctors from around the world. Corrado specifically chose this conference with the goal of maximizing the number of individuals worldwide to understand new advances to finding a cure for diabetes, discovered at the University of Florida and with the generous support of the Howard Hughes Medical Institute.

Octavio Romo-Fewell

First Tier Prize Winner – Science Section

Octavio Romo-Fewell is an undergraduate student pursuing a bachelor’s degree in chemistry at San Diego State University (SDSU). Being an immigrant and the first member of his family to ever strive for higher education, he has overcome numerous challenges in his career path. After he finished middle school in Tijuana (Mexico), his parents made a crucial decision for him to continue his education in San Diego, California. Their plan was to provide him with the opportunities they never had. In addition, their economic situation was precarious and they could only afford to live back in Tijuana, where living conditions challenged his adaptation to the American culture. Nevertheless, he was blessed with strong family values, and all these experiences shaped his character to be strong and determined.

The goal accomplished in his project was the extraction and isolation of bioactive compounds from a native plant of Thailand. The crude extract from the leaves and twigs of Mallotus Macrostachyus, exhibited cytotoxicity against two mammalian cancer cell lines, the murine lymphocytic leukemia (P-388) and the human nasopharyngeal carcinoma (KB). The ethyl acetate extract of the plant also exhibited anti-HIV-1 activity in the anti-syncytium assay (active) and the HIV-1 reverse transcriptase (RT) assay (weakly active). The monetary award will allow him to concentrate on his studies while developing skills to aid him in obtaining his goal of a career in scientific research.

Ashley Thomas

Second Tier Prize Winner – Science Section

Ashley Thomas is currently a third year Microbiology & Cell Science major and Anthropology minor. She is researching the use of gene therapy for treatment of Parkinson’s disease in Dr. Ronald Mandel’s lab for almost two years, helping her learn to work independently and confidently in the lab. Since participating in and being chosen as an award recipient in the 2010 Creativity in the Arts and Sciences Event, she has also gained confidence in presenting and discussing her research in a large venue.

The Howard Hughes Medical Institute Science for Life program has equipped her with the skills to perform research and to present this research at various conferences. With the Science for Life Creativity Award she plans to continue to present his research at national conferences, for instance at the Society for Neuroscience 2010 Conference. Foremost, she would like to thank the Howard Hughes Medical Institute Science for Life program for the numerous opportunities to delve into and gain more experience in scientific research. With the 2010 Howard Hughes Medical Institute Science for Life Undergraduate Creativity Award he plans to present his research project at a national research conference. More specifically, she plans to submit a proposal to present at the Society for Neuroscience 2010 Conference, scheduled for November 13th-17th. With the support of HHMI and his research mentor, she plans to further his study on the use of gene therapy for the treatment of Parkinson’s disease.

Andrew Scheuermann

Second Tier Prize Winner – Science Section

Andrew Scheuermann is a junior double majoring in Chemistry and Economics. After graduating from Edgewood High School in 2007, he entered the University of Florida and began working in Dr. Cammy Abernathy’s group that September. Since then, Andrew has been awarded UF’s Wentworth Scholarship, the Department of Material Science’s REM Scholarship, the Arnold and Mabel Beckman Scholarship, the Anderson Award of Highest Distinction and the Hazen E. Nutter Scholarship from the Department of Liberal Arts and Science, has maintained a 4.0 GPA, and is currently a UF nominee for the Goldwater Fellowship awaiting the decision with crossed fingers.

Having also been a winner of last year’s HHMI Poster Symposium for his research on GaN-based HEMTs and MESFETs, Andrew presented this year his research from a summer internship at Sandia National Laboratories on MgO nanoparticles for thermal battery separators. This project is part of the National Nuclear Science Administration’s initiatives to secure our national defense through the nuclear weapon program while simultaneously allowing its research to proliferate and be published serving the public through the many new outlets of nanotechnology. This fast paced, elevated security project involved the growing and characteriza-tion of hundreds of nanopowders in the search of the one nanocomposite that provides both the desired electrical and mechanical properties. Uniquely, Andrew and his team were able to finish phase 1 and 2 of the project in their entirety by the end of the summer exceeding expectations and facilitating deeper study on the topic.

With the Undergraduate Creativity Award, Andrew is looking to present at a prestigious conference such as the Gordon conference. In addition, he hopes to travel abroad this summer with the REU program for an international research experience. In his free time, Andrew helps coordinate the Undergraduate Research seminars on campus and leads a successful rock band performing regularly around town. Andrew is a part of several clubs at UF but plays the biggest role in the UF Fencing Team. He is the All Men’s Team Captain and recently became the highest ranked foilist in the school and the second highest collegiate foilist in the state of Florida. After placing 13th of over a hundred at the last Division 2 North American Cup he hopes to medal nationally this season.

Angel Rene Del Valle-Echevarria

Second Tier Prize Winner – Science Section

Ángel René Del Valle-Echevarría is currently in his senior year at the University of Puerto Rico at the Mayaguez. He will be graduating this June with a bachelor’s degree in biology. His main
Stephanie Davlanes

1st Prize Winner (Tie with Megan Kendzior) – Art Section

Stephanie Davlanes tied with Megan Kendzior for the first prize in the art section of the 2010 CASE. Stephanie used her CASE award to travel to Costa Rica and lend her talent to independent Costa Rican coffee farmers. She worked closely with farmers on coffee farms and in the coffee cooperative of a small town in Costa Rica. In response to the trip and the issues she researched, she will be designing labels and a website for the Costa Rican Coffee Cooperative so that the farmers may sell their coffee directly.

Elise Frost

Runner Up – Art Section

It is Elise’s intention to use her HHMI award by funding her own artistic pursuits as well as considering her collaborator, Jeremy Miranda, whom she is sharing the award equally with for his dedication and input to the project. Jeremy has made plans to use this money in order to further his scope of dance through attending Laban Movement Analysis workshops this semester in New York City. Elise’s personal plans for the remainder of the award will be put toward attending the American College Dance Festival Association (ACDFA) held at the University of Illinois this semester. Along with performance opportunities, ACDFA will provide exposure to a wealth of dancers and artists involved in colleges and universities throughout the country.

Megan Hamilton

Runner Up – Art Section

Megan Hamilton is a freshman studying graphic design and mathematics at the University of Florida. Her three pieces in CASE, Animalia, were digital paintings depicting three different species of animal. She plans to use her prize money to travel to Miami in December to experience the Miami:Art Basel art show.

Greg Cole

Runner Up – Art Section

Greg Cole is a Digital Media and Graphic Design dual major student at the University of Florida. Many of his pieces use tools such as processing, electronics, video, graphic design, and more traditional creative methods to create work. One of his most successful pieces, AdShades, augments a viewer’s world by removing advertising and other messages in a space. The system allows a viewer to experience an everyday space that is transformed into a series of abstracted colorful shapes, making the world a gallery space for critical thought.

Rita Cook

Second Tier Prize Winner – Science Section

Rita Cook (not pictured), a student at the University of Florida, was also awarded a Second Tier Prize in the science section.

Megan Kendzior

1st Prize Winner (Tie with Stephanie Davlanes) – Art Section

Megan Danielle Kendzior is a native Floridian who graduated this April, 2010, from the University of Florida with a BFA in Dance Performance and Composition. Her senior thesis work, Witness, was composed as a result of a University Scholars Research Grant from the University of Florida, which funded her travel to the Auschwitz Concentration Camp in Poland and to the Impulstanz International Dance Festival in Vienna during August of 2009.

These experiences, in addition to her generous and inspiring faculty mentors and fellow students at UF, have encouraged her growth as a choreographer, dancer, administrator and human being.

She has performed in the works of Jose Limon, Shapiro & Smith Dance, Neta Pulvermacher, Beatrice Kombe, Hemisphere Dance, Incidents Physical Dance Theater and has engaged in the choreographic process with many of her fellow students. She is the founding president of a student organization of dance majors, Dance in a Suitcase, whose purpose is to expose dance majors to the vast field of modern dance and to bring in guest artist opportunities to the University. Megan is grateful to have been acknowledged as an emerging choreographer by the Creativity in the Arts and Sciences Competition. She plans use the generous first place award to continue her research and fieldwork by sharing her work, Witness, with communities across the globe through performance opportunities in cities such as New York City, Vienna and Tel Aviv. She looks forward to a choreographic, professional and movement-oriented future within the field of modern dance.

interest is nutrition enhancement in crops that lack essential nutrients and have a propensity to grow in hostile climates and soil by using molecular tools. He also enjoys reading about new developments in plant biotechnology that may contribute to the economy in the future. His short term goal is to gain a PhD in Plant Biology, especially in Plant Biotechnology, become a professor, perform research and give the same opportunity to his students as he was given. He plans to use his prize money for lab supplies such as primer sequences.

Evan Kassof

Runner Up – Art Section

Evan Kassof (not pictured), a University of Florida student, also qualified for a runner up prize.
Undergraduate Publication Awards


Our fifth Distinguished Mentor Awards (DMA), a prestigious award competition that recognizes faculty excellence in undergraduate mentoring, was awarded to seven outstanding mentors in the fourth year of the Science for Life program. The mentorship is awarded for a two-year term starting the semester after the competition. Awardees were carefully selected to receive this honor amongst dozens of nominees and applicants from numerous colleges and departments, ranging from junior faculty to distinguished professors. Dr. Pam Soltis, a curator at the Florida Museum of Natural History, chaired this year’s selection committee, which included UF faculty and previous winners of the DMA.

Dr. Lise Abrams (Psychology):

Dr. Lise Abrams is an associate professor and undergraduate coordinator of the Psychology Department at the University of Florida. After earning her Ph.D. in cognitive psychology from UCLA, she came to the University of Florida in 1997, where she established the Cognition and Aging Laboratory. Her research investigates memory and language processes in young and older adults, specifically the processes involved in comprehending and retrieving words and the changes in these processes that occur with normal aging. Specific areas of interest include: (1) memory retrieval failures such as the tip-of-the-tongue states, which are naturally-occurring retrieval failures characterized by a temporary inability to recall a known word; and (2) language errors that occur in writing, such as the production of spelling errors and homophone substitution errors. Dr. Abrams has supervised over 80 undergraduates in research, 12 of whom have conducted senior honors theses in her laboratory, and she has published articles with 10 undergraduate co-authors in peer-reviewed journals. Supported by the National Institute on Aging and the National Institute of Mental Health, her research has been recognized by Sigma Xi, who awarded her the 2007 Young Investigator Award. Also known as an inspiring and dynamic teacher, Dr. Abrams has received recognition for her teaching and mentoring, earning a teaching award from the university’s College of Liberal Arts and Sciences and mentorship awards from the American Psychological Association Division 20 as well as the organization Women in Cognitive Science. Most rewarding to her is recognition from the students themselves, who have twice designated her as the Psi Chi / Psychology Club Professor of the Year. abrams@ufl.edu

Dr. Daniel Hahn (Entomology and Nematology):

Dr. Dan Hahn is an Assistant Professor in the Department of Entomology and Nematology at the University of Florida. Work in the Hahn lab integrates ecology, physiology, biochemistry, and genetics to understand the mechanisms underlying adaptation and biological diversification. In other words: 1) how do organisms deal with the stressful world they live in, 2) how can shifts in life history timing lead to reproductive isolation and the formation of new species, and 3) can studying insects living at the extremes of environmental stress tell us anything about humans? The Hahn lab works to educate undergraduates by incorporating them in research and outreach. Our goal is to integrate undergraduates into our research team keeping them long enough that they build into budding scientists that can play a critical role in all aspects of their research project and feel a sense of intellectual ownership over their work. This has lead to students receiving university-wide and national fellowships, presenting their work at local and national venues, participating in events that disseminate our work to the general public including high school teachers and students, and inclusion as co-authors on publications. Former Hahn lab undergraduates have gone on to medical and dental schools, graduate schools, and careers in teaching and industry. The above picture is of our lab group at the 2010 annual meeting of the Society of Integrative and Comparative Biology in Seattle, Washington. From left to right are Diana Jordan and Genevive Ochs (undergrads), Sharon Clemmensen and Frank Wessels (grad students), Dr. Dan Hahn, and Dr. Greg Ragland (postdoctoral associate). dhahn@ufl.edu

Dr. Peng Jiang (Chemical Engineering):

Dr. Peng Jiang is an assistant professor of Chemical Engineering in the College of Engineering at the University of Florida. He received his PhD from Rice University in 2001 and joined the faculty at UF in August 2006. He was a postdoctoral fellow in the Department of Chemical Engineering at Princeton University from 2003 to 2006 focusing on electrokinetically induced assembly. He also gained industrial R&D experience when he worked at Corning and GE. His research focuses on the development of new chemical, physical, engineering, and biological applications related to nanostructured materials. His current research interests include ultrasensitive plasmonic biosensors, nanofluidic bioanalytical systems, biomimetic materials for efficient solar cells and sensors, and self-healing materials. He is a recipient of the NSF CAREER Awards. During the last 4 years, 14 undergraduate students have worked in the lab. Many of them have coauthored in peer-reviewed publications and presented their research results at regional and national conferences. 11 students have been awarded various fellowships, including UF/HMMI Science for Life Research Award, University Scholars Program Award, and UF Undergraduate Research Program Award. pjiang@che.ufl.edu

Dr. Chen Liu (Pathology, Immunology, & Laboratory Medicine):

Dr. Chen Liu is currently an endowed professor at the University of Florida College of Medicine, in the Department of Pathology, Immunology, and Laboratory Medicine. He is also the director of the GI/Liver Pathology section.
and fellowship training program. He received his medical degree from China and his PhD degree from the University of Pennsylvania. He did postdoctoral training at The Scripps Research Institute. He completed pathology residency training at the Medical College of Pennsylvania and completed a surgical oncolgy pathology fellowship at the MD Anderson Cancer Center. Dr Liu is board-certified in both Anatomic Pathology and Clinical Pathology. In 2000, he was recruited to the Department of Pathology at the University of Florida. Dr. Liu’s areas of research are pathology, virology, immunology, and cancer biology. One of his main research programs is to investigate the innate and adaptive immunity in hepatitis C viral infection, mainly focused on the role of the innate antiviral molecular network in liver cells and the T cell response. He is also studying the molecular pathogenesis and biomarkers of liver cancer. His group is actively searching for novel targets for liver cancer therapy. Most of his research programs are funded by NIH or other research foundations. Dr. Liu is a well established investigator in liver disease research. He has published more than 112 research articles. He is actively involved in training young investigators, physicians, graduate students, medical students, and undergraduate students. Many of his trainees have received research awards, such as University Scholar, HHMI Life for Science, and American Cancer Society awards. liu@pathology.ufl.edu

Dr. Mark Settles (Plant Cell & Molecular Biology):

Dr. A. Mark Settles is the Vasil-Monsanto Associate Professor of Plant Cell and Molecular Biology in the Horticultural Sciences Department, Institute of Food and Agricultural Sciences, at the University of Florida. He received his Ph.D. in Genetics from the State University of New York at Stony Brook and completed post-doctoral training at the University of Florida. The Settles laboratory studies the molecular genetics of seed development in maize. Using both visual and near infrared reflectance spectroscopy screens, the laboratory identified seed mutants for molecular cloning. A subset of cloned mutants revealed that RNA splicing has an important role for plant cell differentiation as well as a greater understanding of central carbon metabolism. Currently, the laboratory is funded by grants from the NSF Plant Genome Research Program, the USDA-CSREES, and the Vasil-Monsanto Endowment. As part of the NSF-funded project, Dr. Settles initiated an undergraduate summer internship program that trains pre-professional students from Florida A&M University in genomics research. In the past five years, Dr. Settles has mentored 12 undergraduates with 3 undergraduates co-authoring peer-reviewed publications. Nearly all undergraduates received competitive awards from the HHMI Science for Life, University Scholars, McNair Scholars, and Plant Molecular and Cellular Biology programs for their research training. settles@ufl.edu

Dr. Weihong Tan (Chemistry):

Dr. Weihong Tan is a V. T. and Louis Jackson Professor in the Department of Chemistry and the Associate Director in the Center for Research at the Bio/Nano Interface at the University of Florida. His laboratory has developed internationally recognized interdisciplinary research programs in chemical biology, bionanotechnology, bioanalysis and biomedical engineering. Currently, his group is working on synthesizing a variety of DNA probes for biomedical studies and for single molecule DNA nanomotors, in developing new nanomaterials and bionanotechnology for bioanalysis, molecular imaging and drug delivery, and in elucidating molecular foundation of diseases such as cancer using a chemical biology approach. His work is at the forefront of scientific research and has been recognized by many awards, including the Pittcon Achievement Award in 2004. During his 14-year professor career in UF, he has mentored more than 40 undergraduate students and put in tremendous efforts to inspire their independence in research, which has resulted in the extensive success of his undergraduate students. In the last five years, the undergraduate students in his laboratory have published three first-author papers in high-impact chemistry journals (Journal of the American Chemical Society, Small and Analytical Chemistry) and are the co-authors on 14 other publications. Students are encouraged to take active roles involving in different research projects and interdisciplinary topics. The majority of the undergraduate students have contributed to at least one experimental publication during the time they stay in his group. As an advisor, Dr. Tan is highly committed to provide undergraduate students with the sufficient resources for their training and independent research experience. Undergraduate students from his lab have learnt various research skills and have done independent research, and have developed cooperative spirit and leadership ability. Undergraduate students in Dr. Tan’s lab have the freedom to carry out research topics of their interest and receive sufficient support. Furthermore, students under Dr. Tan’s mentoring have also received quite a few research awards, including the well recognized award such as Barry M. Goldwater Scholarship, which led them to other prestigious academic and professional opportunities. tan@chem.ufl.edu

Dr. Connie Mulligan (Anthropology):

Dr. Connie J. Mulligan is an associate professor of Anthropology in the College of Liberal Arts and Sciences. She is also an Associate Director of UF’s Genetics Institute. She received her PhD from Yale University in 1990 and joined the faculty at UF in 2000. After her PhD, she held postdoctoral fellow positions at the Smithsonian Institution in the República de Panamá and Washington DC, where she analyzed DNA from modern and ancient human populations to explore human migration patterns, and at the National Institute on Alcohol Abuse and Alcoholism, where she investigated the genetic basis of alcoholism. Current research efforts are funded by two main NSF grants and are focused on 1) the genetic and socio-cultural basis of hypertension in African Americans and related diseases that also show racial inequities and 2) human dispersals in the region of Arabia and the Horn of Africa as well as colonization of the New World. These projects are directed at a better understanding of human evolution from a broad anthropological perspective as reflected in our population history (e.g. migrations) and adaptations to our environment both positive and negative (e.g. human disease). During the past 5 years, 16 undergraduate students, 5 graduate students, and 3 post-doctoral fellows have worked in the lab. Undergraduate students have received various NSF and NIH grants, have presented at 3 international conferences, and co-authored 8 abstracts and 4 publications. cmulligan@ufl.edu

2011 Viewbook 113
Sponsors

The Howard Hughes Medical Institute

Units from all across the University of Florida including:
Office of the Provost • University of Florida Honors Program • Vice President for Research • Office of the Senior Vice President for Health Affairs • College of Liberal Arts and Sciences • College of Agriculture and Life Sciences • College of Engineering • College of Education • College of Medicine • College of Pharmacy • College of Dentistry • College of Veterinary Medicine • College of Journalism • College of Nursing • Whitney Laboratory for Marine Bioscience • Florida Museum of Natural History • University of Florida Foundation • Department of Chemistry • The J. Crayton Pruitt Family Department of Biomedical Engineering • Department of Materials Science and Engineering • University of Florida Genetics Institute • Keene Translational Diabetes Research Endowment • Emerging Pathogens Institute • McKnight Brain Institute

and

Scripps Florida, The Scripps Research Institute
Morehouse College
The Pasteur Institute, Paris
The University Louis Pasteur, Strasbourg
ENS-Cachan
The Max Planck Institute for Polymer Research, Maim
Scientific Equipment Group, Olympus America Inc.