

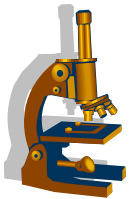
# **Marine Academy of Technology & Environmental Science**



## **Thirteenth Research Showcase**

# Abstract Guide

**February 27, 2019**



February 18, 2019

**This is the Thirteenth year of the Research Expo! We had a strong 2017-2018 student research year outside of MATES with multiple projects selected for the Delaware Valley Science Fair and posters presented at the South Jersey Junior Science Symposium. Five of our students presented at the Mid-Atlantic Diamondback Terrapin Working Group Meeting, and there will be over 80 projects competing at Stockton University's Jersey Shore Science Fair in March. All freshmen and transfer students were required to conduct an independent experiment. Once completed, the students completed a poster culminating in the poster session on February 27, 2019. Many hours went into the projects as the first year MATES students will be presenting their posters. All posters will be displayed in alphabetical order of their last names in nine categories. They will also be judged based on their category.**

**We would like to thank the students for their project presentations this year. The students worked hard and it will show in the following abstracts, and during their poster session. Mr. Jason Kelsey, fellow student research coordinator who provides the students with tremendous insight on research. Thanks to the MATES Parent-Teacher-Student Organization that was generous in providing funds for materials for numerous projects. Also, thanks to SUEZ, the Fish Hawks, the Garden Club of Long Beach Island, The EIFF Foundation and Exelon for their contributions to our research program. We wish to thank our Ocean County Vocational Technical School Board of Education, Administration (Mr. Hoey, Dr. Michael Maschi, Mr. Frazee, and Mr. Biscardi, MATES Principal). A special thanks to the MATES Staff, especially Mr. David Werner (research advisor), Dr. Michael Bixler, Mr. Brian Jones, Ms. Maryann Minnier, Ms. Mia Dill, Ms. Jennifer Hudak, Mrs. Kelly Kelsey, Mr. Adam Sprague, Ms. Michele Colon, Mr. Joseph Arfin, Mr. Brian Coen and Ms. Melissa Wolleon who contributed to the success of the project. Also, many, many thanks to Ms. Katie Manna, Ms. Esther Gallacchio, and our dedicated maintenance staff for all of their support and assistance. Our lunch was prepared by Ms. Deborah Dimm and Ms. Doreen Donovan.**

**Thanks to the parents who have contributed much time and effort in making the projects possible. Without parental support, this research would not be possible. This year's Research Class helped to organize the Expo, and all the thanks in the world to our Research Assistance and Development (RAD) Team for helping the young researchers for outside fairs and this Expo. RAD met over the summer and throughout the school year by providing our students with assistance! Thanks to the RAD senior coordinators Frank D'Agostino and Claudia Schreier. And, last, but not least, a very special thank you to all of our judges who volunteer to provide our students with constructive feedback about their projects. We greatly appreciate your time and expertise in making the 2019 MATES Research Expo a true success. Thank you first year research students and good luck!**

Sincerely,



**John Wnek, Supervisor,  
Science and Research**

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## **BEHAVIORAL AND SOCIAL SCIENCE**

### **101. HOW ELECTRONIC DEVICES AFFECT OUR LIVES**

Ethan Broome, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisor: Mr. Jason Kelsey

Devices such as phones and computers have drastically changed many of our lives. We rely on them for many tasks, including learning and communicating. As a result, most of our time is spent in front of a screen. But how much of our lives are controlled by devices, and how do they affect us? For my experiment, I created a survey that questioned people about their devices and how they affected them. 88 people took my survey, which was distributed electronically through Google Forms. I questioned them on their usage, any precautions they may have taken, and any side effects they experience while or after using devices. I analyzed the answers and attempted to identify any correlations between them. As expected, those who relied on screens for work or school, and those who used screens for long periods at a time had issues such as headaches, watery eyes, sore/irritated eyes, and trouble focusing. On the other hand, those who used them for less time and those who took precautions, such as computer glasses, had less of these problems. The results of this survey show the importance of devices in our life and how much we rely on them.

### **102. HOW HUMAN BEHAVIORS ARE ALTERED BY REFRAINING FROM SOCIAL MEDIA FOR ONE WEEK**

Kellie Cochran, Block 3 Science Class, Marine Academy of Technology and Environmental Sciences (MATES), Advisor: Mr. Robert Cochran

Today's world revolves around social media; in fact, it is become so prevalent in society that many cannot go a day without checking their social media apps. This is due to social media's addictive quality as well as the fear it creates of missing out. Although social media has many benefits, such as allowing loved ones to stay connected, it also has many drawbacks. The aim of this research project was to observe how human behaviors were altered when abstaining from social media for a week. To test this, thirty participants ranging from age thirteen to nineteen were chosen to take part in this two week experiment. During the first week, participants carried out their normal social media habits. At the end of the week, the participants filled out a twenty multiple choice question survey that consisted of questions regarding how the subjects felt when using social media. This same process was repeated for the second week and the only difference between the two weeks was that during the second week, participants used no social media. The experience demonstrated that there is a correlation between the results of the surveys and the participants experiencing more positive behaviors when abstaining from social media.

### **103. THE EFFECTS OF JAZZ MUSIC ON TEST SCORES BASED ON GENDER, AGE, AND MUSICAL BACKGROUND**

Michelle Elias Flores, Block 4 Science Class, Marine Academy of Technology and Environmental Sciences (MATES); Advisors: Mr. Jason Kelsey and Dr. John Wnek

Humans during the span of their day, hear and produce all different types of sounds. A majority of tests focus on a person's ability to recall prior information and use of logical thinking. High School students are known to stress about testing, but are also very avid music listeners. Jazz music has been known to stimulate the brain and improve test results because of its peaceful sound projection. What if someone were to take an intelligence test while listening to the jazz music? To determine if jazz music really did help boost test scores depending on age, gender, and musical background, I surveyed over 100 people about their musical preference, musical background, gender, and age. After I had these survey results, I conducted two sets of timed tests on 49 of those participants, one involving no music and 10 minutes of testing, and the second test having jazz music played in the background with 15 minutes of test taking. Each participant was recorded for time ended and overall completion. The data demonstrates that most people who studied with music on and had preference of rap/hip-hop scored poorly compared to a musical background of pop. Males show higher results with the music than females, and the females show higher results without the music

## **BEHAVIORAL AND SOCIAL SCIENCE (CONT'D)**

### **104. THE EFFECTS OF VISUAL, AUDITORY, AND TACTILE LEARNING STYLES ON DIFFERENT AGE GROUPS**

Victoria Farley, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. David Werner

From interpreting graphs, listening and analyzing, or physically retaining information, every learner has a different preference when having to perceive, or apply, what they have been taught. Visual learners learn best through what they can see, auditory learners thrive when presented with lectures, and tactile learners rely on their senses to succeed in a classroom. A study was conducted by surveying four age groups and grade levels to test changes in learning style preference over time. Surveys were sent out to approximately 600 students in 4th grade, 7th grade, 10th grade, and college. Each individual's responses were then used to determine their learning style. The study showed that the 4th, 7th, and 10th graders all had a majority auditory preference. The college students demonstrated a notable difference, however, and had a majority visual preference learning style. Although a predominance of the participants preferred auditory learning, the gap in preference lessened and distributed more evenly as time passed. The shift likely occurred because as schooling progresses, students have to alter the way they learn to align with how teachers deliver information. Finding a correlation between learning styles and teaching styles is vital in maintaining a healthy classroom atmosphere with eager learners.

### **105. DOES A PHONE CONVERSATION AFFECT REACTION TIME?**

Christos Kaiafas, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. David Werner

With the growing popularity of cell phones, people use them anywhere and at any time, including while driving. The increase of cell phone usage while driving has led to an exponential amount of phone-related car crashes, most of which include teenagers. This leads to the question, "does a phone conversation hinder reaction"? An experiment was conducted where test subjects test their reaction time. They "grabbed" a yardstick suspended over their hand without a phone, with their phone having a conversation, and the phone on speaker mode to simulate Bluetooth in a car. It was hypothesized that the test without the phone would have a quicker reaction time than speaker, which was hypothesized to have the second fastest reaction, then with the phone being the slowest. This experiment was tested on four groups, Males and Females ages 14-18 and Males and Females ages 40-55. Data was separated and averaged for each method to end up with a final average for each. A correlation was identified, showing that people had slower reactions time with the phone and on speaker than without a phone.

### **106. DOES LISTENING TO MUSIC WHILE TAKING A TEST AFFECT THE SCORES OF STUDENTS?**

Brett Meehan, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES)

Music has been known to help with focus and concentration. It has also been known to decrease anxiety levels in people of many different age groups. In order to test the compatibility of these two results, tests were done to see if listening to music while taking a test will increase the score. Various students were sampled ages fourteen to fifteen years old, and split into three groups for testing. All tests were performed at the Marine Academy of Technology and Environmental Science (M.A.T.E.S.) in Manahawkin, New Jersey. This experiment showed that there was no correlation between music and test scores.

## **BEHAVIORAL AND SOCIAL SCIENCE (CONT'D)**

### **107. COMPARISON OF THE CIRCADIAN RHYTHM WHEN READING A BOOK ON A BLUE LIGHT-EMITTING DEVICE VS. READING A PAPER BOOK BEFORE BEDTIME**

Grace Pluemacher, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

This project is the result of an experimentation of the effects of blue light from electronics on the circadian rhythm. A circadian rhythm is a biological sleep-wake 24-hour cycle. Data was collected using the wGT3X-BT Actigraph. The effects of the blue light were determined by analyzing the sleep onset latency, efficiency of sleep, and the number of awakenings during the night. Participants wore monitors for four nights and wrote down what time they went to sleep and what time they woke up. For the first two nights, participants read a paper book for one hour directly before they went to sleep. For the last two nights, participants used two electronic devices: an iPad 1 and an iPad Mini on full brightness for one hour directly before they went to sleep. After the four nights, the data collected from the nights reading the paper book were compared to the nights using the iPads. Circadian disruption, the delay or disruption of the circadian rhythm, was analyzed for each participant by comparing the latencies for the four nights and the efficiency from each night. It was found that the latencies on the nights when the iPads were used were about 2.7 times more than the latencies on the nights when the participants read a paper book. Overall, most participants had a delayed circadian rhythm with a longer latency and a worse efficiency when they used the blue light emitting iPads before they went to sleep.

### **108. ANALYZING THE RELATIONSHIP BETWEEN CONSUMER COMPREHENSION AND SHOPPING HABITS TO UNDERSTAND THE PREVALENCE OF FAST FASHION**

Devin Rauscher, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisors: Dr. John Wnek and Mr. David Werner

The term “fast fashion” refers to the business model of selling as many articles as clothing as you can, often for a cheap price for consumers and low labor costs in developing countries. This leads to an almost constant shift of clothing, trying to stay relevant to consumers, creating an incredibly fast fashion cycle, hence the name. However, this way of selling clothing has been proven to damage the environment, overuse natural resources, and exploit labor in developing countries. Waste from the fashion industry is one of the greatest polluters in the world, and while most people can say that they have heard of global warming and how to reduce their impact on earth, very few understand how their shopping habits become another contributing factor. The “Understanding the Fast Fashion Industry” survey, which was created and distributed for this project, collected responders’ understanding and impression of fast fashion using multiple choice and open-ended questions. Data was then organized and analyzed to determine a relationship between age, background knowledge, and shopping habits and current knowledge about fast fashion and its effects. Those with a background in fashion between the ages of twenty and twenty-nine tended to have the most accurate description of the industry, and throughout all age ranges, those who buy the most clothes tended to know the least. Generally speaking, there is a loose relationship implying that those who have background knowledge and own less clothing know more about fast fashion; moreover, it indicates that this industry is so prevalent and destructive because so few do know about it and therefore buy clothes produced this way.

## **BEHAVIORAL AND SOCIAL SCIENCE (CONT'D)**

### **109. SOCIALLY CONFORMING BEHAVIORS OBSERVED IN TEENAGERS**

Bridget Salmon, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. David Werner

As humans we are often inclined to follow the lead of others. Avoiding social pressures is hard for many people because of the human nature, everyone wants to be liked. Teenagers especially, are quick to conform to avoid teasing, bullying, and exclusion. Almost everyone has conformed at some time in their life, but how many people do it without realizing it on a day to day basis? To find the answer to this question, two separate tests were given to 33 people. Each of the tests consisted of the four same line comparison questions, but switched in order. The test is meant to make a person have self-doubt because of its simplicity, which ultimately leads them to rely on their peers. The first of the two tests was taken by oneself, while the second was taken with people sitting in groups. Data was analyzed by looking to which group a person was in, and how many of their answers were changed from their individual test. Of the 33 people tested, 26(78%) changed their answers and 23(70%) had the same answers as their group members. The results indicate that at least, approximately, 70% of them conform without realizing it. These trends of conforming support my hypothesis of, if people are put in a situation of pressure, then they will conform to do what others are doing.

### **110. COMPARISON OF STUDENT TESTING ANXIETY: COMPUTERIZED VS. WRITTEN**

Ryan Schager, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. David Werner

Technology has increasingly been implemented daily into school system curriculums. With increased use of technology today, test anxiety has become a prominent issue for high school students. Does the implication of computerized exams cause unnecessary test anxiety to students? In order to reach a conclusion, two formats of the same true/false point based survey were formulated in order to question individuals regarding their test anxiety on computerized exams, versus written pencil-and-paper exams. The survey includes questions regarding the respective format in order to gain an understanding of the student's anxiety levels comparatively. A combined total of over 500 computerized and written surveys were distributed to high school freshman and senior students ages 13-18. Data collected was separated by the format of the survey, than analyzed for responses. The data suggests that a majority of freshman and senior students exhibit more test anxiety using computerized exams than traditional written exams. This research is important in determining the style of exam that may be most appropriate for high school students.

### **111. HOW CAN A CHORD CHANGE LISTENERS' PERCEPTION OF MUSIC?**

Seamus Watson, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Many factors can affect the sound of a piece of music, and the emotion it conveys. A song's tempo, key, and rhythm can all cause it to cause evoke different feelings in listeners, and songwriters often write music with a specific emotion in mind for the sound. Studies have been done in the past on how each of these affect the feeling of music, but research has not yet been done on whether just one chord can convey emotion or change the sound of a song. To test this, seventeen students were asked to listen to a track of chords and record their reactions to each one. The results showed that one chord can contain emotion, as the participants often provided similar reactions. The chords rated most happy were major chords that were not especially high or low, while high and low minor chords had the scariest ratings. While listeners' reactions often were affected by previous chords, the results of this project show that a feeling can be conveyed in music through just one single chord.

## **BOTANY**

### **201. THE EFFECTS OF USING MINT AS PEST DETERRENT ON *HYPOESTES PHYLLOSTACHYA***

Meahan Azmi, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Pesticides are chemical substances that reduce the severity of pests. However, the use of harsh chemicals can lead to plant injury and health impairment. It was hypothesized that chemical pesticide will cause a decline in the health of the *Hypoestes phyllostachya*, or polka dot plant, while natural pest deterrent made from peppermint oil will maintain health. To test this hypothesis, ten polka dot plants were experimented on indoors over the span of five weeks. Healthy leaf counts and stem length measurements were taken weekly. Upon the final week of data collection, it was found that the five plants treated with natural mint pest deterrent displayed more healthy foliage than those treated with chemical pesticide. Although all plants experimented on survived, the ones treated with chemical pesticide were less healthy than the ones treated with natural pest deterrent. A second trial observing an additional ten plants led to similar results. The experiment demonstrated the negative effects harsh chemicals can have on a species as well as the benefits of turning to more environmentally friendly forms of plant protection.

### **202. THE EFFECT OF THE pH LEVEL OF WATER ON THE SUSTAINABILITY OF *PHASEOLUS VULGARIS***

Everett Botwinick, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

The pH scale is commonly used to determine the acidity or alkalinity of a substance. The scale ranges from 0-14, 0 representing the most acidic pH and 14 as the most alkaline. In today's society, many fragile land and water ecosystems are harmed by the pollutant-augmented acid rain. Acid rain is formed when sulfur and nitrogen compounds, such as ones formed in factories, rise into our atmosphere. The aim of the study was to determine whether the pH of water had an effect on the height of *Phaseolus vulgaris*, the common bean plant. Three different samples of water with a pH of 6, water with a pH of 7, and water with a pH of 8 were administered to plants for a 6-week period. Ten plants were watered with each pH of water once per day and the heights were recorded once per week. At the conclusion of the experiment, an ANOVA test was run to determine statistical significance between the averages. Overall, the pH of 6 had the best heights across the board, making it the most favorable for growing plants..

### **203. THE EFFECTS OF DEICING AGENTS IN THE SOIL OF *TARGETES ERECTA***

Collin Della Sala, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

A major thing that affects a plant's growth is the soil it is grown in. The salinity level in soil can slow down the growth of a plant, cause harm or kill it entirely. People using deicing agents may lead to higher concentrations of salt in the soil of the nearby area. To find a more environmentally friendly solution nine groups of plants were grown, six in each group. One group had regular soil while the rest had varied amounts of deicing agents in the soil. Four had regular rock salt, a common deicing agent while the other four had a Petsafe deicing agent. The plants were grown and measured for ten weeks, counting which ones grew and which did not. A clear trend had been showing itself by the end of the tenth week. Only the Petsafe group with the smallest concentration grew while three of the rock salt groups produced some plants. Counter to my hypothesis all data points toward the rock salt actually being better than the Petsafe though they both showed negative effects on the plants.



## **BOTANY (CONT'D)**

### **204. THE EFFECT OF INORGANIC FERTILIZERS ON *ULVA LACTUCA***

Taner Drexler, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Fertilizers are a very common way to enrich plants with the essential nutrients they need for growth. However, the inorganic fertilizers that are being used have a drastic impact on our marine ecosystems. Due to runoff, the man-made chemicals from these inorganic fertilizers are carried off into our waterways. The bodies of water in which the fertilizers have settled in become rich with nitrates and phosphates, causing the rapid growth of marine plants. When this increased population of plants begins to die, the decomposition of the algae reduces the level of oxygen in the water, which leads to the death of several different marine organisms. This study was conducted in order to compare the effects of inorganic fertilizer (Miracle-Gro) and organic fertilizer, which are widely regarded as more environmental friendly fertilizers, on *Ulva lactuca*. Eleven containers of *Ulva lactuca* collected from Barnegat Bay were examined over a period of 18 days. The inorganic Miracle-Gro fertilizer was added to five of the containers, while the other five contained the organic fertilizer. The last container contained no fertilizer to act as a control. The length of the algae was measured daily, and dissolved oxygen tests were conducted on the first and last day of the experiment. The results of my experiment showed that both fertilizers drastically increased the growth of *Ulva lactuca*, although the dissolved oxygen of the sea lettuce was higher in the inorganic containers.

### **205. THE EFFECT OF MICROPLASTICS ON THE GROWTH OF *AMMOPHILIA BREVILIGULATA***

Lucas Monchinski, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Microplastics are in abundance in the ocean and, despite the best interests of conservationists, they are still a glaring issue today. The purpose of this experiment is to determine if microplastics impair the growth of *Ammophila breviligulata*, the American beachgrass. I hypothesized that the sample of beachgrass being watered with microplastics would have reduced heights and chlorophyll levels over time in comparison to the control sample. 50 plants were divided into two equal groups. All plants were watered regularly, but the same 25 plants were given a microplastic treatment weekly. Heights of the plants and chlorophyll levels were recorded weekly. At the end of the eight weeks of observing height and five weeks of observing chlorophyll levels, the data displayed a difference in the averages of both plant groups. The plants exposed to microplastics had significantly lower height and chlorophyll levels than the control group. It is likely that this occurred since plastics release harmful toxins when they break down. These toxins may have damaged the roots of the plants and caused a reduction in growth.

### **206. STUDYING THE EFFECTS OF FERTILIZING *AMMOPHILA BREVILIGULATA***

Victoria Pyott, Block 4 Science Class, Marine Academy of Environmental Science (MATES); Advisors: Dr. John Wnek and Mr. Jason Kelsey

*Ammophila breviligulata*, also known as American beachgrass or dune grass, can be found in beaches along the Atlantic Coast, and is planted annually along the coastal regions of New Jersey. Planting and maintaining the grass is important because dunes depend on the intricate root systems of the grass to retain a stable structure. Dunes protect the beaches from erosion, flooding and storm damage, while they also protect the inland from storms and water intrusion. This project aimed to explore what fertilizers would best aid their growth. By January 2019, various fertilizers with different nitrogen content were used to fertilize dune plants. The plants were allowed to stabilize and were then monitored for five weeks. The results of the study showed that group one, fertilized with a 20-0-0 fertilizer, showed the most growth.

## **BOTANY (CONT'D)**

### **207. COMPARISON OF GROW LIGHTS USED ON SWEET BASIL IN HYDROPONICS**

Logan Schneider, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Mr. David Werner

Vertical farming has become an increasingly popular alternative to typical rural farming. These farms have complete control over a plant's growing process including its nutrient intake, light source, and climate. This experiment investigated the difference in growth for sweet basil (*Ocimum basilicum*) plants that were grown in hydroponic kits under different types of lighting. The original sample size of the project was 45 sweet basil plants and they were separated into five hydroponic kits with 9 plants each. Every one of those kits were grown under either a high pressure sodium (HPS) lamp, metal halide (MH) lamp, compact fluorescent light bulb, blue/red LED, or a green LED. This experiment suggests that the MH light grew the biggest basil plants which were, on average, the tallest and had the largest leaves of all plants grown under the other lights. The HPS light was found to be the second most effective lighting system, with compact fluorescent lighting being the third best. The blue/red LED light grew the smallest average sized basil plants, growing larger than only the plants under the green LED light, which were all dead.

### **208. ANALYZING THE EFFECT OF DEPRIVING PEPPERMINT PLANTS OF NECESSARY NUTRIENTS TO OBSERVE PLANT GROWTH**

Brianna Tonner, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. David Werner

All plants need nutrients in order to grow, whether it be from the soil they are in or the fertilizer that is used. With a lack of nutrients plants can have growth problems in the roots, cell walls, and flowers. Different nutrients contribute to various parts of a plant's growth and depriving a plant of even one nutrient can greatly affect its growth. As different nutrients affect the various parts of a plant, plants also need different nutrients based on whether they are a leafy vegetable or seed based. This project analyzed the effect that different soils had on the growth of mint plants. To do this a sample of thirty-eight peppermint (*Mentha x piperita*) plants were divided into five different groups each one grown in a different soil that varied in nutrient content. There were three control samples with a normal soil nutrient. Examples of soil used were soil from my backyard, sand, soil that is mixed with wood chips, other variations in nutrient. Peppermint plants were grown underneath a UV light for a total of 6-7 hours a day and were watered every one or two days; depending on how moist the soil seemed on a day to day basis. I hypothesized that the plants deprived of nutrients would be smaller and would die faster as compared to the control. The data clearly supported my hypothesis as some of the plants that lacked nutrients showed deficiencies in growth and survival rate.

## **EARTH AND SPACE SCIENCE**

### **301. THE EFFECT OF SEA SPRAY ON PRECIPITATION AMOUNTS THROUGHOUT CENTRAL NEW JERSEY**

Emily Byrne, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Storms have always had detrimental effects on our society and they will continue to cause severe damage. However, an aerosol created by the ocean, called sea spray, still causes question of whether it benefits or makes storms worse. Due to sea spray and the effect it could possibly have on clouds and precipitation, the areas closer to the ocean will receive less precipitation. This is given that the particles of ocean spray are too dense for clouds. The experiment was conducted by placing five rain gauges across central New Jersey ranging in location from Vincentown to Manahawkin. Each day for seventy-five days the gauges were checked for precipitation and air temperature was collected. During periods of colder temperatures, locations closer to the Atlantic Ocean experienced greater precipitation. Colder air temperatures lead to colder water temperatures. As a result, the sea spray has a different density; thus, sea spray will have a different effect on clouds and the amount of precipitation produced.

### **302. THE AFTER-EFFECT OF CARBON DIOXIDE INTAKE ON THE pH LEVEL OF THE OCEAN**

Emma Cartnick, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. David Werner and Dr. John Wnek

The ocean has maintained a static, slightly basic pH level over the past three hundred million years, remaining at 8.2; however, in recent years, the pH level dropped down to 8.1. Could this increase in acidity correlate to increasing carbon dioxide emissions? Oceans have a major role in the Earth's carbon cycle. The surface water of the ocean absorbs carbon dioxide (CO<sub>2</sub>) whenever it comes in contact with the atmosphere. Over time, the atmosphere has become more heavily concentrated with CO<sub>2</sub> due to increases in carbon emissions. This increased concentration has led to a surplus of CO<sub>2</sub> being dissolved into the ocean, lowering the pH level. The objective of this study is to determine the quantity of excess CO<sub>2</sub> that has entered the ocean in recent years, causing a drop of 0.1 pH units. This measurement was ascertained by observing the pH level after varying amounts of 0.07mL drops of acetic acid (CH<sub>3</sub>COOH) were added to a volume of ocean water. Each trial consisted of a beaker containing 500mL of ocean water, a mixture fabricated from baking soda and tap water. Drops of CH<sub>3</sub>COOH (0.07mL per drop) were added to the water until the pH decreased from 8.2 to 8.1. The trials concluded that 2.213mL of CH<sub>3</sub>COOH were required to be added to 500mLs of ocean water in order to drop the pH 0.1 units. This translates to roughly  $2.788 \times 10^{24}$  mL of CO<sub>2</sub> in the ocean. Overall, this experiment showed that roughly  $2.788 \times 10^{24}$  mL of CO<sub>2</sub> were excessively added to the ocean in recent years to cause the drop in pH levels.

### **303. WILL PROMEGA BRAND DIAMOND NUCLEIC ACID DYE IMPROVE FORENSIC SCIENTISTS' ABILITY TO LOCATE LATENT DNA?**

Ava Kennedy, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Forensic scientists face difficulty locating latent DNA on tape samples from crime scenes because it cannot be seen by the eye. Visualizing this DNA can help investigators create a DNA profile or fingerprint that can associate a criminal with a crime scene. The purpose of this study is to determine whether a commercially available fluorescent dye typically used in laboratories can be used to locate latent DNA found on the sticky side of evidential tape samples. This research will determine if Promega brand Diamond Nucleic Acid Dye diluted in distilled water can visualize latent DNA on tape samples containing fingerprints of subjects both under and over 18. The dye was diluted in a 20x solution of distilled water. The samples were dipped in the dye solution for 20 seconds and rinsed in pure distilled water before being observed under a 496 nm blue-green light source. Three variances of tape including clear packing tape, duck brand tape, and gorilla brand tape were tested with thumb and index finger prints. This study concluded that Promega Diamond Dye can visualize latent DNA on tape samples and can potentially be used by scientists to locate DNA that is typically not visible to the naked eye.

## **EARTH AND SPACE SCIENCE (CONT'D)**

### **304. MEASURING SOUND ABSORPTION PROPERTIES OF MARSH SEDIMENT VERSUS COASTAL SEDIMENT**

Nicole Nguyen, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. David Werner and Dr. John Wnek

Sound pollution is a rising problem as human activity and construction develop more in the ocean. This study compares the sound absorption properties of coastal sediment and marsh sediment, collected from Brant Beach and Sedge Island respectively, to analyze sound pollution's impact on the organisms of these environments. For each sediment type, four kilograms were placed in a container with 20 kilograms of water. A range of frequencies was played at three volume levels: maximum, middle, and low; the amplitudes were then compared. It was hypothesized that marsh sediment would absorb more sound because of its higher porosity percentage compared to coastline sediment (sand). After testing, however, the sand appeared to absorb more sound on frequencies from 500 Hz to 4000 Hz. After 4000 Hz, the marsh sediment showed a higher absorption amount. This pattern remained consistent through each volume level. The largest amount of absorption for both sediments was 52-73 dB at 3500 Hz on the maximum level. Therefore, this indicates that, depending on the frequency, coastal environments will be less affected by sound pollution than marsh environments. Understanding these sound absorption properties works towards lessening the damage on aquatic life by selecting the ecosystems least prone to sound pollution.

### **305. THE EFFECTS OF *SPISULA SOLIDISSIMA* ON pH LEVELS AND NUTRIENTS OF POOR QUALITY SOIL**

Allyanna Panganiban, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
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Seashells are found in many beaches globally. However, bivalve shells are considered to have no main use and are often regarded as waste. Their improper disposal on beaches generates debris and wastes natural resources. A third of the Earth's land is also infertile due to agriculture. To answer this, I hypothesized that by adding pulverized shells of the Atlantic surf clam, *Spisula solidissima*, in poor quality soil, its low pH level and nutrient supply may improve with the shell's composition of organic matrix and calcium carbonate. Many Atlantic surf clams were pulverized and 20 pots of soil were used. Each group of 5 underwent different soil treatments: unaffected soil, soil with 1/8 inch depth, 1/4 inch depth, and 1/2 inch depth of pulverized shells. Nutrients (potassium, nitrogen, and phosphorus) and pH levels of each pot were recorded daily in the span of 10 days. All treatment data, except the unaffected soil, exhibited high pH level increase on the first days but stabilized at the end. Nutrient levels stayed roughly the same except for a slight increase in nitrogen levels. Thus, while *Spisula solidissima* can raise pH levels with its alkaline properties, it cannot effectively improve poor soil caused by agriculture.

### **306. SOIL NUTRIENT VARIATIONS IN COASTAL SAND DUNES: MAN-MADE DUNES VS. NATURAL DUNES**

Eily Sitarik, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. Jason Kelsey

The efficacy of man-made coastal sand dunes as compared to naturally occurring dunes has been tested in varying ways. Man-made dunes are practical for quickly rebuilding the barrier between coastal storms and oceanfront communities; however, natural dunes are a more permanent solution due to greater stability over time because of gradual build up rather than sand being piled up all at once. This project tested for variations in soil nutrients between the two types of dunes, specifically nitrates and phosphates, to compare another aspect of the ongoing comparison. To conduct this research multiple sand samples were collected from the base of each dune on the side facing the ocean. The samples were then tested using a colorimeter to give nutrient levels. These tests concluded that natural dune nutrient levels were higher than that in man-made dunes. These higher nutrient levels are important to the higher stability of natural dunes because it allows for more rapid growth of erosion preventing vegetation in these dunes as compared to man-made. Therefore, the higher nutrient levels in natural dunes contribute to the overall endurance of the structure.

## **EARTH AND SPACE SCIENCE (CONT'D)**

### **307. AN ANALYSIS OF SOIL COMPOSITION ACROSS THE UNITED STATES**

Juliet Slota, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

All soils have different compositions depending on where they are located, their elevations at which they are found, and when in geological time they were formed. This study examined the relationships between geographic locations and the soils' compositions. Over the course of several months, composition, organics, conductivity, moisture, pH, and iron were tested on 14 different soils from across the United States. Since the soils were taken from preserved lands, such as National Parks, the soils have been mostly untouched for the past hundred years and most of time before that. After the data was collected, relationships were drawn. There was a dichotomy of similarities and differences exhibited in the findings from all 14 soil locations; Colorado, Utah, Nevada, Arizona, New Mexico, and Tennessee. This study could be used to determine how and when these soils were formed, how they might have been used and changed in the past, how they are all related, and what plants and animals have, could, and did survive in these areas.

### **308. THE EFFECT OF DIFFERENT RATIOS OF VARYING GREEN ORGANIC MATERIALS ON THE pH OF COMPOST**

Emily Wong, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Hundreds of millions of trash are put in landfills to decompose in America alone, which can take up to a few hundred years to fully decompose. These landfills harm the environment and development around it. To combat this, compost can be made from biodegradable materials that are commonly thrown away. The objective of this research determined which ratio of green organic materials would produce the pH that is most favorable to the majority of plants, 6.5 pH. To carry out this experiment, 3 compost piles with different ratios, 1:2, 1:1, and 2:1, of green organic materials were made. Both the green organic materials, coffee grounds and grass clippings, and brown organic materials, leaves, were put in a small container with holes to allow aerobic decomposition. Over the period of 6 weeks, the compost piles were monitored, adding water to the piles when necessary, to ensure the most efficient rate of decomposition. Once the materials fully decomposed for each compost pile, samples from each of the piles were tested for pH. Results indicate that the compost pile with 2 parts coffee grounds and 1 part grass clippings had the average pH closest to 6.5 pH. The results collected in this experiment can be beneficial to lessening landfills and maximizing plant growth.

## **ENVIRONMENTAL SCIENCE**

### **401. THE EFFECT OF LONG-TERM TEMPERATURE EXPOSURE ON BOTTLED WATER CONTAINING BIPHENOL A**

Aidan Edwards Beelitz, 1st Block Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. Dave Werner and Dr. John Wnek

Water bottles are a common luxury used in almost every place in the world. Bottled water brands like “Poland Springs” and “Nestle Purelife” are commonly taken to sporting outings. Often these are left in hot cars on sunny days where the temperatures can reach upwards of 38 degrees Celsius (100 degrees Fahrenheit). These bottles are made up of many different chemicals, notably, BPA or Bisphenol A. Heat contained in the cars have enough energy to break the bonds holding the BPA in the bottles, and BPA has been linked to causing breast and ovarian cancers. By heating bottled water brands in a controlled incubator, the test was able to replicate the conditions of hot cars. After taking samples from the bottles and analyzing them with a spectrophotometer, the results that indicated that the samples heated at over 44 degrees Celsius (115 degrees Fahrenheit), water inside the bottles were contaminated with more chemicals than the bottles tested when no heat was applied. Bottles were also frozen for different amounts of time. This freezing process also increased the amount of chemicals in the water when tested in the same manner as the heated bottles.

### **402. ANALYSIS OF PINE LAKE’S TRIBUTARIES AND HOW THEY AFFECT ITS WATER QUALITY**

Michael Hudak, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. David Werner and Dr. John Wnek

Nitrates and phosphates are two common chemicals found in freshwater bodies. These chemicals can be dangerous to humans and biotic inhabitants of the waterbody. Both substances are known to cause health issues, such as methemoglobinemia from the intake of nitrates. Human activity can increase the amounts of nitrates (ppm) and phosphates (ppm) in water bodies through the use of fertilizers and septic systems. The purpose of this study is to examine the ability of tributaries to transfer nitrates and phosphates into a freshwater lake. Data utilized in this study was collected at Pine Lake in Manchester, New Jersey throughout the winter. There are two tributaries, the Union Branch and the Ridgeway Branch, that flow into the western side of the lake. Three water samples were collected from three sites: Pine Lake, Union Branch, and Ridgeway Branch. The dissolved oxygen (ppm), temperature (°C), pH, nitrates (ppm), phosphates (ppm) were measured from the samples within 24 hours of collection. In this study, each location was compared to the others to view differences in the parameters. The results of this study show that the Union Branch and Ridgeway Branch have a significant impact on the water quality of Pine Lake.

### **403. HOW DOES COMMON URBAN RUNOFF POLLUTANTS AFFECT THE GROWTH AND DEVELOPMENT OF CYANOBACTERIA?**

Logan Johnston, Block 4 Science Class, Marine Academy of Technological and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Blue-green algae, or cyanobacteria, are unicellular aquatic algae that are photosynthetic and live in colonies. These algae are mixotrophic, which means that they can photosynthesize to create sugars as food, or can absorb nutrients from their surroundings, which can include pollutants. However, which urban pollutants give it the most nutrients, and which will impact their growth the most? The idea here is that blue-green algae have the ability to absorb the nutrients off of pollutants. I have grown and analyzed five colonies of algae who were individually given either oil, gasoline, chemical-based de-icing salt, subsoil sediment, and organic matter. The colony with oil increased 32 grams in mass, for sediment it increased 38 grams, for the salt it increased 35 grams, for gasoline it increased 37 grams and it increased 41.5 grams for organic material. It appears that organic material such as food scraps have been the most efficient nutrient boost for cyanobacteria, and oil is the least efficient food source for the blue-green algae.

## **ENVIRONMENTAL SCIENCE (CONT'D)**

### **404. EFFECTIVENESS OF CLEANING METHODS ON DUCK FEATHERS**

Julia Lokerson, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Oil spills release harmful and dangerous chemicals into the environment that damage the wildlife. Birds are one such animal that is affected by these events, due to the effect it has on the alignment of their feathers. There are several known methods of cleaning oiled birds, such as using Dawn soap, but are there other brands that could clean them just as effectively, if not better? Three brands were but to the test: Ajax, Palmolive, and Shoprite store brand dish soaps. Five ounces of Mallard Duck (*A. platyrhynchos*) feathers were soaked in two cups vegetable oil and then cleaned out in two cups of a solution consisting of 25% soap and 75% water; and then they were further rinsed out in water and air dried. The feathers were massed after soaking and after cleaning, and the differences in mass were compared to determine any correlation. From the data collected it was shown that there was no significant difference between brands, showing no correlation between the type of soap used on the feathers and its effectiveness in removing oil.

### **405. HOW CLIMATE CHANGE IMPACTS THE REPRODUCTION AND POPULATION OF CALANOID COPEPODS IN THE ATLANTIC OCEAN**

Kyle Lopes, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES)  
Advisor: Mr. Jason Kelsey

Copepods are microscopic crustacean creatures that are the base of any oceanic food web. The reproduction and basic processes of copepods are heavily dependent on surrounding water temperature, which is why climate change poses a huge threat to copepod populations and reproduction everywhere. My experiment tested whether climate change has a negative or positive impact on the population and reproduction rates of Calanoid Copepods in the Atlantic Ocean. My hypothesis was that as the temperature steadily inclined, the populations would also rise. To test this, I set up a tank with saltwater, and set it to 62°F (16°C), the average oceanic temperature in the Atlantic Ocean. Then, Calanoid copepods and phytoplankton were added into the tank and I allowed them to acclimate for two days. Over a span of two weeks, or 14 days, I increased the temperature in the tank slowly to match the possible effects of climate change. In relation to my hypothesis, my results supported the original thought and expectations. At each temperature change, the amount of copepods concentrated in a 4x4 millimeter grid on the microscope grew more dense. The data gathered is important and applies to real world concerns because if there were a negative impact on population as the temperature grew, the oceanic food webs would have collapsed in the near future.

### **406. HUMANS, SWIMMING, AND BACTERIA IN HARRY WRIGHT LAKE, WHITING, NJ**

Kayla Murdock, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

Recreational lakes are often filled with many types of bacteria such as *E. coli*, *Salmonella*, etc. This could be an effect from humans being in the lake. It was hypothesized that the natural upstream area would have a lower concentration of bacteria than in the swimming area. This would occur because humans have bacteria on their skin, and in any waste that they would put in the water. To determine whether or not this was a result of human swimmers, a ten week experiment was performed. Every Sunday, two samples were taken from points in the upstream area, the midstream area, and the designated swimming area of the lake. The samples were tested with the Coliscan Easygel kit, and the bacterial colonies were counted. The results from the data analysis show, that there was a significant difference in the data from the midstream area of the lake. In the beginning of the trial, when there were more swimmers, there were more colonies recorded from the swimming area. Throughout the entire experiment, the upstream area had the least amount of bacterial colonies since humans were not swimming in it.

## **ENVIRONMENTAL SCIENCE (CONT'D)**

### **407. RISK ASSESSMENT OF ARSENIC IN AQUATIC ANIMALS IN WATER BODIES**

Allyssa Panganiban, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek, Mr. David Werner and Mr. Jason Kelsey

*Oryza sativa* is an important dietary supplement that contains arsenic: a toxic substance that can be hazardous, especially for humans. *Oryza sativa* has distinctive amounts of arsenic for each type. Consumers often rinse store-bought rice. About 3–43% of the arsenic is removed when rinsed, and often, the water used to rinse goes down the drain of sinks into a watershed. This project was conducted to assess the risk if arsenic concentrated in *Oryza sativa* is washed into water bodies. I hypothesized that at least one type of rice, specifically brown rice, would have enough levels to negatively affect the organisms in adjacent wetland areas to the water bodies of disposition. To determine this, three types of rice (long-grain white, brown, and basmati), each with five sample sizes, were tested with an Arsenic testing kit. They were washed prior to testing, and the rice wash was used. Statistical tests were run to see if the groups' arsenic levels in ppm were statistically different or not, and afterwards, were compared to the aquatic animals' level restriction of arsenic. The rice wash of the three rice types had arsenic levels less than the restriction level of arsenic in aquatic organisms. The results of this study show that the accumulation of arsenic from *Oryza sativa* would not be enough to harm aquatic organisms in wetlands.

### **408. COMPARING WATER QUALITY AND BACTERIA BETWEEN AREAS THAT HAVE BEEN PREVIOUSLY IMPACTED BY FLOODING AND AREAS UNAFFECTED**

Grace Puskas, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Dr. John Wnek

Flooding can severely impact municipal areas with water coming into contact with harmful pathogens from waste pipes and sewers, mixing it with our water supply, and exposing it to the citizens in its general radius. *Vibrio cholerae* (Cholera), *Shigellosis* (*Shigella*), *Salmonellosis* (*Salmonella*), and *Escherichia coli* (*E.coli*) are common pathogenic bacteria that can cause minor disease if consumed; however, there are also non-pathogenic bacteria and many beneficial nutrients that cause no harm to human health. To research water quality, I traveled to Charleston, South Carolina where recent flooding as the result of Hurricane Florence. Twelve samples were taken, with six of them for bacteria testing, while for the final six were used to test for basic parameters. Whirl-Pak bags were kept cold to take back to the Marine Academy of Technology and Environmental Science for salinity and nutrient testing. In order to test bacteria, 1 ml samples of water were taken from six different locations, some of which were previously flooded. The Coliscan Easygel Method was used to test for the presence of pathogenic bacteria. Using color indicators, bacterial types were identified with E-coli being the most prevalent. Throughout sampling sessions, I noticed that the water temperature decreased as we headed north, which was indicative of latitudinal differences.



## **ESTUARINE SCIENCE**

### **501. THE EFFECTS OF STORM WATER RUNOFF ON THE WATER QUALITY OF A STREAM IN A COASTAL COMMUNITY**

Annabel Bornebusch, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

After rain events, storm water runoff pulls unwanted pollutants into waterways. Dillon's Creek, a tributary of the Toms River, NJ, is known for its high bacteria levels. The source of bacteria is debated in that waterfowl occupy the creek, and there is storm water runoff into the creek as well. Optical Brighteners are associated with human uses as they are the whitening agents in laundry detergent and toilet tissues. If there is a correlation between increased levels of Optical Brighteners and fecal coliform bacteria, then there is a high probability that the cause of increased bacteria levels are human sources. The objective of this study was to observe the correlation between storm events, optical brightening agents, and coliform bacteria colonies in Dillon's Creek. For this experiment, five locations along Dillon's Creek were sampled, including the Turtle Run Pond. Samples were collected both before and after three storms. The water quality parameters tested included temperature, pH, coliform bacteria, and Optical Brightening agents. The results showed strong relations between bacteria and optical brightening agents especially after each storm. These findings suggest that there may be some underlying issues relating to runoff caused by several factors that may require further investigation.

### **502. WHAT HABITAT DOES *PALAEEMONETES VULGARIS* PREFER IN BARNEGAT BAY?**

Jeffrey Brewer, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey

*Palaemonetes vulgaris* more commonly known as the Shore Shrimp is found throughout Barnegat Bay and is a vital part of the local food web. They're found in a wide range of habitats and serve as prey for a large variety of organisms that people value. To identify their preference in regards to habitats, a tank was constructed containing four common throughout the Barnegat Bay. The habitats included were sand, gravel (dust stone), rocks (river rocks), and crushed surf clam shells. This experiment was conducted by utilizing 40 Shore Shrimp collected in Ship Bottom, Long Beach Island over the course of two weeks. The overall purpose of this research is to determine which habitat is most preferred among Shore Shrimp, this can eventually lead to other research such as whether or not there is a direct correlation between the concentrated populations of these shrimp and those of some of their predators such as Blue Crabs and Striped Bass. Over the course of five days these shrimp were introduced into the tank and left to roam for 24 hours in groups of 20. After 24 hours the amount of shrimp in each habitat was recorded and their behavior observed, a new group of shrimp would then be introduced and the rest would be held in a separate container. Once all results were reviewed and analyzed it could be determined that rocks were the most favorable habitat and there was no significant difference in the behavior of shrimp.

### **503. OXYGEN CONSUMPTION OF SHORE SHRIMP (*PALAEEMONETES VULGARIS*) IN DIFFERENT SALINITIES**

Achilles Emnace, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisor: Mr. David Werner

Shrimp travel great distances throughout their lifespan, especially in larval and post-larval stages, which means they experience varying salinities. Like all aquatic organisms, shrimp are oxygen regulators or conformers, but the ability to maintain metabolism in different environments differentiates. In order to figure out if shrimp oxygen consumption increases, *Palaemonetes vulgaris*, or the common shore shrimp, were held in tanks with different salinities for a four week period. Seven shrimp were held in each tank with an aerator, and the dissolved oxygen level was tested every four days. The dissolved oxygen levels varied from 2.8 ppm to 6.3 ppm. The data was analyzed and it was identified that there was no significant correlation between the salinity of the water and the oxygen consumption of shore shrimp. In conclusion, the oxygen consumption of shore shrimp is not affected by the salinity of water.

## **ESTUARINE SCIENCE (CONT'D)**

### **504. THE EFFECTS OF VARIOUS DEICING AGENTS ON *PALAEEMONETES VULGARIS***

Shealyn Lawless, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

*Palaemonetes vulgaris* is a common species found amongst estuaries on the east coast, and they are a food source for many animals in their habitat. Deicing agents are a convenient and cheap way of melting ice; however, introducing these foreign or inorganic chemicals into an ecosystem can cause this local species to suffer. This research was aimed to observe how the introduction of rock salt, urea, or calcium magnate acetate coated calcium carbonate into the water of the shore shrimp would affect their behavior. 720 shore shrimp were divided into groups and put into two-percent or seven-percent concentrations of each deicing agent. Each concentration of deicing agent was tested through a course of three trials. The hypothesis composed was that the shore shrimp would have the biggest negative reaction to urea due to the fact that urea can cause changes in dissolved oxygen levels and algae presence. Data collected throughout the research by looking at shrimp mortality and salinity of each trial. Multiple t-tests were run on the data of shrimp mortality from each concentration and it was shown that the seven-percent concentration of urea had the biggest behavioral difference to the shore shrimp placed into untreated water. These deicing agents are used commonly, and this research can help show how the runoff of these chemicals are affecting marine species.

### **505. THE PREFERENCE OF VEGETATION DENSITY BY *MALACLEMYS TERRAPIN TERRAPIN***

Kyle Matin, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

*Malaclemys terrapin terrapin* (Northern Diamondback terrapin) is a vital species in maintaining the health of marsh ecosystems. However, as habitat destruction and vegetation loss increases due to soil and water pollution, climate change, and coastal development, Northern Diamondback terrapin hatchlings become more susceptible to predation. In this experiment, it was what tested to see what density of vegetation is optimal when protecting *Malaclemys terrapin terrapin* nest ecosystems, A total of nine solo hatchlings and nine groups of three hatchlings were used. Hatchlings were placed in an enclosure that contained sand and a large patch of vegetation, a moderately sized patch of vegetation, a small patch of vegetation, and small, sparse patches of vegetation that were gathered near known nesting sites to mimic the vegetation hatchlings would encounter. Data was then analyzed and broken down by hatchling nest/clutch, solo trials, group trials, and time, as well as the vegetation the hatchlings were attracted to in order to identify a preferred vegetation density amongst hatchlings. A preference in vegetation density among *Malaclemys terrapin terrapin* hatchlings was not identified, indicating that hatchlings act randomly and may not have an instinctive trait that guides them towards denser vegetation.

## **ESTUARINE SCIENCE (CONT'D)**

### **506. THE RELATIONSHIP BETWEEN *PORPHYRA SP.* AND TEMPERATURE AND OXYGEN PRODUCTION RATES IN BRACKISH WATER**

Akshar Patel, Block 3 Science Class, Marine Academy of Technological and Environmental Sciences (MATES),  
Advisor: Mr. Jason Kelsey

There are three main groups of algae: Green Algae (*Chlorophyta*), Brown Algae (*Phaeophyta*), Red Algae (*Rhodophyta*) and red algae is the largest group. The species of red algae that was chosen for this experiment was *Porphyra sp.* Since this species is found globally, it is found in different temperatures which may have an impact on the dissolved oxygen levels around that ecosystem. It was hypothesized that the samples in the cold water would have the most dissolved oxygen because as temperature increases oxygen availability decreases. This species of algae was placed in five different containers in complete darkness: two samples were placed in hot water (35°C), two samples were placed in cold water (5°C), and one sample was placed in room temperature water (20°C) as a control. The salinity value for all of the containers was 20 ppt (parts per thousand). Two dissolved oxygen tests were taken at the site of the algae. One dissolved oxygen test was taken every one hour for each container for a total of three hours. It was concluded that the samples in the cold water had the highest average of dissolved oxygen at 10.37 ppm and the lowest average was the hot water at 8.17 ppm. Some extensions that can be made to this experiment is to test different groups of algae and have a bigger sample size for more accurate readings.

### **507. THE EFFECTS OF TEMPERATURE ON THE BIOLUMINESCENT RESPONSE OF *PYROCISTIS FUSIFORMIS* ON MECHANICAL STIMULATION**

Sarah Santos, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

Global warming already has had observable effects on the environment. From a rising sea level to the increased water temperatures, climate change has taken a toll on ocean ecosystems. The objective of this study was to observe how increased temperatures would affect the defense mechanism of a group of major primary producers — Bioluminescent Dinoflagellates; *Pyrocistis fusiformis*. These single-celled organisms possess the ability to produce flashes of light when agitated. For this experiment, nine containers of *Pyrocistis fusiformis* were cultured over the course of a month. Once ready, the temperatures of each container were adjusted, with three set at 30°C, three set at 20°C, and three set at 8°C. They were placed separately in a modified light chamber to record the intensity of their bioluminescent response. Results showed that the dinoflagellates set at 30°C performed better than those exposed to the cooler temperatures. This study suggests that as ocean temperatures rise to a certain point, *Pyrocistis fusiformis* will not only survive, but their bioluminescence intensity will increase as well. Dinoflagellates are essential to marine ecosystems and understanding how increased temperatures will affect them is extremely beneficial because of their crucial role in the food chain.

## **HEALTH, MEDICINE AND SPORTS**

### **601. THE EFFECT OF CONSISTENT STRETCHING OF THE LOWER EXTREMITIES ON STRIDE LENGTH AND PITCH SPEED**

Ryan Ehrmann, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. Jason Kelsey

In a baseball pitcher's motion, there are six phases: the wind-up, stride, arm cocking, acceleration, deceleration, and follow-through. All of these phases generate energy and momentum that contributes to the speed of the ball. The stride phase is the distance from the planted, trailing foot to the opposite, leading foot when it lands. This study was done to see the effect of consistent stretching of the hamstrings, quadriceps, and hip flexors on a pitcher's stride length and pitch speed. The result of this experiment could show young pitchers how they can enhance their pitching and ultimately bring it to a new level. Ten participants were gathered and had their stride lengths and pitch speeds measured. Then, six went home with a six-week stretch schedule and four did not. Over the course of these six weeks, the correlation between stride length and pitch speed was observed in the six stretchers and the four non-stretchers. Whether or not the consistent stretching had any effect on the stride lengths and pitch speeds of the stretchers was also observed. The results suggested that there is not much of a correlation between stride length and pitch speed, and the six weeks of consistent stretching did not have much of an effect on stride length and throwing velocity in the participants.

### **602. CAN COLOR CAUSE PHYSIOLOGICAL REACTIONS? DETERMINING WHETHER CERTAIN COLORS CAUSE BLOOD PRESSURE TO RISE OR FALL**

Alexandra Hoeler, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

All people have emotions, which are neural impulses that create response and move the organism to action. The ability to respond to stimuli is a characteristic of life and emotions are considered responses to the world around them. Blue is linked to serenity, peace, and trustworthiness. Red is linked to passion, anger, and aggression. Yellow is known to be happy and friendly as well as warning which is strange because it can make you feel uncomfortable and on edge or happy and tranquil. Purple is usually associated with mystery, romance and luxury. Although these might not be the emotions you experience and associate with these specific colors, everyone has reactions to colors. If I show participants certain colors such as red, blue, yellow, purple, and green, then as UK Essays (2018) states, their blood pressure should increase and decrease accordingly. I showed 30 participants ages 11-45 the colors blue, red, purple, and green to verify whether their blood pressure went up or down based on the emotions typically associated with that color. I have found that the most reactive colors are green and red, commonly making the blood pressure rise due to some type of heightened response.

### **603. HOW BATTING PRACTICE REVEALS OUR FALSE ASSUMPTIONS ABOUT LEARNING**

Noah Jeremias, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Batting practice is a routine task that all baseball players go through on a daily basis. They receive different pitches, such as fastballs, curveballs, and changeups, all of which they will experience in a game. Yet for all its tradition, advances in cognitive science and innovations in sports show that teams are undergoing batting practice the wrong way. Players were assigned to two different groups: Control and Experiment. Control received a uniform order of pitches, while experiment received a random order of pitches. After four sessions of this, there was a final test where both groups received a random order of pitches. The quality of their hit was determined off of a point system that had been predetermined. In this study, the control group had an average score of 111.15 points throughout the study, while the experimental group had an average score of 74.1. Although the control group had a high score throughout the study, their score plummeted during the final test. The control group received an average of 66 points, while the experimental group received an average of 84.4 points. This study supports the theory that varied learning is more effective than uniform learning.

## **HEALTH, MEDICINE AND SPORTS (CONT'D)**

### **604. HOW DOES AEROBIC EXERCISE AFFECT THE SHORT TERM MEMORY OF MIDDLE SCHOOL STUDENTS?**

Emily Jones, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Exercise is proven to benefit the body, but could it have a significant effect on processes in the mind as well? The purpose of this study was to determine how aerobic exercise affects the short term memory of middle school students. To conduct my research, I had both a control and experimental group with 45 middle schoolers in each. I administered a Free Recall Task to test initial short term memory. Then, my experimental group did 20 minutes of aerobic exercise, whereas the control group continued on with daily activities. Both groups then waited 11 minutes because research supports that exercise has the most effect after this point. During this time, the participants completed a questionnaire about their age, gender, and athleticism. Finally, they completed another Free Recall Task. To analyze my data, I ran t-tests to determine if there was a statistical difference between the control and experimental groups. I ran an overall t-test, one between genders, and one between athletes and non-athletes within the separate groups. All of my t-test results were greater than the alpha, 0.05, meaning that there was no statistical difference between the control and experimental groups. Therefore, in my study, aerobic exercise was not shown to have a significant effect on short term memory.

### **605. USING BAYES THEOREM TO DETERMINE THE LIKELIHOOD OF WINNING IN DIFFERENT COMPETITION FORMATS**

Brody Littleford, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Mr. Jason Kelsey

All competitors have an equal chance of winning in a competition, but does the specific format of the competition significantly change your numerical chances? Using Bayes Theorem, a formula to examine conditional probability, hypothesized competitions with generated statistics, and a TI-83 Plus graphing calculator, different competition formats were investigated and analyzed in an attempt to identify any significant differences within their conditional probability of earning a top placement. A Bayesian model encompassed the sample sizes and non-conditional probability of achieving recognition in a team centric competition, an individual centric competition, and a competition incorporating both team and individual results. Optimal statistics were analyzed and incorporated into developing this model. Starting with sample sizes of just thirty and increasing up to seven hundred fifty, the conditional probability of earning a top placement is insignificant statistically. However, when comparing competitions with anywhere from thirty to one-hundred participants, in all three formats, the differences in percentage are statistically different. In addition, when comparing the top placement percentages, comparing the data from competitions, in all three formats, with more than three-hundred participants, the data is also significantly different. After analysis, team competitions will always result in the highest probability earning a top placement. Competition formats may have unequal chances of winning in smaller competitions, but as more people strive for the thrill of winning, this behavior is increasingly insignificant.

### **606. TESTING FOR NOISE INDUCED HEARING LOSS AFTER EXPOSURE TO DECIBEL LEVELS**

Miranda Lynch, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. David Werner, Nurse Meehan

When the ear is exposed to soundwaves of high decibel levels, a traveling wave that forms along the basilar membrane bends tiny hairs called stereocilia so far that they break off and are never replaced. Because of this, a chemical reaction that causes an electrical signal to get sent to the brain does not occur, resulting in the brain not being able to interpret the sound. This is called Noise Induced Hearing Loss (NIHL). To test this phenomena, four students were exposed to levels of 30 and 80 decibels for 10 minutes each. Their hearing was tested before and after the exposure to see if there was any notable hearing loss. After testing, the data suggests that the students suffered no hearing loss as the decibel ranges were too low to cause any change. This experiment showed that the decibels used can be tolerated for a short duration; however, long exposure may result in some hearing changes.

## **HEALTH, MEDICINE AND SPORTS (CONT'D)**

### **607. ANALYSIS OF BITE MARKS IN RELATION TO FORENSICS DENTISTRY**

Sky Rodriguez, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

In the news there are always big headlines about horrific incidents of assault. The topic of cold cases is sometimes complex because I thought there must be some way that even without fingerprints and other concrete evidence you could catch a culprit. There is little research done on bite marks and how they relate depending on gender. My study focuses on the use of bite marks as a unique identification marker. To conduct this research I took three bite marks from high school students and measured them. After looking at them, on average male bite marks are larger. However, with how small of a sample size I acquired I cannot make any definitive claims about whether there is a certain size that male and female bite marks are.

### **608. COMPARING THE EFFICACY OF CONCENTRATED BLEACH AGAINST OTHER HOUSEHOLD CLEANERS**

Sarah Smith, Block 4 Science Class, Marine Academy of Technology and Environmental Sciences (MATES),  
Advisor: Mr. Jason Kelsey and Dr. John Wnek

Today, there are thousands of cleaning products all claiming to be the most effective. The first choice for many would be bleach. However, bleach is dangerous; it can burn skin and is lethal if ingested. This study analyzes cleaning agents to determine if there is a safer, but effective, cleaner in comparison to concentrated bleach. This experiment was carried out by observing colonies of *Escherichia coli* B (*E. coli*) that grew after being cleaned with bleach, Lysol wipes, vinegar, iodine, hand soap, rubbing (isopropyl) alcohol, and distilled water. Bacterial samples were swabbed onto a tile and cleaned using a designated agent. One section was not cleaned and used as a control. Each section was then swabbed and wiped into petri dishes to grow for 72 hours. The numbers of visible colonies were counted. The results showed that bleach was the best cleaning agent, followed by Lysol, then vinegar. The statistical test used was a t-test which indicated a significant difference between the number of colonies on the vinegar dish and the bleach dish, demonstrating bleach to be more effective. When comparing bleach to Lysol, there is no statistical difference in the number of colonies between them.

### **609. THE EFFECTS OF A RUNNER'S HEIGHT ON CERTAIN ASPECTS OF THEIR RUNNING FORM**

Abby Stephens, Block 1 Science Class, Marine Academy of Technology of Environmental Science (MATES);  
Advisor: Dr. John Wnek

When running, having strong running form is vital because it can help to decrease the risk you have of injuring yourself while running. I hypothesized that taller people will have worse running form in the top region of the body, and that shorter people will have worse running form in the lower region of the body. I gathered 25 participants, boys and girls from the freshman class at M.A.T.E.S., and had them go to the gym at M.A.T.E.S one time each. I recorded their name, age, and height. They then ran on a treadmill while I videotaped them for 20 seconds on the right side and 20 seconds from the back. After every participant ran, I split them into three groups based on their heights (4'10"-5'2", 5'3"-5'6", 5'7"-6'3"). I compiled all of the videos I recorded and uploaded them to the computer. I analyzed each video by looking at certain angles on Camtasia software. As predicted, the results showed that taller people have weaker running form in the top half of the body, while shorter people have worse running form in the lower body. Strong running form is vital for the success and safety of all runners and understanding this experiment can emphasize how important running form is.

## **HEALTH, MEDICINE AND SPORTS (CONT'D)**

### **610. THE EFFECT OF DIFFERENT INSOLE CUSHIONING MATERIAL ON POSTURE AND GAIT**

Olivia Takla, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Back pain, muscle fatigue, and respiratory issues are a few of the many problems poor posture is associated with. The body works together as a chain of muscles, ligaments, and bones, starting from the foot; when one part is misaligned, it messes the entire system. Good insoles offer both cushioning and support to your feet in order to maintain the appropriate alignment of your body. The purpose of this research is to determine which of the three insole cushioning materials: memory foam, EVA yoga foam, or gel, is the most efficient in supporting the foot in order to prompt healthy alignment of the rest of the body. The experiment was conducted by performing a posture screen assessment (anterior view deviation and lateral view deviation) of the volunteer's initial posture and followed by a screening after wearing each of the insoles. After walking, the pressure distribution of the foot (calcaneus region, metatarsal region, and the medial region) was additionally analyzed in order to identify a trend in gait patterns and foot deformities. I hypothesized that the EVA foam insoles would promote the most improvement in posture because of its durability yet resilience. I also believed that pressure would most commonly be applied at the metatarsal region of the foot because statistics show that most foot deformities occur near the ball of the foot. The results indicated that the EVA foam promoted the most rectification based on the anterior view deviations; however, the memory foam insoles induced better alignment based on the lateral view assessments. Furthermore, my hypothesis on foot distribution was not supported in that the metatarsal region would bear the greatest pressure when walking. It was determined that the calcaneus region bore most of the pressure.

## **MICROBIOLOGY**

### **701. THE DIFFERENCE IN BACTERIA AMONG WOODWIND REEDS**

Estelle Balsirow, Block 1 Science Class, Marine Academy of Technological and Environmental Science (MATES),  
Advisor: Mr. David Werner

Woodwind reeds are an integral part in woodwind instruments, as they allow instruments to create and control sound. However, bacteria such as streptococcus and staphylococcus are known to inhabit reeds due to the use of the mouth and sharing of reeds. Such conditions are a cause for concern for a woodwind player's health. This study was conducted to determine which reed contained on average the most bacteria. Cultures were grown on a petri dish using a regular agar medium, then given a qualitative rating from 1 to 5. The ratings were then averaged based on the number of trials for the type of reed. 31 reeds were collected and analyzed, and were categorized based on the type of instrument which uses the reed. These categories were oboe, alto saxophone, tenor saxophone, clarinet, and bassoon. Of all categories, the oboe reed had the most average bacteria, with the qualitative rating averaged to 2.29 out of a 5 rating.

### **702. BACTERIAL ANALYSIS OF CIRCULATED PAPER CURRENCY**

Danielle Murat, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. Jason Kelsey

Paper bills are constantly circulating throughout society, becoming a vector of transmission for bacteria. As paper bills circulate, they are typically stored in warm, moist pockets or wallets. The dark and damp environment in which money typically resides provides optimal conditions for the paper bills to harbor infectious bacteria. In addition, paper bills provide a large surface area that serves as a breeding ground for pathogens. In my study, I utilized a novel method to test the number of bacterial colonies on dollar bills. To start, students passed around fifty-one-dollar bills, simulating circulation. A dollar bill was then soaked in distilled water, creating a bacterial mixture. After one milliliter of the mixture was added to *Coliscan Easygel*, the product solution was decanted into a petri dish and properly incubated for 24 hours. After testing fifty one-dollar bills, my experiment concluded that paper bills are not a competent fomite for bacteria. Furthermore, the presence of bacterial colonies appears to be related to the time lapse after direct handling of the bills. To elaborate, 58% of the dollar bills that were handled directly prior to testing contained 0-20,000 bacterial colonies per 100 milliliters, while the dollar bills that were not handled prior to testing had essentially no bacterial growth.

### **703. THE EFFICIENCY OF VARYING TREATMENTS FOR BACTERIAL INFECTIONS CAUSED BY *ESCHERICHIA COLI***

Julianna Rose, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Dr. John Wnek and Mr. Jason Kelsey

Bacteria are single-celled microbes found nearly everywhere that are sometimes pathogenic and can cause bacterial infections. For example, *Escherichia coli* (*E. coli*) is known to cause urinary tract infections. Antibiotics are a well-known treatment option; however, some bacteria have become antibiotic-resistant. Medical researchers have since developed alternative treatments including bacteriophage drugs and over-the-counter drugs such as Azo Urinary Tract Defense®. Additionally, many believe that cranberry juice is a sufficient treatment option for urinary tract infections. The objective of this study is to look at the efficiency of Cefazolin antibiotic, Azo, and Ocean Spray Original Cranberry Juice Cocktail in killing three strains of *E. coli*. Along with these tests, a survey was given to the general public. Each Petri dish was streaked with an *E. coli* strain and covered with three pieces of filter paper dampened with each treatment. Upon observation, Cefazolin prohibited the largest amount of growth, Azo prohibited nearly as much growth as Cefazolin, and cranberry juice prohibited the least amount of growth as hypothesized. The survey proposed a situation in which the consumer had to pick a treatment based solely on its description. The majority of people chose an alternative treatment option over an antibiotic or home remedy. After revealing the names of each treatment, the majority switched their choice to an antibiotic. The results further establish the idea that a well-educated consumer population creates a higher demand for new medical treatment options as bacteria become more resistant to antibiotics.



## **MICROBIOLOGY (CONT'D)**

### **704. THE EFFECT OF AIR PRESSURE ON AQUATIC COLIFORM GROWTH**

Michael Scannicchio, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

With the increasing amount of aircraft in the sky and people exploring the earth's crust, humans and their items are subject to changes in air pressure every day, along with the bacteria of everyday life. If bacteria duplicate faster or slower in certain pressures, certain information can be used to help combat the spread of everyday illnesses. The hypothesis states that the control will contain the most colonies. To determine if there was a relationship between air pressure and Coliform growth, samples containing bacteria were taken and tested. The data that was gathered revealed that differences in air pressure caused almost no change in the amount of colonies that had cultivated in each of the tests. This study refuted the previously stated hypothesis, as the control had no statistical difference than the other trials. Altogether, the difference in air pressure resulted in no change in Coliform growth.

### **705. *ESCHERICHIA COLI* AND ITS REACTION TO VARIOUS ESSENTIAL OILS**

Lakshmi Yannam, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. David Werner and Dr. John Wnek

Throughout medical history, there are many instances where antibiotic resistance has occurred. A bacterial population can evolve within hours to gain resistance to various medications. In order to combat this growing problem, researchers have been investigating other potential ways to kill microbial growth. Although these alternative herbal treatments are not very common, they are often used in certain cultures. One such method investigated in this study is the use of essential oils. Tested in this study, tea tree, clove bud, oregano, thyme, and cinnamon cassia oils all have various antimicrobial properties. *Escherichia coli* was used because of its prevalence in the human body. Filter disks were dipped in the above oils to measure the ring of bacterial inhibition, which is the area around a filter disk where bacterial growth is not present. The cinnamon cassia oil had the smallest inhibition ring, only about 2 mm in diameter, while both tea tree and oregano oil had the largest inhibition ring, measuring approximately 2 cm. All things considered, this study supported the notion that, out of all the oils studied, tea tree and oregano oil are the best oils for combating bacterial infections of *E.coli*.

## **PHYSICAL SCIENCE AND ENGINEERING**

### **801. HOW DOES THE pH OF WATER AFFECT THE CORROSION OF METAL PIPES?**

Dominic Attalienti, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Piping today is mostly made up of plastic PVC pipes and copper pipes. However, some older homes still have galvanized steel pipes and cast-iron pipes. In the case of Flint Michigan, their lead and iron pipes were extremely corroded due to time, yet the pH of their water was about 8. To test whether the pH of the water was significant to the corrosion of metal pipes, I submerged four different types of metal pipe into five different tanks with water pH ranging from 6-8.5. I observed that the rust on the cast-iron pipe in the tank with a pH of 8.5 was more rigid and stiff than in the tank with a pH of 7 and that little rust formed on the pipes in the tanks with a pH of 6 and 6.5. After performing an ANOVA test with the pipe data, there was a significant difference from the initial values compared to the final readings for every type of pipe. Pipes submerged in higher pH waters corroded much faster compared to the others.

### **802. HOW DO VARYING LEADING EDGE DESIGNS OF A WIND TURBINE BLADE AFFECT POWER OUTPUT?**

Rebekah Bernardo, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. David Werner

Wind turbines are a clean, renewable source of energy, and one of the many clean energy sources the world has been looking towards in recent years. One of the more recent advancements of the area include leading edge designs inspired by the fins of a humpback whale, mimicking specifically the tubercles on the leading edge of the fin, which have been found to reduce drag and increase efficiency in lower wind speeds. This experiment was designed to mimic the effect of the tubercles and test two different shapes that can be implemented onto the leading edge of a model wind turbine blade. Three designs, created using modeling clay, were applied to the blade and were tested, along with a control, using a high velocity fan and a multimeter to measure voltage. The results show that there is no significant difference between the groups of data, save for design Three, which was shown to have a decrease in voltage by 5%. This means that, at that wind speed and pitch, the design started to stall, creating more drag and slowing down the rotation. It can be concluded from this experiment that there is minimal difference between the two design shapes used.

### **803. WHAT CAN STOP THE OXIDATION PROCESS IN IRON?**

Connor Devlin, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Mr. Jason Kelsey

Oxidation happens anywhere as long as there is iron and oxygen. It occurs when a compound loses electrons. When this happens to iron, it is called rust. Rust is a prevalent issue everywhere, especially along the coast. People want to know how to stop rust that is what I wanted to do. My plan was to test out different coatings to reduce, and maybe stop rusting. I used Shrinkwrap, Neverwet, paint, Instant Waterproofing, cleaning alcohol, Aqua Armor, and Flex Seal Liquid for my different coatings to protect from water, I also had control. For each type of sealant, I had 10 cubes of A36 steel, plus one to keep out of any sealant or water and just exposed to air. They were to be placed in water for a while to see how much they would rust. I placed the ones without sealant and the ones with Shrinkwrap and alcohol on December 26th. I just decided to ditch iodine because i knew it wouldn't work. The rest were started on January 20, 2019. I checked three days per week: Mondays, Thursdays, and Saturdays. The Flex Seal Liquid, Neverwet, Instant Waterproofing, and Aqua Armor worked the best, as there was no rust on them

## **PHYSICAL SCIENCE AND ENGINEERING (CONT'D)**

### **804. HOW EXPOSURE TO ACIDIC ENVIRONMENTS AFFECTS A GALVANIZED METAL'S SUSCEPTIBILITY TO CORROSION**

Joseph Kane, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

Iron, a commonly used material in construction, has a major drawback in that it corrodes easily, since rusted iron is nearly useless. Coating iron with a thin layer of zinc, a process called galvanization, prevents this. As pollution increases, however, so does the frequency and severity of acid rain, in which acids form in the atmosphere and fall with normal rain. The purpose of this study was to determine whether or not galvanized metals had a weakness against this increasingly relevant problem. Iron nails, both galvanized and not, were subjected to being submerged in water, an acidic solution with a similar pH to acid rain, and the acid followed by water, simulating a cleaner future environment. The amount of corrosion was measured using an analytical balance. I discovered that while all normal nails tested had similar weight losses, for galvanized nails, pure water had little effect. Exposure to water after exposure to acid, meanwhile, did have one, although still relatively little compared to being in just acid or normal nails. A lack of rust on any galvanized nail tested suggests that the zinc coating was never fully breached, although it appears to have started to have been. This data suggests that galvanized metal, after exposure to an acidic environment, is more susceptible to corrosion in the future than had it remained in a non-acidic but otherwise similar environment.

### **805. ATTEMPTED SYNTHESIS OF GRAPHENE USING WATER AND DRY ICE**

Paul Mastroserio, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mrs. Kelly Kelsey

Graphene, a carbon isotope, is the strongest material discovered on the planet, while also conductive, transparent, organic, ductile, and a plethora of other promising characteristics. Modeling after methods of synthesis involving liquid agitation and dry ice, a method was devised to synthesize graphene while only utilizing three common elements, Oxygen, Hydrogen, and Carbon. To produce graphene,  $\frac{1}{3}$  lb of frozen carbon dioxide was placed in a beaker along with 2 grams of pure graphite powder. Distilled water (250 ml) was then poured into the beaker and agitated by rapidly sublimating carbon dioxide under a fume hood or outdoors until all dry ice sublimated and the graphite settled. A control trial was made using a stir rod without dry ice to test whether dry ice had influence over results. The stir rod trial had clear water with graphite powder on the bottom of the beaker, and each trial utilizing dry ice had a thin, bright, and brittle gray coating at the top of the water. The unidentified substance responds poorly to instruments, and maneuvers around any disturbances on the surface of the water, making it unable to be properly extracted or identified. Graphite is not buoyant in water, meaning that while inconclusive, an alteration to the chemical structure of graphite likely occurred to the unknown surface substance, possessing different traits than graphite.

## **PHYSICAL SCIENCE AND ENGINEERING (CONT'D)**

### **806. THE EFFECT WATER ELECTROLYSIS HAS ON ALUMINUM, STEEL, IRON, AND ZINC IN CORROSION**

Mason Melito, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey

Water electrolysis is when electricity is used to split water molecules into hydrogen and oxygen atoms. Boaters are constantly buying expensive new parts for their boats, and sometimes even new boats, to repair the damage that electrolysis has done. The electrical current that is a byproduct of electrolysis attacks parts of boats, specifically the hull and the propellers. The goal of this experiment was to find the best metal to attach onto a boat to divert the electrical current away from the boat's metal, and onto an excess piece attached to the boat. Aluminum, steel, iron, and zinc were all matched up so there were two in each container, with every possible combination created. They were then left in their containers for 96 days, with a kick start from a 9 volt battery. It was hypothesized that all of the metals would either lose weight, or stay the same weight, with the zinc losing the most overall weight, thus being the best metal to use. However, the results did not support the hypothesis. Instead of the metals all losing weight, the metals either gained, lost, or stayed the same weight. The two metals that would work the best to solve boaters problems are Iron and Zinc, because the iron consistently lost weight, and the zinc also would lose weight and sometimes increase, which means that the current is attracted to it.

### **807. ANALYZING THE COLLAPSE OF THE WALNUT STREET BRIDGE**

Gia Pissott, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Jason Kelsey and help from Mr. Jones

The Walnut Street Bridge is a truss bridge spanning the Susquehanna River in Harrisburg, Pennsylvania. The 2,801 foot bridge collapsed on its west end in 1996. The Walnut Street Bridge didn't stand a chance against the winds of the North American Blizzard of 1996. Rebuilding of the west end would've cost \$14 million. During testing, model bridges were built with designs that are slightly altered from the original bridge design.

### **808. DOES WEATHER AND/OR TEMPERATURE HAVE A DIRECT EFFECT ON THE ENERGY PRODUCED BY PHOTOVOLTAIC CELLS?**

Breanna Wixted, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Dr. John Wnek

Solar energy, collecting and using energy produced by the sun, is both abundant and somewhat simple to obtain which makes it the fastest growing renewable energy source.. The photovoltaic effect, simply, is electrons that get excited from photons and create an electrical current. Throughout the fall and winter months of 2018 to 2019, photovoltaic cells were tested under different weather conditions such as overcast, rain, wind, and snow. Since photovoltaic cells rely on the sun to produce the most amount of energy, it was hypothesized that any other weather condition would directly affect the maximum energy output produced by a photovoltaic cell. It is also hypothesized that temperature will have a positive effect on the energy output released by the multimeter. Under the "perfect" conditions, the photovoltaic cell produced 9.70 Direct Current Volts (DCV). During the trials, as hypothesized, the photovoltaic cells only produced as much as 5.91 volts when cloudy; 7.12 volts when snowy; and 7.12 volts when partly cloudy. The same day, the photovoltaic cells were placed inside next to a window to test the temperature effect on the energy produced. The energy produced when inside decreased. In conclusion, weather conditions affect photovoltaic cells' energy output negatively and temperature does not compensate the difference.

## ZOOLOGY

### **901. HOW AGE AFFECTS LEARNING ABILITY IN *ORYCTOLAGUS CUNICULUS*: YOU CAN TEACH AN OLD RABBIT A NEW TRICK**

Cameron Callis, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

*Oryctolagus cuniculus*, or the domestic rabbit, is a highly intelligent and commonly kept household pet. They can be litter trained and taught tricks. This experiment tested if a “junior” rabbit, a rabbit under 6 months old, would learn faster than a “senior” rabbit, a rabbit over 6 months old. Five junior rabbits and five senior rabbits were timed completing a cardboard maze. Upon completion, the rabbit would get a food reward, prompting it to complete the maze faster each time. Each rabbit was tested daily for a period of 14 days. The data was then graphed and analyzed. Because the slope of the senior trendline, -2.02 was steeper than the junior trendline, -1.04, it can be concluded that senior rabbits learn at a faster rate than junior rabbits. This information would be important to know when training a rabbit, so that someone would know whether to train it at a young age or wait until the rabbit is older.

### **902. SYNERGISTIC EFFECTS OF TOXIC ESSENTIAL OILS AND OLFACTORY LURES ON *CULEX* AND *ANOPHELES* SPECIES**

Gwen Ericson, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Dr. John Wnek

The toxic effects of various compounds on vector-bearing mosquitoes have been long studied, however, many of the pyrethroid compounds on the market today are linked to environmental distress upon bees, other insects, mammalian, and aquatic lifeforms. The aim of this research was to devise an efficient mixture composed of essential oils and olfactory lures, and use this solution in developing a stationary feeding system to result in the most knockdowns of *Culex* and *Anopheles* species. The solution must remain cost-effective in order to be targeted towards developing nations and retain the lowest-possible level of ecological consequence. In phase I of research, larvae of both species were reared in a two-chambered vessel to adulthood; at which time the toxic effects of three EPA minimum risk essential oils (*Thymus vulgaris*, cinnamon, *Cinnamomum zeylanicum*, and savory, *Satureja montana*) were tested against the common repellent Deet. Phase II combined the most successful oil, thyme, with various forms of attractant in a series of tests to devise a final solution. Honeybees were also exposed to the solution to determine unintentional mortality rates and interest levels. Phase III examined feeder prototypes to engineer a system which best limited toxic airborne particles. All phases of research most supported an ATSB solution comprised of 1% thyme oil, 10% sucrose, and 50% inert ingredients supplied to mosquitoes through a polymer ball system.

## **ZOOLOGY (CONT'D)**

### **903. THE EFFECT OF *EISENIA FETIDAS*' DIET ON THE NUTRIENTS THAT ARE RELEASED INTO THE SOIL**

Todd Ferry, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

The Red Wiggler Earthworm (*Eisenia fetida*) plays an essential role to soil composition and plant growth in our ecosystems. Their casts are abundant with nutrients from the foods they eat that assist in maintaining proper soil composition. These nutrients consist mainly of nitrogen, phosphorous, and potassium. Different single-food diets consisting of banana peels, spinach leaves, and coffee grounds, were tested with *Eisenia fetida*, to analyze the connection between the nutrients these earthworms consume and the nitrogen, phosphorous, and potassium levels found within their casts. *Eisenia fetida* were separated into three groups of three buckets, and each group was fed a specific nutrient rich diet consisting of bananas, which are rich in potassium; spinach leaves, which have high nitrogen content; and coffee grounds, which contain large amounts of phosphorous. A fourth group, the control, held only soil and did not accommodate any *Eisenia fetida* or food. The soil in each bucket was tested every other week for two months to study the change between the levels of these nutrients. The data collected shows that the soil in the buckets containing bananas had the highest potassium levels, and the soil in the buckets containing the spinach leaves and coffee grounds had the highest nitrogen and phosphorus levels, respectively. These results support the hypothesis that earthworms reprocess the nutrients found within their diets and return them to the soil.

### **904. *MALACLEMYS TERRAPIN* HATCHLINGS PREFERENCE UNDER VARIOUS CONDITIONS OF LIGHT VEGETATION**

Erin Geoghegan, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisors: Dr. John Wnek and Mr. David Werner

*Malaclemys terrapin* hatchlings are terrapins ranging down the eastern coast of the United States, most abundantly found off the coasts of New Jersey. Having the ability to survive in water bodies of varying salinities, they most commonly appear in brackish waters. Although their natural behavior is not often observed, it is known that they travel in groups for mating in the months of May and June. While nesting, they move up the coasts in a northwest direction inland from water bodies. Their greatest threat is humans, despite not being observed often. Humans sometimes harvest them for food, and other predators such as Black-crowned Night-herons (*Nycticorax nycticorax*). As a result of congregation, the exceptional threat humans pose to them, and a lack of research and human interaction, they exhibit a sense of introversion in nature. If behavioral testing, such as light vegetation preference were to be performed on diamondback terrapin hatchlings, they would appear to be drawn into the darkest region as to avoid human contact. In order to test this hypothesis, fifteen trials were executed, each one containing two terrapin samples, to observe their reactions when placed into a habitat with light overhead and cover options consisting of 100%, 60%, 30%, and 0% shading. Random terrapin hatchlings were chosen, each ranging in size, color pattern, observed behavior, and more. The results indicated that in their frequent movements, they are found to most commonly relocate into darker regions, or into the northwestern portion of the tank. These results may help in future research involving terrapin behavior, including their social behavior and natural instincts.

## **ZOOLOGY (CONT'D)**

### **905. MEASURING THE INCREASED METABOLIC RATE IN *BETTA SPLENDENS* DURING AGGRESSIVE BEHAVIOR**

Rocco Raimondi, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Dr. John Wnek

The Siamese Fighting Fish, or the Betta Fish (*Betta splendens*), is a very territorial and aggressive freshwater organism. Betta fish have a specialized lung-like organ called a labyrinth organ, which allows them to gulp air as part of their oxygen intake. If two males notice each other, they will flare their gills, display their large fins, and fight. During combat, almost all of their oxygen consumption is derived from gulping air, as they cannot flush/pump water over their gills when they are flaring. The aggressive behavior of *B. splendens* was stimulated in order to measure an increase in oxygen consumption consistent with an increase in metabolism compared to a dormant state. Quantifying their oxygen requirements would highlight the need for sufficient fresh air and space above the water surface, as many owners of betta fish are not knowledgeable of the health and welfare requirements of these beautiful fish. A Delta Tail male betta fish was purchased from a local pet store. To stimulate the presence of another male, a mirror was utilized. A contained airspace over a testing tank was used to measure the amount of oxygen consumed from the air when resting and when displaying (aggressive behavior) for one hour intervals. After several experiments were completed, the data was analyzed and it was concluded that the fish consumed more than double the amount of oxygen (in ml) when fighting compared to resting.

### **906. DO *ODOCOILEUS VIRGINIANUS* RELY MORE OF THEIR SENSE OF SIGHT OR SENSE OF SMELL IN FORAGING FOR FOOD?**

Rokas Stancauskas, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES);  
Advisor: Mr. Jason Kelsey

The *Odocoileus virginianus*, better known as the White-tailed Deer, has many attributes that allow them to thrive in their environment. They have a good sense of sight in the dark with their tapetum lucidum, and they have an exceptionally strong sense of smell with their elongated snouts that allow them to have longer nasal paths. Their nose and nasal paths hold on average around 297 million olfactory receptors, which compared to humans and our 5 million olfactory receptors, is very good. To see which sense deer relied on more, I set up an experiment comparing scented food and colored food to normal food, to see how much effect either sense had on deer. In order to carry this out, we went to two locations, Howell Woods and Collier Mills, and in each location we set up two feeders. Cameras were set up to capture which feeder the deer chose. This went on for a total of six weeks, with two sets of three weeks; one set that had a feeder of scented food and a feeder of normal food, and the other having a feeder of colored food and a feeder of normal food. After three weeks, the locations would swap their sets. After examining the pictures of both locations and counting up the results, it is found that both scent and sight have a strong influence on how deer forage, but neither is stronger in deer than the other.

### **907. THE EFFECTS OF MICROPLASTICS ON GRASS SHRIMP, *PALAEOMONTES SP.***

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Microplastics (plastic particles, 5 mm in diameter or less) are a widespread marine pollutant collecting in shorelines across the world. These plastics harm the marine life directly, impairing vital actions for energy production. Microplastics can directly affect coastal and open ocean marine life, including *Palaemonetes sp.* (Grass Shrimp). By exposing grass shrimp (*Palaemonetes sp.*) to microplastic particles derived from used contact lenses, the microplastics should collect in their stomachs and gills can be observed. Shrimp when eating can experience high output of energy but gain low amounts of energy when filtering the microplastics, eventually killing them. Therefore, out of the 100 shrimp sampled, only 20 survived due to low output of energy and blockages. In the end, the purpose of the study was to observe if microplastics effect low food chain organisms. The results collected suggest that grass shrimp are affected greatly by the existing microplastics and will continue to spread microplastics through the food chain.