Newburgh Free Academy

North Campus Presents

The Eighth Annual Science Research Symposium

June 2020

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

Microplastic Concentrations Found in the Hudson River

  - Daniel Rego

The Effect of the Intestinal Microbiota on Oral Drug Metabolism

  - Amanda Waite

How Burn Victims React to Different Types of Healing Methods

  - Shaun Zamenick

How PCBs Affect Fish Populations in the Hudson River

- Shaima Herzallah

The Effect of Exercise on the Memory of Early Stage Dementia and Alzheimer Patients: A Systematic Review

❏ Junior Presenters

- Lila Amer

Tears as a Biomarker for Ocular and Systemic Diseases

- Darcy Guerra

The Effect of Bilingualism on Cognitive Abilities in Children

- Arnaz Reza:

Discovering and Characterizing Microbacterium Foliorum Phages: Beginning Insights

- ❏ Senior Presenters
  - ➢ Stephanie Alvarado:

The Effectiveness of Herb Infused Oils vs. Chemical Cleaning Products on Bacteria Reduction

  - ➢ Diana Ramos:

Behavior Traits Detected In Shelter Dogs During Human Interactions

- ❏ Goodbye video
- ❏ End of symposium

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.

Behavior Traits Detected In Shelter Dogs During Human Interactions By: Diana Ramos - Senior
Advisor(s): Dr. Clare Thomas-Pino, Adj Prof UMaine

The American Society for the Prevention of Cruelty to Animals estimates that 5 to 7 million pets are admitted to shelters each year, with approximately 60% of admitted dogs ultimately euthanized. In order to improve living conditions and decrease euthanasia rates, animal welfare organizations are advocating the use of behavior modification programs to improve dog behavior while at the shelter. The present study aimed to observe the development of a shelter dog's understanding of specific commands as they took part in training sessions. In correspondence to earlier research, it was hypothesized that with the continuation of behavior modification programs already established in shelters, adoption rates would increase because of the dogs being taught to spend more time engaging in proper behavior and less time engaging in inappropriate behavior. A total of 5 dogs participated in the training exercises; learning how to sit, touch, watch and parallel walk alongside other dogs. Results from this experiment failed to demonstrate a positive correlation between a dog's understanding of the command and the ability to complete the task as time passed. Although the observations collected were not significant enough in supporting the original hypothesis, two dogs did however experience a change in behavior. Bella, a 5-year old Labrador/Beagle Mix, had the opportunity of walking with potential adopters. While Max, a 9-year old Hound/Collie Mix who had a difficult time comprehending commands in the beginning, was able to sit down when asked in the last session.

***3rd place winner in Animal Science at 2018 Somers Science Fair**

The Effectiveness of Herb Infused Oils vs. Chemical Cleaning Products on Bacteria Reduction

By: Stephanie Alvarado- Senior
Advisor(s): Dr. Victoria Romano, DPN, CNRP, CN-P
Mr. Ross Topliff M.S. Chemical Engineering

Do cleaning products reduce microorganisms that cause harm? The recent increase in hospital-acquired infections has prompted the question of whether cleaning products used in hospitals are 99. 9% effective as they claim to be. Previous studies stated that a portion of cleaning products display little to no effect on bacterial growth reduction. This study was set out to determine the possibility of a more natural, effective alternative to the commercialized cleaning products. Over the course of five consecutive days three different commonly used cleaning products in hospitals: Lysol All Purpose Cleaner, 409 Multi-Surface Spray, and Windex Glass Cleaner, were tested on their effectiveness on bacterial reduction. Results were then compared with herbs; aloe vera, and rosemary. Different samples of bacteria were used to "stimulate" general surfaces that are in the healthcare setting. Over a period of 72 hours, samples of bacteria cultures were placed in a petri dish to properly grow. The zone of inhibition was measured to determine the effectiveness of each product being tested against the bacteria. It was hypothesized that the zone of inhibition would be larger in bacteria treated with herbs when compared to the zone of inhibition of bacteria treated with commercialized cleaners. Indicating that herbs are more effective in reducing bacterial growth. The results of the experiment showed that commercial cleaners reduced the number of bacteria more than the herbal remedy. When further analyzing the results, it was found that both the herbal oils and the synthetic cleaners enhanced the growth of the bacteria. More research is needed to arrive at a conclusion, due to not having an initial point of bacteria. For future research I would perform the same experiment except I would lower the variables. I would lower the types of bacteria down to two and get plates with known initial bacteria or wait the 72 hours then record the initial growth of bacteria.

***Selected as Student Speaker in Chemistry and Biochemistry at 2020 Jr Sci Humanities Symposium**

Discovering, Characterizing, and Annotating a Microbacterium Foliorum Phage (Vegas)

By: Arnaz Reza- Junior
Advisor(s): Dr.Suparna Bhalla, Associate Professor of Biology at Mount Saint Mary College

Bacteriophages are considered the most abundant entities on Earth, approximately 10^{30-31} particles. Phages are viruses that infect a specific bacterium. The advent of antibiotics brought a decline in phage studies because antibiotics can be administered easily. However, a rise in bacteria rapidly becoming antibiotic resistant is problematic. Antibiotics kill bacteria indiscriminately, even those beneficial. Phages attack only host-bacteria, not human cells, so they are well candidates to treat infections. Phages represent the backbone of modern molecular biology used to identify basic genetic material like nucleotide triplets encoding for an amino acid and identification of restriction enzymes. But phage research itself remains patchy, thus providing more information on phages is the objective. In order to appreciate phages, an understanding of possible interactions with their environment and hosts is purposeful. To make sense of their viral abundance, I plan on researching my phage's (Vegas) mechanisms of infecting bacteria and the functions of Vegas's encoded genes. The first step is isolating, purifying, and amplifying a phage from the soil, whilst confirming it infects the bacterium. Electron microscopy is used to identify the morphology of the phage, and bioinformatic analysis of genomes will identify gene functions. These genes will be compared to other phages for higher understanding of phage diversity. It was hypothesized if Vegas was a novel phage that infected the host: Microbacterium Foliorum. If so, the common and unique characteristics of Vegas can be classified through annotation of genes.

The Effect of Bilingualism on Cognitive Abilities in Children

By: Darcy Guerra - Junior
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 the benefits, especially children. When bilinguals switch between languages there have been signs of increased activation in the dorsolateral prefrontal cortex, this region has to do with certain cognitive skills like attention and inhibition. It has been shown that the processing representations from two languages can lead to a domain-general enhancement of the cognitive system. This advantage is believed to be due to the bilinguals extensive practice in exercising selective attention and cognitive flexibility during language use, because both languages are active, when only one is in use. It has also been shown to improve cognitive reserve which uses brain networks to enhance brain function during aging. For my research I am to conduct an experiment where the advantages presented are tested for different levels of bilingualism. The stroop test which measures executive function would be used. I would like to see how the results may be affected by different factors, such as the level of bilingualism, but also variables like age, gender, and social environment. My hypothesis is that the more fluent and the younger the age acquisition is the more advantages they gain in executive functioning.

Tears as a Biomarker for Ocular and Systemic Diseases

By: Lila Amer -Junior
Advisor(s): Dr. Kevin O'Donovan, MD, USMA

The complex composition of tear fluid presents as a future biomarker for systemic and ocular diseases. By analyzing the proteomics, glycomics, lipidomics and metabolics of tears, diseases can be pre-ordinately diagnosed. Tear collection is inexpensive, non-invasive, and easily replicated. Using the Schirmer's tear collection method, the components of tears extracted from the eye of a diseased patient can be compared to the tears of a healthy human eye. This comparison allows for the identification of abnormal levels of chemicals or hormones on the surface of the eye. Because ocular health is impacted by disparity in other regions of the body, tear fluid shifts in its hormones and chemicals in accordance to the imbalance of homeostasis. The elevated or depleted levels of these substances in the tear fluid can be identified using a mass spectrometer and gel electrophoresis machine. This experiment aims to identify the specific characteristics that verify tears as a biomarker. It is hypothesized that human tears possess traits capable of being used as precursors to diseases. Establishing the connection between tear fluid and bodily diseases allows for the research of tear fluid as a biomarker. This form of diagnosing systemic and ocular diseases allows for predictive and preventive medicine.

The Effect of Exercise on the Memory of Early Stage Dementia and Alzheimer Patients: A Systematic Review

By: Shaima Herzallah- Sophomore/Junior
Advisor(s): Dr. Victoria Romano, DPN, CNRP, CN-P, Dr. Clare Thomas-Pino, Adj Professor 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 is the most common cause of Dementia. An estimated 5.8 million Americans suffer from Alzheimer's dementia. Alzheimer's disease is triggered by an abnormal protein misfolding that most often originates in medial temporal structures which includes the hippocampus and is known to play a role in memory. Over the years, researchers have been studying this area to try to find a treatment since Alzheimer's and Dementia are incurable diseases. However, studies have shown that exercise and physical activity can improve memory. Most studies reviewed used aerobic exercises such as walking, running, swimming, hiking, dancing, etc. Patients that were used in some of these studies were over the age of 65 and mostly females since it is more likely for women to develop these diseases more than men. For this study, I plan to gather about 20 to 30 published studies on this topic and quantify them according to patient age range, gender differences, stage of diagnosis/treatment. I will also look at commonalities and differences in the type of physical activity used to be effective with patients. My goal is to help determine specific treatments using physical activity that can improve memory and quality of life for those suffering from these diseases.

Microplastic Concentrations Found in the Hudson River
By: Zachary Don- Sophomore

Microplastics are defined as extremely small pieces of plastic debris in the environment resulting from the disposal and breakdown of consumer products and industrial waste. There are different types of microplastics, such as fibres, used in clothing; microbeads, often found in exfoliating skin care products; fragments, which are pieces of plastic that result from the breakdown of larger pieces of plastic; and foam. Because of their chemical makeup, plastic takes hundreds of years to decompose. As a result of increase in single use products, plastic pollution in waterways has dramatically increased. Microplastics have been found in many fish and birds as a result of plastic pollution. In addition, the effects of human consumption of microplastics is still unknown. Because of this, it is important for increased research on microplastics. Most research has been focused on ocean plastic pollution and its effect on marine ecology. However, studies on freshwater systems such as the Hudson River and its tributaries have not been as extensive as ocean studies. Since freshwater systems play a large role in everyday life, it is important to identify and quantify microplastic amounts in local waterways, such as the Hudson River.

The Effect of the Intestinal Microbiota on Oral Drug Metabolism

By Daniel Rego - Sophomore
Advisor: Milner, Erin E MAJ, PhD, DABCP USMA

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. Extensive research has been conducted to identify the various enterotypes that exist in the intestinal environment.This project will initially focus on three specific aims: 1) select and analyze a subset of GI microbial strains individually and heterogeneous colonies, 2) select and analyze a subset of drug structural motifs, and 3) utilize liquid chromatography mass spectrometry instrumentation to determine the concentration of the parent drug and subsequent metabolic products.

How Burn Victims React to Different Types of Healing Methods

By: Amanda Waite - Sophomore
Advisor: Maria David, MD, SM, FAAP

Burns are a prevalent and burdensome critical care problem. The priorities of specialized facilities focus on stabilizing the patient, preventing infection, and optimizing functional recovery. Research on burns has generated sustained interest over the past few decades, and several important advancements have resulted in more effective patient stabilization and decreased mortality, especially among young patients and those with burns of intermediate extent. When you treat a burn victim a type of “band-aid” to say is needed to help the healing process. Different doctors use different types of these “Band-aids”. In my research I intend to focus on two main treatment options, SkinTemp and XeroForm. Both treatments are types of dressings put over a burn. However XeroForm’s active ingredient is petroleum and while the active ingredient in SkinTemp is collagen. Each active ingredient responds differently to skin type and the healing process, and patients often need to choose between either treatment. In my study I plan to provide more information to the patient or the proxy on making a choice to use either SkinTemp or XeroForm. I plan on doing this by analyzing healthy skin cells looking for protein components that could possibly change post treatment. Then I will analyze the skin and see how it reacted to each treatment.

How PCBs Affect Fish Populations in the Hudson River
By: Shaun Zamenick - Sophomore

The Hudson River, one of the main rivers in New York, is filled with many different flora and fauna. However, this great landmark is in trouble because companies like GE have polluted it with chemicals including PCBs (Polychlorinated Biphenyls) and mercury. It is my intention to find out how these chemicals are affecting the populations of flora and fauna in and around the river as well as whether these organisms are developing immunity to the toxic effects of these chemicals. I propose that through monitoring and testing of the river populations and comparing them to the existing data kept by the New York State Department of Conservation, we will find that the reason for increased and returning populations to the river is because of said immunity.

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**: University of Pennsylvania Alumni '20, Biological Basis of Behavior with Language Certification in American Sign Language and Deaf Studies, Dean's List Award 2016-2017
- **Katie Jones '16**: Johnson & Wales University Alumni '20, Criminal Justice and Applied Psychology double major with a minor in business, member of National Alpha Phi Sigma criminal justice honor society, 4.0 GPA
- **Phoebe Rutaquio '16**: SUNY New Paltz Alumni 20', B.S. in Psychology, Concentration in Psychobiology
- **Jazmin Phipps '17**: Senior - SUNY Oneonta. Senator and Attorney General of the Student Association, Vice President of the Political Science Club, and Treasurer of the Mock Trial Team.
- **Adam Amer '19:** Freshmen- Stony Brook University, major in Applied Mathematics minor in International Studies.

- **Kiara McBean ‘19:** Sophomore- University of Albany, History major, Biology minor, Fall 2019 Dean’s List, 2020 Spellman Academic Achiever
- **Daniel Hanrahan ‘19:** Education major - Eastern Gateway Community College, provides community rehabilitation for the disabled
- **Andrew Gomez ‘19:** Freshmen- University of Albany, computer engineering major
- **Joshua Fuentes ‘19:** Mount St. Mary College’, Orange Ulster Boces, working towards LPN certification

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Mr. Michael McLymore, ***Assistant Superintendent Human Resources***

Mr. Danny Dottin, ***Executive Director Human Resources***

Ms. Sara Feliz, **Executive Director Youth Development & Community Engagement**

Mrs. Andrea Moriarty, ***Assistant Superintendent, Curriculum and Instruction, Elementary***

Dr. Lisamarie Spindler, ***Assistant Superintendent, Curriculum & Instruction, Secondary***

Mr. Rodney Asse, ***Assistant Superintendent, Finance***

Dr. Pedro Roman, ***Assistant Superintendent, Chief Equity Officer***

Mr. Christopher Bayer***, Assistant Superintendent, Exceptional Learners***

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Abdullah Rahaman, ***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 2019-2020 school year:

Jeffrey Rubin, Ed. D Psychologist

Lisa Korenman, PhD Professor

Adele Grossman, retired Science Teacher NECSD

Matteo Doddo, Principal NFA North

Alfred Romano, Director of Science

Verna Lee, Science Teacher NFA North

Patricia Gould, Science Teacher NFA North

Dr. Lisamarie Spindler, Asst. Supt. Curriculum and Instruction, Secondary

Ross Topliff PE, Principal, Tops Engineering, PLLC

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

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