



2016 Science Research Journal



The United States has a continuing trend of lower vaccination rates. One of the most vulnerable portions of the population is children, who are still in the process of receiving their vaccines. Reasons for not vaccinating a child are often unclear, but can mostly be attributed to mistrust and apathy towards certain vaccinations. Parents at Pediatrics at Oyster Point in Newport News, Virginia were questioned through a survey in order to understand the attitudes they hold towards the controversial Measles/Mumps/Rubella vaccine, the Influenza vaccine, and the Human Papillomavirus vaccine and how attitudes or demographic factors can affect their decisions on vaccinating their child. Chi-square analysis revealed no connection between age and trust or how necessary the parent thought each of the three vaccines were. The chi-square analysis also often unclear, but may indicated that ethnicity and race did not affect any variation of vaccine attitudes in the sample. Continued chi-square analysis found that vaccine attitudes were linked with whether or not they vaccinated the child, noting only that the MMR vaccine is required for enrollment in public schools in Virginia. Twelve percent of the parents surveyed incorrectly believed that the Measles/Mumps/ Rubella vaccine can lead to disorders such as autism. Of those who indicated they did believe the false statement, there was a statistical association between the false answer and receiving vaccination information from unreliable sources.

Kaitlyn Reid **Grafton High School** York County Public Schools

"Reasons for not vaccinating a child are be attributed to *místrust and apathy* towards certaín vaccinations."

"I am so thankful for the opportunity to have worked with Dr. Brian K. Butcher this school year. Being able to have a balance between conducting my research project and shadowing Dr. Butcher gave a unique experience and look into the medical field. Spending my mentorship in the pediatric office gave me the opportunity to interact with patients, sit in on medical conferences, and meet with psychology professors to discuss ways to better my project. From the start Dr. Butcher welcomed me into his practice with open arms and helped me explore the world of medicine and connect me with others who could help me with my project. I am deeply grateful to my mentor and Governor's School for preparing me for the future."

Kaitlyn will be attending Virginia Tech.

Comparison of the Intel Xeon Processor and Xeon Phi Coprocessor in Highly Parallel Programming

"...compatibility of with a variety of systems and programming languages makes the Xeon Phi a viable candidate for use in the PWA processes utilized in CLAS12 and GlueX experiments"



Matthew Vick Tabb High School York County Public Schools

Abstract

Particle physics experiments at Jefferson Lab produce massive amounts of data, and in order to analyze these data, a suitable tool with high performance is needed to run Partial Wave Analysis (PWA). Both the Intel Xeon Phi coprocessor and Intel Xeon processor devices are capable of meeting the performance demands of PWA for these experiments due to their utilization of parallel processing. In order to compare both devices, two benchmark programs that measured the performance of each thread on each device while performing amplitude processing and likelihood computations used in PWA were run. It was anticipated that there would be significant difference in performance between the two devices and that the Xeon Phi would demonstrate greater performance. However, the results of the benchmark programs ultimately suggested that both devices had very similar performances. Several trends in the data, including stagnation in performance demonstrated by the Xeon Phi in later stages of the test, indicated that future comparisons should focus on optimizing code in order to ensure that the full parallelization capabilities of both devices are utilized. Ultimately, more trials are required to determine if there is a substantial difference in performance between the Xeon and Xeon Phi.

"For my mentorship, I had the pleasure of working with Carlos Salgado at Jefferson Lab. My experience has allowed me to grow not only in the field of computer science, but also in the field of nuclear physics. I learned several valuable skills and gained experience with tools that will greatly benefit me throughout my career. I also learned more about the possible applications of computer science to different fields, which will definitely influence my career choice in the future. The knowledge I gained from my mentorship will be a great help to me in the future, and I am thankful for the opportunity to have such a valuable experience. "



David Thames Lafayette High School Williamsburg/James City County Public Schools

"As our technology evolves into mobile computing and interaction, the archiving and storage of information must evolve as well"

Enhancing Mobile Mink, a Mobile and Desktop Web Archive Merging Application

Abstract

As the internet grows in importance in our society, it becomes increasingly necessary to archive the information stored on the web. There are solutions to archive and allow access to the archived web; however, these archives were created for websites meant to be viewed on desktop computers. Recently, mobile websites are becoming increasingly popular. Previous methods of archiving often have difficulty finding the mobile versions of web pages, since the structure linking the pages together is often different from that of a desktop page. Further, while a mobile page is linked to its desktop counterpart on the live web, this linkage is lost during archiving.

The Mobile Mink app allows users to browse through archived, time stamped snapshots of the website – called mementos – along with their mobile counterparts on their Android phones, creating a linkage between the mobile and desktop versions of the site by aggregating that information together into a single Time Map. Recently, memento has begun dividing large Time Maps into multiple paginated Time Maps to improve response time from memento servers. Although this improves the response time on each paginated version, it requires the client to use multiple HTTP requests and aggregate the mementos in order to retrieve all mementos for a certain URI-R.

The design goal of this project was to develop a Time Map inversion web service to offload the responsibility of creating aggregate Time Maps from the device to the server to save battery, data, and computation on the device. The service was able to both aggregate the Time Maps and invert the Time Maps order (listing from newest to oldest) which decreased processing and network responsibilities of the device, but in some cases lead to a longer response time to display the mementos to the user.

"Working with Dr. Brunelle at MITRE Corporation has been a great experience, allowing me to expand my knowledge across multiple fields and follow my curiosity. I was able to have the freedom to control much of the specific direction and implementation of our project while still having a mentor to work with and provide a basis for the knowledge I needed to learn in order to successfully implement this project. In addition, I was able to meet other developers at MITRE and observe their work, which ranges across many branches of Research and Development. Through the people I have met and the knowledge I have learned, I will have the opportunity to continue my involvement at MITRE and in research and development as a whole over this summer as an internship."

David will be attending Virginia Tech.



Laurel Vaughan Heritage High School Newport News City Public Schools

STEM Educational Curriculum: Hands on Learning at the Mobile Learning Center

Abstract

"products created were geared toward creating a greater interest for students for Science, Technology Engineering, and Mathematics (STEM) fields."

A curriculum was created for the Hampton Grows Incorporated Mobile Learning Center for students grades 6-8. The curriculum was centered around hands on learning techniques so students with any learning type could benefit from it. A total of twenty-nine lessons were created for the curriculum. Experiments and worksheets to coincide with the lesson plans were also developed. The experiments that were created involve plant growth, rain barrel water use, chick life cycle and much more. Activities in the Mobile Learning Center can be taken back to classrooms for completion and additional instruction. The worksheets created were made to appeal to students who are visual learners. The products created met the Virginia Standards of Learning for science, mathematics, and health. The products created were geared toward creating a greater interest for students for Science Technology Engineering, and Mathematics (STEM) fields.

"Mentorship has been a very unique experience for me. It has given me the opportunity to do more advanced work that many people my age only get to hear about. The hands on work that I got to do allowed me to further explore my passion for botany and learn about the multiple aspects of it. I will always remember my time at mentorship and use it to help me continue my research pursuits in college." Anti-Cancer Drugs and Hypoxia: Cell Viability



Bianca Brinceanu Woodside High School Newport News City Public Schools

"inducing hypoxia in cancer cells may improve the effectiveness of anti cancer drugs"

Abstract

Cancer research is a predominant topic in research centers around the world. Lung cancer is one of the most lethal and progressive forms of cancer. There are recent, experimental drugs, such as Rev-5901, Paclitaxel, and Cobalt (II) Chloride, which have shown relatively good results in inducing apoptosis in malignant tumors. Cancer research has been aided by the determination of which anti-cancer drugs perform best for each cell line, and at what concentration they can safely but effectively be used. Cell viability was addressed and assessed for each drug at several concentrations. Hypoxia is a current issue for chemotherapy. By inducing hypoxia on the cells, followed by the incorporation of other anticancer drugs, cell sensitivity was lowered, thus giving the drug a better chance to perform. A low cell viability was achieved when anti-cancer drugs were introduced to cells in a hypoxic condition. A concentration over 300 µM of CoCl2, the solution that induces hypoxic conditions, produced too low of a viability, making any concentration over that too high to use in the study.

"Mentorship not only taught me how to perform cancer research, or how particular drugs work, or how hypoxia affects the sensitivity of cancer cells to an anti-cancer drug performing; it taught me how to strive for something and follow it through. I am grateful for the opportunity that was given to me to work alongside professionals in the field of cancer research, as well as learn research techniques and knowledge that I can use in the future. "

Bianca will be attending Christopher Newport University.

Quintin Lassiter Warwick High School Newport News City Public Schools

Electropolishing Wireless Thermometry Prototype System

"EWTPS will facilitate electropolishing of niobium cryomodules"

Abstract

The Stanford Linac Accelerator Center (SLAC) National Laboratory is modifying their Linac Coherent Light Source (LCLS) by adding the LCLS-II upgrade. Jefferson Lab will manufacture half of the required cryomodules for the LCLS-II upgrade. Cryomodules are vacuum vessels that contain niobium cavities that accelerate the electron beam. Niobium cavities must be manufactured with a high quality factor. Quality factor is the ratio between the amount of energy stored and energy lost. Some of the energy lost is through thermal radiation caused by niobium surface imperfections and impurities. To remove these niobium surface imperfections, the cavities go through an electropolishing process. Electropolishing involves submerging a cavity in hydrofluoric acid (HF) connected to a DC power supply. Imperfections of the niobium are oxidized from the cavity through reduction reaction. The temperature of the (HF) is continuously monitored so niobium etching is controlled. The temperature is monitored by the MCC electronic board connected to a PC. The MCC device will no longer be manufactured leaving Jefferson Lab without a replacement.

To solve this problem the Electropolishing Wireless Thermometry Prototype System (EWTPS), was manufactured and tested at Jefferson Lab. One of the specifications of the EWTPS set by Jefferson Lab was that it must record the temperature of the HF and use wireless communication from the EWTPS. To meet these specifications, the EWTPS used an Arduino to read the thermocouples and XBee wireless technology to transmit the data to a PC. To ensure that the EWTPS meets industry standards, it was compared to the industry standard, the MCC device, in lifetime and accuracy tests. The EWTS meets industry standards by successfully running continuously for 100 hours and recording room temperature at the same accuracy of the MCC device for five two-hour trials. Using the EWTPS, Jefferson Lab will be able to manufacture less expensive cavities for LCLS at the same efficiency.

"My mentorship with Ms. Christiana Wilson at Jefferson Lab has been a remarkable experience. I have gained so much knowledge and experience during this mentorship that I will be able to take with me to college and future endeavors. Designing and manufacturing a device from start to finish has allowed me to experience what electrical engineering is in the real world. At Jefferson Lab, I was able learn from so many other faculty along with my mentor. I was able to converse with chemists, welders, graduate students, researchers, managers, and other engineers. From having these conversations, I learned more than I could have ever learned through reading a textbook. The hands on experience of mentorship at Jefferson Lab has allowed me to grow to be a better student and hopefully in the future, a better engineer. "

Quintin will be attending North Carolina Agriculture and Technical State University.

Plotting/Verifying Atmospheric Ozone Concentration Data with the Langley Mobile Ozone Lidar

Abstract

Ozone, a gas formed by chemical reactions with oxygen and ultraviolet radiation, exists in the upper atmosphere and at ground level. At high concentrations, ozone can threaten the health of human populations and vegetation. Thus, ozone measurements are critical to accurately monitor and forecast air quality. Light detection and ranging systems (lidar) are used to examine atmospheric gases. The Langley Mobile Ozone Lidar (LMOL) is a differential absorption lidar designed for measuring atmospheric ozone concentration.

Data were collected from the LMOL during the DISCOVER-AQ campaign in 2014. These data were processed with a computer program to generate curtain plots of atmospheric ozone concentration. These plots displayed ozone concentration (in parts per billion by volume) versus altitude (in meters) over a fixed length of time. Newly-generated plots were compared to pre-existing plots to confirm the reliability of the program. Plots were edited by adjusting vertical/horizontal resolutions and by removing poor data. Data from ozonesonde balloon launches were used to confirm the accuracy of LMOL ozone measurements. Tests were conducted to determine if background noise was affecting the LMOL telescope receiver. Test results may be referenced for future adjustments within the LMOL system. Data files from the plots were uploaded to the Tropospheric Ozone Lidar Network (TOLNet), a NASA website created to archive ozone data from lidars at five sites across the United States. Ozone measurements from the LMOL can benefit air quality science by providing accurate data to study ozone formation and transport. In addition, policy makers will be better informed to set regulations for pollutant emissions.



Samuel Washburn Poquoson High School Poquoson City Public Schools

"Ozone measurements from LMOL allows study of ozone formation and transport"

"Mentorship allowed me to explore science and engineering in a professional setting. I developed my skills in research, communication, and critical thinking."

Effects of Substituents and Bridge Length on the Nonlinear Properties of a Series of Bis – Azo Dyes

Abstract

A recent discovery has been made about the nonlinear properties of organic semiconductors. There is evidence the crystal structures have a specific relationship with their electronic processes and origin. Nonlinear optical responses are largely due to the specific properties exhibited in aromatic rings. Looking at the optical responses is a similar approach where electronic properties are optimized independently from their orientation and certain physical and chemical properties. The three main properties that are the focus of the present research efforts are the evaluation of the first-, second-, and third-order polarization. Most of the structures that are focused on and altered have a basis line of symmetry to allow for calculations to be conducted for the electronic states that are exhibited in the molecules as a whole. Attempts have been made to substitute the amine groups with more electron-rich molecular groups, however, the results showed that there was no identification of a material with a larger nonlinearity. With most organic solids being molecular solids, the molecules can retain their geometric shape and properties. The theoretical study aims towards finding low band gap energy between the chemical structures altered from basic structure. Altering organic semiconductors will allow for applications in specific topics such as photodynamic therapy and optoelectronic devices. The study was conducted computing theoretical calculations to modify the uses of the organic semiconductors. Low band gap energies have been met in certain cases. Comparisons can only be made on the structures already known to have low band gap energies. The molecular design allowed for the alterations of the polymers and changed the nonlinear properties to provide data for their use with technological devices.

"Altering the bonds of semiconductors can lead to cheaper technology and new medical equipment such as photodynamic therapy to treat cancer cells"



Binal Patel Tabb High School York County Public Schools

"I had the wonderful opportunity to work with Dr. Ndip at Hampton University this year. On the first day, my mentor told me how advanced my study would be and that looking at computational software would not be a breeze. I was working on foreign empirical software to alter bonds between different organic semiconductors. This study broadened my horizon to a new idea and approach in optoelectronic devices. The strict deadlines and flexible mentorship times allowed me to emerge in a new light for my project. I was able to understand different concepts and fields such as theoretical theories, computational chemistry, and applications in the biological field. The skills I have developed in chemistry and software will help me advance my scientific career and in the years ahead."



Rhiannon Edwards Warwick High School Newport News City Public Schools

"MDCs may pretreat water used in other water treatment processes to reduce energy expenditures" Low Cost Continuous Flow Microbial Desalination Cells for Environmental Sustainable Integrated Water Treatment

Abstract

Microbial Desalination Cells (MDCs), modified microbial fuel cells with a chamber for water desalination made of ion exchange membranes, are a promising new technology in environmentally sustainable water treatment. Electrogenic bacteria in the anode produce current that is transferred to the cathode where reduction occurs, then the electrons flow back across the system and ionize saline water in a central chamber. The salt ions are attracted to the anode and chathode through the ion exchange membranes, leaving desalinated water in the center. Wastewater used as fuel for the system also allows for simultaneous, but separate, wastewater treatment and desalination. These systems produce no toxic byproducts, require almost no outside energy, and can sustain use for long perios of time. However, current construction methods are costly and investigation into performance in real-world application is needed.

A tubular MDC system that allows for continuous water treatment of both salt-water and wastewater was constructed using low-cost materials. The treatment goal was a 50-60% reduction in salinity with both aerobic and anaerobic wastewater treatment. Additionally, applied external voltage was analyzed as a method to increase desalination efficiency. Changes in pH, conductivity, Total Dissolved Solids (TDS), and peak voltage were used to determine system effectiveness. The system met design and treatment objectives, with a maximum of 59.4% desalination without applied voltage and up to 89.5% desalination with applied voltage, and cost approximately \$450 to construct. These results support the use of MDCs outside of laboratory settings, and potentially as a way to pretreat water used in other water treatment processes to reduce energy expenditures and to bioremediate wastewater using certain species of electrogenic bacteria. The system can run independently of a power grid using solar pumps, and has potential as an environmentally sustainable method of water treatment in third world countries if optimized further.

"My mentorship experience was unforgettable, and I am so thankful for all the time and resources provided. I got to experience working in a professional laboratory environment, worked with brilliant professionals, and was able to design and conduct a research project that I followed through all of its stages."



Matthew Trepte Grafton High School York County Public Schools

"Optimization algorithm will reduce computational and financial expenses on the order of hundreds of thousands of dollars" Novel Algorithm to Optimize the Analyses of Elementary Particle Systems

Abstract

Quarks are fundamental components of matter. Since guarks are difficult to measure directly, simulations are necessary to learn more about their properties. Calculations with these simulations, however, are extremely computationally expensive and require large amounts of memory. An algorithm is created that optimizes the calculation and memory demands of these analyses. By selecting and manipulating the orderings of matrix computations and then re-ordering the evaluation sequence of particle systems in large datasets, the optimization algorithm considerably reduces demands. The performance of the algorithm is compared against a naive approach in a published study for simple and several more complex datasets. The algorithm is found to have lower runtimes and use less memory for five datasets used in the study. In fact, the algorithm enables 3 times more runtime reduction than the naïve approach with 1/5 the memory. In 2015, a proposal for analyses of these theoretical particle systems required around 50 million core hours, costing around \$2.5 million. Thus, with this optimization algorithm, significant savings will be achieved.

"Fortunately, during last year's Tidewater Science and Engineering Fair, I presented to a theoretical physicist, Dr. Robert Edwards, who works at JLab and knew Governor's School's mentorship program. Turns out, the analytical process of my algorithm was similar to an algorithm he was contemplating, and I became his mentee for the year, given the challenge of creating the optimization algorithm. Mentorship has exposed me to a wealth of diverse experiences, great people, and challenges often associated with work in the real world. It has enabled my first step to my life-long adventure into the world." Mapping the Polarization of Alkali Metals in a Target Cell

Abstract

Helium-3 (³He) is a gas commonly used in nuclear physics. The basic structure of the nucleus allows scientists to isolate the neutron for studies on spin structure and guarks. However, the nucleus must first be polarized so that the orientation of the neutron spin is known. The ³He is contained in a target cell made of aluminosilicate glass. Physicists use a process called spin-exchange optical pumping to polarize alkali metals also in the cell. Spin-exchange collisions are used to transfer spin from alkali metals to the ³He nuclei. This process should result in approximately the same polarization for both alkali metals and ³He. However, in reality there is a large disparity between the two values. The polarization level of ³He is significantly lower than the polarization levels of the alkali metals. A commonly-held theory is that there are regions in the glass cell that contain lower alkali polarization levels than others, affecting the overall ³He polarization.

So far, results from tests to characterize the cell indicate that the ³He in the cell has an average polarization of approximately ninety percent. Faraday Rotation will be used to determine the polarization of alkali metals at different depths in the cell to determine if there are regional differences in polarization. The results are expected to show a lower ³He polarization towards the back of the cell. If this difference in polarization is observed, then in order to increase ³He polarization, changes would need to be made to the polarization technique to increase laser penetration and alkali polarization in the rear of the cell.



Vivian Carvajal Jamestown High School Williamsburg /James City County Public Schools

"helium neutron is isolated for studies on spin structure and quarks"

"My mentorship was the highlight of my Governor's School experience. I had the honor of working side -by-side with my mentor at the College of William and Mary. He taught me how to properly conduct research at a university, which is something I have considered as a career. But he also offered advice on colleges, classes, and other milestones in life. This mentorship experience provided me with experience and knowledge that I will continue to use throughout my career." Defining Site Boundaries on the Western Shore Marshes, Surveying Avian Populations, and Projecting Changes in Habitat and Avian Populations to 2100

Abstract

Climate change has contributed to rising sea levels over the past century. Various model projections estimate several feet of eustatic sea level rise by 2100. These predictions are concerning given the fragility of coastal wetlands to environmental changes. Salt marshes are critical as storm surge buffers, coastal erosion barriers, and habitat for a diverse congregation of species, including many birds. The Audubon Society has defined the Western Shore Marshes of Virginia as an Important Bird Area (IBA). However, there is uncertainty as to the location of the coastal boundary. In order to develop an understanding of the bounds of the IBA, geographic coordinates were recorded along the edge of the marsh vegetation and inland boundary lines for nine different sites within the IBA. The defined area was analyzed using an interactive Sea Levels Affecting Marshes Model website with data from past analyses. A larger segment of the area, including surrounding territory with the potential for accretion, was analyzed separately.

Ten bird species were chosen to focus on during bird surveys of the sites. Surveys of each site were conducted and added to the public eBird database. While sightings of the target species were few, thousands of new data were entered into the record, providing further understanding of the avian composition of the Important Bird Area. Further, specific study of individual sites is necessary to observe the target species.

On the low end of sea level rise estimates, the model projections show that the target species marsh habitat is flooded more frequently, but remains intact. The higher scenarios present disastrous consequences for the birds. Using the generalized projections, it is shown that the rural regions will be able to add habitat in the late century while the more developed regions will lose most of the specialist populations as rising seas engulf existing habitat. Jeremy Nelson Kecoughtan High School Hampton City Public Schools

"All flora and fauna will be affected by climactic changes not just birds."

"Under the tutelage of David Youker, the President of the Hampton Roads Bird Club, I discovered and observed a vibrant portion of the natural world: birds. As Mr. Youker and I traversed the Tidewater region, I learned about patience and responsibility while remarking at the various types of avian life that reside in Virginia. There is a special feeling when you find a target species. The experience enlightened me about the potential effects of climate change. Though I do not plan on studying ornithology, my mentorship project allowed me to showcase my ability to conduct research and develop relationships within the world of academia."



Relationship between Dwell Time and Hardness in Brinell Hardness Testing

Abstract

Bryan Staha Smithfield High School Isle of Wight County Public Schools

"Found that dwell time is basically unimportant for Brinell hardness test results."

Hardness is an easily measured and informative property of materials. Often hardness is measured using the Brinell hardness scale and Brinell test equipment. Brinell hardness testing requires an indentation to be made in the material under controlled conditions. The diameter of the indentation is correlated with hardness. One factor that is considered when hardness test methods are developed and the associated specifications are written is the time that the force is applied to the material to make the indentation. To provide the most accurate and repeatable hardness data, the type or alloy of metal should be the only variable that affects the results and all other factors should be controlled. Testing materials of different hardness at different dwell times and plotting the results can be used to determine the importance of the dwell time variable. The ideal dwell time window for the method defined in the American Society for Testing and Materials (ASTM) standard E10 is 10 to 15 seconds. It is important to know if data generated outside of this window will significantly affect the result. Knowing how data could be affected outside of this window, or if there is the possibility measurements could be different within the window, can be used to refine procedures for Brinell hardness testing, or if necessary recommend changes to the ASTM committee for Indentation Hardness Testing. After Brinell tests at varying times the delta between a 5 second dwell time and a 30 second dwell time proved to be insignificant because the delta in hardness was within the acceptable margin of error for the specimens. The delta between the different measurement methods was significant.

"I had the privilege of working under Charles Southall at Newport News Shipbuilding. For the most part, I worked in the Material Testing Lab in the shipyard which was an excellent opportunity. In the lab I observed simple physics applied in the professional world and gained an understanding of practical engineering. I was able to design my own experiment and test my hypothesis in a real-world laboratory setting. At my mentorship, I had to deal with unexpected problems and results that I never would have witnessed in a classroom setting. Being in an industrial and professional environment helped me to develop my critical-thinking and problem solving skills. Overall, the mentorship experience was the most memorable and useful thing I took away from Governor's School and will doubtlessly help me in the years to come."

Bryan will be attending Virginia Tech.

Determining an Optimum Level of Dietary Astaxanthin to Improve Coloration of Amphiprion ocellaris

Abstract

Amphiprion ocellaris (false Percula clownfish) is one of the top-selling species in the marine ornamental fish industry, and is one of many fish species still subject to ecologically harmful wild-catch practices. A. ocellaris can also be bred in captivity, but captivebreeding is not popular due to the dull coloration the fish have in captivity. Using six different concentrations of astaxanthin (the main carotenoid responsible for their orange-red coloration) top-dressed onto fish feed, an optimum concentration of astaxanthin to improve coloration was found. Two hundred and forty juvenile A. ocellaris were fed fish feed dressed with 0, 150, 250, 400, 640, or 1020 ppm astaxanthin for seven weeks. Immediately following the end of the trial, six judges knowledgeable in aquaria evaluated color quality of the fish. Image analysis was performed on the fish, and three one-way ANOVAs determined statistical significance for the treatment means. Boxplots of hue indicated an optimum concentration of dietary astaxanthin at 640 ppm. Results from the judging panel gave valuable insight on the current state of the aquaculture industry concerning A. ocellaris, and the optimum concentration can serve as a parameter for fish feed companies and fish farms to begin placing colorful captivebred A. ocellaris on the market.

"Working with Mr. Steve Urick was one of the most memorable and valuable experiences of our lives. Having such a hands-on mentorship ensured that we were always doing something new and exciting! There was never a dull moment at the facility, whether we were working with clownfish, seahorses, or siphoning tanks. We learned many valuable lessons at our mentorship, including: communication skills, efficiency, teamwork, creative problem solving, and perseverance. These skills, plus the essential aquaculture skills that we picked up from our mentorship, will greatly assist us with pursuing our marine biology careers. As far as our research project is concerned, we had no idea that our study would make such an immediate and prevalent impact in the aquaculture industry. The company that supplied us with our fish feed, Reed Mariculture Inc., and the fish farm that supplied us with our clownfish, Bradford Bay Farms, used our findings to improve the coloration of captive-bred clownfish; this in turn made the fish more attractive for consumers, leading to a decrease in sale of wild-caught clownfish, which is better for marine ecosystems. In the end, all the hard work and late nights analyzing all 240 clownfish was worth it!"



Cassidy Clark Tabb High School York County Public Schools

"coloration of captive bred clownfish can be improved"



Lauren Cook Tabb High School York County Public Schools

Lauren will be attending the University of South Carolina. Cassidy will be attending the University of Rhode Island. Simulation of Traffic Flow at a New Shopping Center



Dain Park Grafton High School York County Public Schools



Benjamin Ormond Smithfield High School Isle of Wight County Public Schools

Abstract

The development of a new shopping complex on the corner of Jefferson Avenue and Oyster Point Road, one the five largest intersections in Virginia, was expected to generate an additional traffic burden with three new entrances and exits. The goal for this simulation was to optimize signal lengths at the intersection of Criston Drive and Oyster Point Road using a computer software, CityTraffic-Simulator, and a mathematical model, the Webster Model. For simplification, several assumptions were made regarding the number of parameters in the simulation; the drivers would be driving in ideal conditions. The Webster Model produced the optimal green signal lengths based on how large the traffic flow is during each phase in the cycle. For the computer simulation, seven conditions of various phase lengths and a condition with resulting signal lengths from the Webster Model were run through the software to observe the number of vehicles waiting at the intersection at the end of each phase. Based on the results, the optimal schedule must include both the longest green signal length, around hundred seconds, for Phase 1 and the shortest, almost zero second, for Phase 2.

"The goal for this simulation was to optimize signal lengths." "Our mentorship at Governor's School was incredible because we were able to work on a project in a field of our interest and learn important professional skills before college. We learned how to communicate efficiently and work as a team. We were also fortunate to be able to participate in many conferences and presentations. These experiences have taught us that it is important to not only successfully complete a project, but also share with the larger society. Everything we have learned and earned from this mentorship will go a long way in our future education and career to help us succeed."

Dain will be attending the College of William and Mary. Benjamin will be attending Penn State University.



Research & Design Highlights



Verizon Innovative App Challenge:

Best in State & Best in Region



Virginia Junior Science and Humanities Symposium James Madison University

1st place, 4th grand Award: Rhiannon Edwards 1st place: Benjamin Ormond and Dain Park 1st place: Claire Du 3rd place: Alexander Culver



Interservice/Industry Training Simulation Education Conference Orlando, Florida

3rd Place



International Science and Engineering Fair Phoenix, AZ

3rd place, Environmental Engineering

Research & Design Highlights



Tidewater Science and Engineering Fair Old Dominion University

1st Overall Grand Prize 1st place, Senior Computer Science 1st place, Senior Medicine and Health 1st place, Senior Physics and Astronomy 1st place, Senior Environmental Science 1st Award of Excellence Senior Division 2nd Overall Grand Prize 2nd place, Senior Electrical & Mechanical Engineering 2nd place, Senior Computer Science 2nd place, Senior Energy & Transportation 3rd place, Senior Behavioral Science 3rd place, Senior Chemistry 3rd place, Senior Electrical & Mechanical Engineering 4 Honorable Mentions 18 Special Awards



Institute for Creativity Arts and Technology, Virginia Tech

Innovation Award People's Choice Award



The Governor's School for Science and Technology 520 Butler Farm Road Hampton, Virginia 23666 (757) 766-1100 Website: www.nhrec.org/governorsschool

Research: Key Component of the GSST Student Experience

A primary goal of the GSST is to provide students with an opportunity to conduct serious scientific research, engineering design, or computer programming projects.

All students take a junior-year course in Research Methods and Ethics, which introduces them to research methodology, statistics, critical thinking skills, and the skills of scientific writing and presentation. In the junior year, all students prepare a science fair project for submission to the Tidewater Science Fair. Students are encourages to take their work to additional state and national competitions.

In their senior year, students design and conduct a year-long research project under the direction of a scientific professional in their field of interest. The field component is supported by an in-school course which guides students through the entire process, from the selection of a problem to the final presentation. Major aspects of the mentorship experience include: preparation of a formal written proposal for their project, oral presentation of the proposal and a status report at mid year to GSST faculty, a final research document, and presentation of final results to a panel of professionals in appropriate fields at the GSST Spring Symposium. In addition, many students present their findings at local, regional, and national science competitions and symposia. Exceptional work has been published in professional journals.

Research sites that have participated in the GSST Honors Research/Mentorship program have included NASA Langley Research Center, Thomas Jefferson National Acceleration Facility, Virginia Institute of Marine Science, Veterans Administration Medical Center, Eastern Virginia Medical School, College of William & Mary, Hampton University, Christopher Newport University, Virginia Living Museum, local engineering firms, hospitals, and a variety of individual medical and professional firms.

