Newburgh Free Academy

North Campus Presents

The Ninth Annual Science Research Symposium

June 2021

- Introduction and Welcome
  - Co-Principal Newburgh Free Academy North Campus: Mr. Matteo Doddo
  - Instructor of the Science Research Course: Ms. Kristin Oberle

- **Sophomore Presenters**
  - Kiara Sevilla

Characteristics of Music that Affect Audience Emotions in Movie Scenes

- **Junior Presenters**
  - Amanda Waite

Effects of COVID-19 on a Person's Breath Output

  - Shaun Zamenick

Equine Behavior: Can Racehorses Learn to Trust Again After Years of Abuse?

Tyrese Boykin

The Effects of Radiofrequency Electromagnetic Fields (RF-EMF) Radiation on Plant Growth

➢ Daniel Rego

The Effect of the Intestinal Microbiota on Antibiotic and Probiotic Metabolism

➢ Zachary Don

Collection and Quantification of Microplastics in the Hudson River

❑ **Senior Presenters**

➢ Shaima Herzallah

The Effect of Exercise on Memory of Early Stage Dementia and Alzheimer's Patients

➢ Darcy Guerra

A Systematic Review: The Effect of the Type of Bilingualism on the Cognitive Functions in Children

➢ Arnaz Reza

A Comparative Study Between Whiteclaw and Other Bacteriophages of the Same Cluster

Science Research in the High School is a three-year experience that affords students the unique opportunity to become part of the professional research community as high school sophomores, juniors, and seniors. Over three years, students conduct unique research, complete a research paper, and participate in scientific competitions. Students enrolled in the science research program will:

- Select and investigate a topic of interest
- Develop skills in traditional and online bibliographic searching
- Conduct extensive background reading on their topic, progressing from popular literature to professional scientific papers
- Regularly present to classmates and various audiences, always adhering to the scientific method using the following elements:
  - Introduction
  - Review of Literature
  - Statement of Objective and/or Hypothesis
  - Methodology/Protocol
  - Analysis and Presentation of Results
  - Discussion of implications of findings
  - Conclusion
  - Acknowledgements

- Communicate with professionals – contact the authors of the journal articles being studied. Establish a dialogue with several researchers, eventually asking one to serve as a research advisor.
- Under the guidance of the mentor/advisor and science research instructor, an original research experiment is designed and conducted. Results are statistically analyzed, implications are discussed, and conclusions are drawn. A final research paper is written.
- Final research papers are entered into regional, statewide, and international science competitions and may be presented for professional publication.

In addition to advanced research skills, students develop numerous life skills such as problem-solving, critical thinking, communication, time management, and public speaking. All science research students advancing in the program beyond their sophomore year are eligible to apply for college credit through SUNY Albany's University in the High School Program with successful completion of research requirements.

Characteristics of Music that Affect Audience Emotions in Movie Scenes
By: Kiara Sevilla - Sophomore

What is the role of music in determining audience emotions during movie scenes? Studies have shown that music modulates perceptions, actions and judgements in everyday situations. Studies have also shown that soft and slow songs reflect sadness while the opposite is interpreted as happy. In my study, I will analyze and compare characteristics of music used in scenes meant to evoke happy and sad emotions from audience members. I will review scene music from five different animated films for the following features: dominant instruments used, use of rising or falling scales, high or low pitches, and fast, slow ,loud or quiet music. I predict that loud, fast, and higher pitched background music provokes happy emotions while the opposite would be used to provoke sadder emotions. I believe that dominant instruments used for music in happy scenes would consist of flutes and drums while music for sad scenes would consist of cellos and violins. Furthermore, I predict that happy music would have an average of 100 or more beats per minute (bpm) while sad music would average less than 100 bpm. Knowing this information would help quantify elements in music that neurologically provoke emotional responses.

Effects of COVID-19 on a Person's Breath Output
By: Amanda Waite - Junior
Advisor(s): Dr. Victoria Romano, DPN, CNRP, CN-P, Kim Poje, RN

The global pandemic Covid-19 has put our world into a state of panic and fright. Covid-19 is a disease that attacks your respiratory system. As of May 9,2021 there have been a total of 32.7 million cases reported and a total of 581,000 deaths. Worldwide there have been a total of 159 million cases and 3.3 million deaths. Covid-19 has affected people of different ages, genders, and health conditions in different ways. It has been seen that some people with underlying lung problems have had a significantly harder time getting over the virus, as well as people of old age. People with these underlying conditions (those conditions being old age and lung problems such as asthma or whooping cough) for about 75% of the people who have died. For my experiment I plan on conducting a test repeated over the course of ten days. The first test will be a simple pulse oximeter which will tell me the volunteers oxygen level. The next test that I will have the volunteer complete is a spirometer test. Each volunteer will blow into the spirometer with their breath and I will record it and have them do that twice more. The purpose of my experiment is to determine if Covid-19 leaves people with low breath output.

Equine Behavior: Can Racehorses Learn to Trust Again After Years of Abuse?

By: Shaun Zamenick - Junior
Advisor(s): Helen King, Equine Behavioral Specialist, Saddle Brook Farm Animal Rescue

Race horses face excessive abuse everyday. Throughout their years on the race track, they are worked beyond exhaustion and face many forms of abuse including starvation, performance enhancing drugs, physical abuse and medical neglect. Many of these highly abused animals are auctioned off to the highest bidder or sold to processing plants for meat and glue among other things. Those lucky enough to be auctioned to a new home, now face forms of PTSD that many deem as untrainable. Through my research and hands on work with retired racehorses at the Saddle Brook Farm Animal Rescue, I hope to prove that it is not only possible to reteach these previously abused animals, but that the horses can learn to trust no matter the degree of previous abuse when you learn to interpret their body language. Empathy and interpretation of equine body language, I believe, are the center of this experiment. These beautiful creatures can learn to trust humans again, giving them a purpose outside of the boundaries of the paddocks as trusted teaching animals or trail guides while others are trained as therapy animals in programs for mental and physical disabilities.

The Effects of Radiofrequency Electromagnetic Fields (RF-EMF) Radiation on Plant Growth

By: Tyrese Boykin - Junior
Advisor(s): Mr. Ross Topliff, Biochemical Engineer, Tops Engineering

Radiofrequency electromagnetic fields (RF-EMF) radiation empowers our today's technology: computers, smartphones, smart appliances, radio, etc, and for applications such as for industry, research, entertainment, and telecommunications uses, and are essentially everywhere, everytime. However, it's been reported that exposure from RF-EMF has some effects on living organisms, and the environment. Few studies have been done on investigating the effects of plants from RF-EMF radiation, particularly in higher frequency bands, as advancing technologies such as 5G will use higher frequency bands for applications. However, some studies on plants from RF-EMF radiation exposure have been reported to cause some morphological changes, cellular/molecular effects, and decreased growth rate. In my research, I plan to investigate the effects of RF-EMF radiation on plant growth rate & morphology, as plants have similar cell structure as humans and animals, and pose some effects that may possibly extrapolate to humans and animals. My research involves using 40 small plants, along with a NETGEAR Nighthawk AX4 4-Stream AX3000 WiFi 6 Router (RAX40) and a Faraday cage, with half growing inside the Faraday cage, and the other half without it. I'll let the plants grow within some time and measure the growth rate and morphology and compare the differences.

The Effect of the Intestinal Microbiota on Antibiotic and Probiotic Metabolism

By: Daniel Rego - Junior
Advisor(s): Major Preston J Dihle, Major Erin E Milner, West Point Military Academy

The intestinal bacteria community (microbiota) in humans contains tens of trillions of microorganisms, including approximately 1000 different species of known bacteria with more than 3 million genes (150 times more than human genes). The diversity of bacteria in the intestines assist with the degradation of nutrients prior to intestinal absorption. The population of intestinal microbiota, a crucial “hidden organ”, could result in maladaptations (dysbiosis). Identifying correlations between dysbiosis and diseases associated with obesity, gastritis, diabetes, and improper food and drug metabolism is an area of interest within the medical research community. Improper drug metabolism due to intestinal dysbiosis, an area of interest that affects the absorption of active pharmaceutical compounds, results in decreased drug exposure and potential adverse side effects. In addition, due to enterotype variability, oral medication absorption varies significantly within the human population. Furthermore, intestinal dysbiosis has been known to occur during antibiotic treatment where probiotics are usually used at the same time to treat such bacterial imbalance in the intestines. This project will focus on identifying the interaction between antibiotics and probiotics by utilizing liquid chromatography mass spectrometry instrumentation to determine the concentration of the parent drug, the probiotics, and subsequent metabolic products.

***Collaborated with USMA cadets on a peer-reviewed article currently under review**

Collection and Quantification of Microplastics in the Hudson River

By: Zachary Don - Junior
Advisor(s): Dr. Klos, Marist College, Maiji Niemisto of the DEC

Plastic pollution is one of the largest forms of pollution in the water today. The average person consumes about 5g of microplastics a week, about the amount of plastic in a credit card. Microplastics, pieces of plastic smaller than 5 mm in size, can be found in every natural water source on the planet. Primary microplastics are pieces of plastic that are produced to be tiny. Some examples of these are microbeads found in exfoliating skin products, plastic pellets or hurdles, and synthetic fibers used in all sorts of textiles such as clothing. Secondary microplastics are pieces of plastic that break down over time into smaller pieces of plastic. Examples of secondary microplastics include foam pieces and fragments. “Fragments” is used to describe any type of plastic that appears to come from a larger piece of plastic. A standardized methodology has yet to be developed for microplastic studies. Because of this, data collected from experiments are hard to compare to one another. In addition, many experiments use expensive or hard to find equipment which makes the experiment hard to replicate. The purpose of this experiment is to test and alter the methodology developed for use in future experiments.

The Effect of Exercise on Memory of Early Stage Dementia and Alzheimer's Patients

By: Shaima Herzallah - Senior
Advisor(s): Dr. Clare Thomas-Pino, Adjunct Professor at UMaine

Dementia is a general term for diseases and conditions characterised by a decline in memory, language, problem-solving and other thinking skills that have an effect on a person's capability to perform day-to-day activities. Alzheimer's Disease (AD) is the most common cause of Dementia. An estimated 5.8 million Americans suffer from Alzheimer's dementia. The vast majority (80%) are aged 75 or older of those who suffer from cognitive decline. One in ten people (10 %) aged 65 and older has Alzheimer's disease and about one-third of people aged 85 and older (33%) have Alzheimer's disease. Limited but compelling data suggests that exercise may decrease cognitive decline and increase hippocampal neurogenesis. Aside from improving memory loss, it has positively impacted those with emotional and mental health deficiencies as well. For this paper, a systematic review consisting of 28 published studies demonstrating the effect of physical activity in improving memory in Dementia and Alzheimer's patients have been conducted. There are currently no disease-modifying or preventive treatments for AD. However, research suggests that exercise positively impacts brain health through neurotrophic, neurogenic and vascular mechanisms.

A Systematic Review: The Effect of the Type of Bilingualism on the Cognitive Functions in Children

By: Darcy Guerra - Senior
Advisor(s): Jeffrey Rubin, Ed. D Psychologist, Dr. Kathleen Bauman Geher, PhD-SUNY New Paltz

There have been many studies on the benefits of bilingualism and the advantages people can gain from them, especially children. When bilinguals switch between languages are signs of increased activation in the dorsolateral prefrontal cortex, the region that controls certain cognitive skills like attention and inhibition leading to a domain-general enhancement of the cognitive system. This advantage is due to the extensive practice in exercising selective attention and cognitive flexibility during language use since both languages are active when one is in use. The processing representation has also been shown to improve cognitive reserve which uses brain networks to enhance brain function during aging. In this study a systematic review was conducted where advantages presented in executive functioning are examined and correlated with different levels of bilingualism. Factors presented in the results such as age, gender, and type of acquisition were also investigated. It was predicted that the more fluent and younger the age of language acquisition, the more advantages they will demonstrate in tasks measuring executive functioning. Executive functions are higher-level cognitive skills, which are used to control and coordinate other cognitive abilities and behaviors. It was found that the younger acquisition of bilingual types obtained the most advantages.

A Comparative Study Between Whiteclaw and Other Bacteriophages of the Same Cluster

By: Arnaz Reza - Senior
Advisor(s): Dr. Suparna Bhalla (Doctor of Philosophy, McGill University, Montreal, Quebec, Canada) & Dr. Evan Merkhofer (University of North Carolina at Chapel Hill, PhD, Genetics and Molecular Biology)

Bacteriophages are considered the most abundant entities on Earth. Phages are viruses that infect a specific bacterium. The advent of antibiotics brought a decline in phage studies because antibiotics were administered easily. However, a rise in bacteria rapidly becoming antibiotic resistant is problematic. Phages attack only host-bacteria, not human cells, making them good candidates to treat infections. Phage research remains patchy, thus providing more information is the objective. In this study, a particular phage's (Whiteclaw) genes were studied. The first step is isolating a phage from the soil, whilst confirming it infects the bacterium. Bioinformatic analysis compared Whiteclaw's genome to that of other phages. It was hypothesized Whiteclaw was a novel phage that infected the host - *Gordonia terrae*. If so, it was expected that Whiteclaw would exhibit gene functions unique to itself, and dissimilar to other phages. It was found that Whiteclaw is a novel phage and while similar to phages of the same cluster, it has its own unique properties. Phages grouped together in the same cluster show 50% or more of the nucleotides being identical. Future research should involve testing phages like Whiteclaw for unique genomic properties that may highlight phages as potential alternative treatments for bacterial infections.

***Selected as Student Speaker in General Biology at 2021 Jr. Science and Humanities Symposium**

Science Research Alumni News

- **Kayla Dubois '15**: Graduated summa cum laude of Union College, Biomedical Engineering major, Electrical Engineering minor, member of Tau Beta Pi engineering honor society,
- **Kaila Helm '16**: Kaila Helm graduated from the University of Pennsylvania summa cum laude with a B.A. in Biological Basis of Behavior with Honors Distinction & American Sign Language Certification (Spring 2020). Currently, she works as a Clinical Subjects Coordinator for Michigan Medicine's Family Medicine Department. Kaila plans to start medical school in Fall 2022.
- **Katie Jones '16**: graduated Johnson & Wales University in 2020 with 4.0 GPA, Criminal Justice and Applied Psychology double major, minor in business, member of Alpha Phi Sigma criminal justice and Alpha Beta Kappa national honor societies; Currently employed at a law firm in Croton NY
- **Phoebe Rutaquio '16**: SUNY New Paltz Alumni 20', B.S. in Psychology, Concentration in Psychobiology, Masters in

Public Health, MPH, Oxford Brookes University, UK, Class of 2021

- **Jazmin Phipps '17**: Graduated from SUNY Oneonta '20 with a Bachelor's in Political Science, Minor in Communications, and Pre-Law Concentration, Seeking Paralegal Certification at Marist College '21 (GPA: 3.9), Full-time Legal Secretary at Workers' Compensation & SSD Law Firm
- **Adam Amer '19:** Stony Brook University, major in Applied Mathematics minor in International Studies.
- **Kiara McBean '19:** SUNY University of Albany, History major, Biology minor, Fall 2019 & 2020 Dean's List, Fall 2020 Dr. Seth Spellman, Jr. Academic Achievement Award Receivement
- **Daniel Hanrahan '19:** Eastern Gateway Community College, Education major, provides community rehabilitation for the disabled
- **Andrew Gomez '19:** University of Albany, Computer Engineering major
- **Joshua Fuentes '19:** Mount St. Mary College, Orange Ulster Boces, working towards LPN certification
- **Stephanie Alvarado '20:** SUNY Orange, Pre- Nursing major

Superintendent of Schools

Dr. Roberto Padilla

NFA North Campus Administration:

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Kevin Rothman, ***Excelsior House Principal***

Rafael Vasquez, ***Assistant Principal***

Rachel Schuyler, ***Assistant Principal***

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Thank you to the following people who served as members of our Scientific Review Committee for the 2020-2021 school year:

Jeffrey Rubin, Ed. D Psychologist

Lisa Korenman, PhD Professor USMA

Matteo Doddo, Principal NFA North

Alfred Romano, Director of Science NECSD

Verna Lee, Science Teacher NFA North

Patricia Gould, Retired Sci Teacher NFA North

Richard Kurtz, Retired High School Sci. Teacher

Ross Topliff PE, Principal, Tops Engineering, PLLC

Toby G. Rossman, Ph.D. Professor/Environmental Medicine NYU Grossman School of Medicine

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