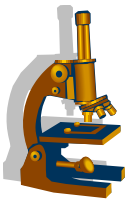
# Marine Academy of Technology & Environmental Science

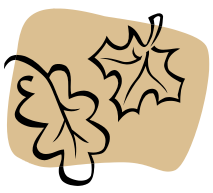
# Tenth

## Research Showcase

# Abstract Guide

## April 13, 2016





**April 13, 2016**

**I cannot believe that is our tenth MATES Research Expo! This was a great year for student research outside of MATES with 24 projects selected for the Delaware Valley Science Fair and posters presented at the Rutgers Junior Science and Humanities Symposium and Monmouth Junior Science Symposium. One of our juniors will be presenting her research at the National Junior Science and Humanities Symposium in Ohio this April. 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 April 13, 2016. 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 eight 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 the Fish Hawks for their contribution to our research program. We wish to thank our Ocean County Vocational Technical School Board of Education, Administration (Mr. Hoey, Ms. Weber-Loeffert, Mr. Frazee, and Ms. Carroll) and MATES Staff, especially Mr. David Werner (research advisor), Dr. Michael Bixler, Mr. Brian Jones, Ms. Maryann Minnier, Ms. Mia Dill, Mrs. Kelly Kelsey, Mr. Adam Sprague (advisor), Ms. Michele Colon, Mr. Sean McAndrew and Mr. Brian Coen who contributed to the success of the project. Also, many thanks to Ms. Robyn Chiariello, Ms. Esther Gallacchio, and our wonderful maintenance staff for all of their support and assistance.**

**Thanks to the parents who have contributed much time and effort in making the projects possible. Without their support, this research would not be possible. I would like to point out that this year's Research Class (sophomores) helped to organize the Expo, and a special thanks to senior our new Research Assistance and Development (RAD) Team for helping the young researchers for outside fairs and this Expo. 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 2016 MATES Research Expo a true success.**

**Congratulations to all of the students listed in this guide for their hard work this year.**

**Sincerely,**

**John Wnek, supervisor,**
**Science and Research**

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## BARNEGAT BAY

### 101. ABSOROPTION RATES OF DIFFERING FERTILIZERS IN BARNEGAT BAY SOIL

Sean Beelitz, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES);
Advisors: Mr. Kelsey and Dr. Wnek

The sea nettle populations has drastically increased in Barnegat Bay throughout the decade. These nettles feed on plankton and larval organisms. Plankton have seen a population growth due to an increase in nitrate concentration. One source of nitrates includes fertilizer runoff finding its way into the bay. However, this runoff can be reduced by choosing a fertilizer that is more eco-friendly. In this project, three simulations of the water table were set up, complete with grass, soil, and water. Three fertilizers were selected, where Milorganite® is eco-friendly, Scotts® is name brand, and Kgro® is the cheap fertilizer. Every three weeks from November to January new fertilizer was added and the nitrate levels were tested. The results showed Milorganite® as a better alternative as it had consistently low nitrate levels. Also, the grass stayed green while the other two withered off during the winter. The cheap Kgro® brand killed the grass, while the Scotts® had higher nitrate levels than the Milorganite® and was not nearly as green. With this study, people may realize that environmentally friendly fertilizer does not mean sacrificing a nice green lawn. Milorganite® reduces nitrate levels in the soil, thus the Bay, and keeps lawns green and healthy.

### 102. WHAT ARE THE pH AND NITRATES OF SOIL IN VARIOUS RENTENTION BASINS IN OCEAN COUNTY?

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

Retention basins are storage areas used to manage stormwater runoff that prevents flooding and downstream erosion, and improves water quality in an adjacent river, stream, lake, or bay. The water that runs off into these retention basins takes along pesticides, fertilizers, non-source point pollution, and animal waste, that all affect the soil making it more acidic. Soil samples were collected from the following retention basins in Ocean County: Toms River, Brick Township, Lakewood, and Lacey Township. My hypothesis was that Brick Township would have the lowest pH and highest nitrates due to the bigger population density and bigger population, while Lacey Township would have the highest pH and the lowest nitrates due to the lowest population density and overall population. The pH and temperature of the soil was tested at the location where they were collected, and then the soil was taken to MATES to test nutrients using nitrate tablets. Brick Township had the lowest pH (highest acidity) compared to the other towns supporting the hypothesis; meanwhile Toms River had the highest pH (lowest acidity). Lacey Township had the lowest temperatures going into the negatives, while Brick Township had the highest temperatures with up to 3°C. Nitrate readings had a constant pattern for each sample, with Brick Township having the highest nitrate rates up to 7ppm which caused the low pH. This experiment is important because it quantifies stormwater runoff. People in Ocean County need to reduce the amount of fertilizers and pesticides they use because these factors all negatively affect our environment (water, soil, etc.).

### 103. PATTERNS IN SOIL PROGRESSIVELY TOWARDS THE BARNEGAT BAY

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

Soil is made up of three different particles: sand, silt, and clay. Each play a different role and have a different effect on soil. Ultimately, the most suitable soil is 40% clay, 40% silt, and 20% clay. This research was done to find patterns in soil based on location in accordance to the Barnegat Bay, a brackish estuary, and find the most ideal soil for plant growth. Soil samples were collected in the same seven locations three times over the course of three months and brought back to the Marine Academy of Technology and Environmental Science to be tested. I hypothesized that the soil furthest from the bay that was tested would be most suitable for plant growth. Also, that the amount of sand would go up when getting closer to the bay and the amounts of silt and clay would go up. Results showed the first site (the furthest from the bay) had the most ideal soil. In addition, the sand and silt increased while the clay decreased.

**BARNEGAT BAY (CONTINUED):**

### 104. EFFECTS OF STORMWATER RUNOFF ON BARNEGAT BAY LIFE

Hannah Nivar Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mrs. Kelly Kelsey Assistance: Mr. Jason Kelsey, Dr. John Wnek

The pH level in which vegetation is planted has one of the greatest influences on plant growth. Soil levels can be measured according to the pH scale ranging from 1 being the most acidic to 14 being the most alkaline. The light which plants receive also has a major role in plant growth due to the wavelengths the greenery is able to absorb. The focus of this study was to determine the finest growing conditions to cultivate a model species of vegetation for experimental purposes; the *Rudbeckia hirta* (Black-eyed Susan). It was predicted that seedlings planted in soil with a pH of 7.0, receiving wavelengths given off from the red, blue and purple artificial lighting would grow the most prosperously. Four Black-eyed Susans were planted in three different kinds of soil levels – 6.75, 7.00, and 7.25– and placed under an artificial lamp. Overall, there was a total of 12 plants under six different lights–red, orange, yellow, green, blue, purple–that are each part of the visible color spectrum. After the collected data was analyzed, the results were able to support the hypothesis, showing the growth success of Black-eyed Susans planted in predicted soil levels and artificial lighting.

### 105. THE EFFECTS OF RAINWATER ON RUNOFF AND BACTERIAL LEVELS AT BARNEGAT BAY

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

My project focuses on the effects on bacterial levels in the Barnegat Bay from rainwater and runoff. Data was gathered from Henderson Labs from the years 2013 through the summer of 2015. Other parameters collected were rainfall, wind, temperature, etc. The main objective of this project was to show the correlation of how rain and runoff the bacterial levels of *Enterococci* in the bay water. My hypothesis is that when large amounts of rain and runoff go into the bay water, the *Enterococci* bacteria levels spike. But when there is little to no rain, the levels remain the same. The results of this project indicated that there was a correlation between runoff and bacterial levels.

### 106. EFFECTS OF BAY HARBOR ESTATES' STORMWATER RUNOFF ON BIVALVES

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

Numerous species of bivalves inhabit international coastlines. They utilize a technique known as filter feeding in order to acquire microplankton that reside within the waters that they are submerged in. It has been concluded, however, that a majority of these organisms are living in highly polluted environments. In order to conclude if the bivalves are ingesting the harmful chemicals and substances along with the microplankton within the water, the "Effects of Bay Harbor Estates' Stormwater Runoff on Bivalves" experiment was conducted. After thoroughly analyzing the data collected over a one week period, it was determined that a majority of the bivalves were unfazed by the presence of the toxins that polluted the water. A few specimens, however, were overwhelmed by the amount of stormwater runoff present within the samples. As a result, two of the test subjects expired and two became ill. In order to preserve the lives of the bivalves that occupy the coastal waters, utilizing green products, or fertilizers, pesticides, and other various chemicals that have been announced to be environmentally friendly, is strongly advised.

**BARNEGAT BAY (CONTINUED):**

### 107. SEASONAL CHANGES IN THE SEASONAL CHANGES IN THE METEDECONK RIVER AT BARNEGAT BAY

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

As a tributary of the Barnegat Bay, the Metedeconk River is put under a lot of stress and the water conditions are changing. The change in season from fall to winter can affect certain measurements in the water. From October 26, 2015 to February 15, 2016, dissolved oxygen, chlorophyll, nitrates, salinity, temperature, and turbidity in the water were measured and recorded every two weeks from five sites along the Metedeconk River that were close to the bay. Nitrates in the soil were also measured using a colorimeter and recorded. The data suggested that the dissolved oxygen and the chlorophyll in the water have a direct, inverse correlation (regression, $P = 0.0292$). This can be explained because oxygen is used when algae decomposes. This supports my hypothesis, which was that the dissolved oxygen levels would rise as the chlorophyll levels go down after the algae decomposes. Another direct correlation that has an inverse relationship is between the dissolved oxygen and temperature, and it can be explained because colder water needs more dissolved oxygen at 100% air saturation. The salinity in the water and nitrates in the water and soil remained constant, which did not support my hypothesis. This project shows how certain measurements in Barnegat Bay change and relate to each other overtime and if any efforts are needed to help bring the measurements to their healthy rates.

### 108. THE ANALYSIS OF STORM DRAIN PUMP STATIONS AT BARNEGAT BAY

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

Newly installed New Jersey Department of Transportation (NJDOT) storm drain pumps may not be as effective as they seem. These pumps were designed to keep coastal roads from flooding, in addition to separating trash, oil, and sediments from the water and to run only during major storms. However, these pump stations have been running continuously under dry conditions, and one even created a silt plume in the water nearby, which led to the discovery that groundwater had seeped into the pipes that were supposed to be watertight. By conducting this study, my goal is to find out if there are significantly different levels of nitrogen, phosphorus, or fecal coliform at any of the sites. I collected water samples each week for ten consecutive weeks, using a control location and two distances per station, taking into account the water temperature, tide, and precipitation amount at every site. Each sample was tested for nitrogen, phosphorus, and fecal coliform. The trends indicate that L Street has higher levels of the parameters than the other pump stations, which shows that L Street may be having continued groundwater seepage.

## BEHAVIORAL AND SOCIAL SCIENCE

### 201. MOST APPROPRIATE FONT FACES AND STYLES FOR EFFICIENT READING AND DESIGN

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

In a world where technology is quickly evolving, the ways in which people communicate are drastically changing. Communication is key for transferring thoughts and ideas between people. Over the past two decades, the use of word processing and graphics design software started to replace traditional handwritten methods for creating professional and/or casual messages. To determine which fonts used by these software are more efficient to read, a sample of 20 volunteers were given 12 paragraphs at the same Lexile level. The time taken to read the paragraphs and the amount of errors made while reading were recorded and put together to form a score. To determine what fonts are more desirable for certain designs, an online survey was created that asked participants to rate five fonts on a scale of 0 to 5 based on how fitting they were to given characteristics. The results of the readings concluded that sans-serif font faces can be read more efficiently than serif font faces and fixed-width font faces. The results of the online survey concluded that serif fonts are perceived most trustworthy, formal, and serious font faces, but sans-serif fonts are perceived most modern, and fonts resembling children's handwriting are most creative.

### 202. EFFECTS OF TECHNOLOGY ON SOCIAL INTERACTIONS BASED ON AGE

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

We are in a generation in which technology is an essential part of our everyday lives. Technology can arguably be considered more or less beneficial to society. Even so, it is still a highly utilized medium for many individuals. This study was conducted to see the effects of technology on social interactions based on different ages. I hypothesized that people aging from 14 to 20 would most support the use of technology and be more "attached" to it, this meaning that their amount of usage of technology would exceed the amount of those of older ages. I also hypothesized that technology would lessen face-to-face communication most prominently in people aging from 14 to 20 and the least in people of older ages. A survey was given to four age groups: 14-20, 21-33, 34-45, and 46-60. There were ten questions, the questions focusing on the personal technology use of the participants and their firsthand beliefs on the effects of technology. The results indicated that the respondents in age groups 14-20 and 21-33 were the most involved with technology which partially supports my hypothesis. 76% of all the respondents answered that technology lessens social interaction as opposed to it improving social interaction; all age groups had a higher percentage supporting the fact that technology lessens social interaction. Respondents in age group 46-60 demonstrated the least use of technology compared to the other three age groups.

### 203. HOW MUCH HAS EDUCATION CHANGED OVER THE PAST FEW DECADES?

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

Surveys were given to 51 people, ranging in age from 14 to 74, in order to see how much people learned. The surveys contained 10 questions each, with half being basic math skills like addition, subtraction, etcetera, and the other half being algebra. Overall, the surveys focus on math skills, which when compared to the participant's age can show how much the participant was taught. According to one of the participants, algebra used to be optional, and being the harder option, most people avoided it. The survey collected three pieces of information from people: age, time taken, and their score as a percentage. The survey's data showed that most people who scored highly took their time. It also showed that younger people were more likely to know what they were doing, and that they usually worked more quickly. This leads to the conclusion that what is now considered low-leveled, basic education was previously of a much higher tier.

**BEHAVIORAL AND SOCIAL SCIENCE (CONTINUED):**

### 204. ANALYZING PERCEPTIONS ON CLIMATE CHANGE: MOTIVATING ALARMED, UNCOMMITTED, AND DISMISSIVE AUDIENCES TO ADAPT

Ellie Hulit, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Kelsey and Dr. Wnek

Climate change is a growing problem. The industrial revolution spawned a need for automobiles which give off an alarming amount of carbon dioxide that pollutes the air. This new invention started the desire for more technological advancements for all of mankind. Climate change is bringing detrimental effects to our world; for example, sea levels are rising, global temperatures are rising, and extreme weather patterns are emerging. The human race, as a whole, must take action against climate change. This study analyzed responses to a survey, regarding climate change, to discover different ways to motivate alarmed, uncommitted, and dismissive audiences to adapt to climate change. The survey used for data collection was created on the website called Survey Monkey, and over 100 respondents participated. After the collection of 111 complete responses, the data was put into a spreadsheet for analyzation. Two hypotheses were created for this study: 1) All three audiences will most likely to adapt to climate change if framing highlights the impact of climate change on future generations. 2) Millennials, anyone from ages 14-29, are more alarmed about climate change than other generations. The first hypothesis was correct since 45% of all respondents indicated they are concerned with environmental problems because of the consequences for future generations. The second hypothesis was incorrect since 75% of respondents aged 50+ were alarmed about climate change, higher than millennials with 60.4% of respondents.

### 205. WHAT ARE INDIVIDUALS MOST AFRAID OF?

Matthew Scannicchio, Block 3 Science Class, Marine Academy of Technology and Environmental Sciences (MATES); Advisor: Mr. Jason Kelsey

Arguably one of, if not the most basic emotion possessed by humans is that of fear. Whether it be of other individuals or of geological disaster, fright is unilaterally present in the brains of all. This experiment was designed to test which fears in particular are the most common among individuals. Five groupings of fear were decided upon: "human fears" (fears of certain kinds of people), "situational fears" (fears of being in certain predicaments or in certain surroundings), "natural fears" (fears of meteorological or geological disasters), and "biological fears" (fears of nonhuman living things), along with a control group composed of benign, everyday objects. Each participant was asked to view a set of images representing several subsets of each grouping and determine, on a scale measuring from 1 to 5, the fear response evoked by the image in question. After the data was compiled, it was found that the participants, on average, were most frightened by the "natural fear" grouping while the "human fear" grouping ranking was the lowest outside of the control group.

### 206. THE EFFECT A PLACEBO HAS ON THE PHYSICAL OUTPUT OF A SUBJECT

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

Placebo medications have been used for hundreds of years to treat illness. Placebos are classified as treatments that use a physiological approach to cure or improve physical health or performance. Usually, for them to work as prescribed, the subject must believe that the treatment works. In this experiment, a placebo was given to 15 subjects. The subjects must run 3 runs over the course of three days. The control run is a simple 100 meter sprint. The next run will require the subjects to be given 125 mL of RedBull®, which contains a high amount of caffeine, which will significantly increase heart rate. After the data was accounted for, one more run was done. In this run, the placebo was introduced to the subjects. The subjects will be lead to believe that the new drink is enhanced to increase physical output. However, this drink is just 125 mL of RedBull®. It was hypothesized that the placebo effect will take place, and the subject will have an increase in performance on the last race.. The results show that the average time in seconds for the control is 16.6; 2nd run is 14.6; 3d is 13.9. From ingesting the Redbull®, an average of 2 seconds was shaved off from the control, and the placebo shaved off 2.7 seconds from the control. These results and are significant for such a short run, and if the race had a longer distance, time could be taken off from the results.

**BEHAVIORAL AND SOCIAL SCIENCE (CONTINUED):**

### 207. EFFECTS OF VISUAL ADVERTISING CUES ON PURCHASE PATTERNS

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

Although people may not realize, when individuals decide to buy a product they are focused primarily on how it is presented. There is not much known if different age groups have differing preferences. To find any distinct differences, a survey was created that displays a series of book covers that changed their designs at some point. Each participant was directed to choose the cover they were more likely to purchase. It was distributed physically to 34 participants in two separate age groups. The participants were obtained locally, through school, and community groups. Their ages ranged from 12 to 20 in the teen-young adult group, and 42 to 72 in the adult group. The data was analyzed in graphs and separated into the two age groups on a question by question basis. A correlation within the teen-young adult group was found. The younger participants were more likely to choose a more minimal book cover in direct comparison to the older age group. Overall, more colorful book covers were favored throughout the age groups. This information may be useful to advertisers who are trying to market to specific ages.

### 208. THE EFFECTS OF THE "FIGHT OR FLIGHT" SYSTEM ON MEMORY

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

The brain reacts to dangerous situations by releasing various hormones causing people to ignore other information and to focus solely on surviving. Witnesses of crimes are put in situations in which this commonly occurs and a "fight or flight" response is initiated. During court trials for these incidents, these witnesses may be asked to answer specific questions, including who the criminal was. Is it true these witnesses will remember the event accurately? Can increased stress on people alter memory? To come to a conclusion, participants were put in a situation that causes an adrenaline rush to mimic the body's reaction when a crime is occurring with less potential risk involved. A quadrat with 25 sections, a timer, a blindfold, the randInt function of a TI-84 plus graphing calculator, and six objects, including a rubber duck, a red Expo marker, a bell, a timer, a dry eraser, and tape were used to perform a memory test with two trials. In the first trial, the control, 13 participants were memorized the placement of six objects in sections of a quadrat for 10 seconds. The subjects were then blindfolded for another approximate 10 seconds as the objects were removed. Then, the blindfold was taken off and the participant was asked to place the objects back in their original places. In the second trial, subjects went through the same process but when asked to remove the blindfold, a startling sound was produced. The data showed that stress negatively affected the number of correctly placed objects in the second trial. It could be concluded that information given by witnesses may not be very accurate.

### 209. THE PRIVACY AVAILABLE TO INDIVIDUALS IN THE DIGITAL AGE

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

The influx of a technological age has intensified the vulnerabilities of the general public online. With the recent trends of digitalization of records and social media use, an increasing amount of personal information has been made public. This project examined the quality of the information obtained online on various government databases in order to analyze the threats associated with it being accessible by all. The information was supplemented by searching the individual through social media. Spear phishing and social engineering are often the means of access to a computer's hard drive through Trojan horses. While the documents obtained from the databases contained more technical information, social media revealed their interests, which when designing a spear phishing attack, could be even more effective. This study showed there was more than enough information readily available online to create a calculated and organized spear phishing attack. Knowledge of social media privacy settings is crucial because users who did not designate privacy settings were the most vulnerable to the information being used for malicious purposes.

## BOTANY:

### 301. THE EFFECTS OF INSECTICIDE AND HERBICIDE ON PLANTS

Meem Arzani, Block 3 Science Class, Marine Academy of Technology and Environmental Science
Advisor: Mr. Jason Kelsey

Pesticides are used for agriculture with positive outcomes. But with the different environment in potted plants, will pesticides cause a change in the plant's health? Insecticides and herbicides can be used indoors as commonly as they are used outdoors for large-scale agriculture or gardening, but the difference in the environment of the treatment area can cause different outcomes. This experiment was designed to test whether the use of insecticide and pesticide on two different plants would affect their growth, soil pH, and health. Twelve plants, six African Violets and six Polka-Dot Plants, were treated for thirty days. Three of each plant were given insecticide while the other three were given herbicide. Of the groups of three plants, one was given no treatment, one was given treatment every day, and the third was given treatment every other day. It was hypothesized that the plants given treatment every day would have a decline in health and the plants given no treatment would be the healthiest. The pH's of the plants all seemed to be similar to each other, so the pesticides were found not to affect pH. Health and growth of the treated plants steadily declined, while health and growth of the untreated plants steadily improved. It was concluded that the use of pesticides on indoor potted plants negatively affected their health.

### 302. THE EFFECT OF VITAMIN E ON THE GROWTH OF THE POTHOS PLANT, *EPIPREMNUM AUREUM*

Teresa Brostow, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. David Werner

The Pothos plant, *Epipremnum aureum*, is a very hearty plant which is common in many households. *E. aureum* is native to typically tropical and subtropical regions around the world. It typically thrives in day temperatures of 75-90 degrees Fahrenheit and night temperatures of 65-75 degrees Fahrenheit. This plant was tested by watering it with water infused with different levels of vitamin E in a cold environment to see if the Vitamin E would make the plants involved in the experiment less vulnerable to the cold temperature of around 35 degrees overnight. Specifically the goal of the experiment was to see the plant's amount of growth in the two-month period of time was increased with the plants fortified with the Vitamin E. My hypothesis was that the plants given 400ml of Vitamin E would have the highest growth change, then the plants fortified with 200mL of Vitamin E would have the second highest, and the plants with no Vitamin E added would have the smallest growth change. I came to this hypothesis because different species in the Antarctic have to consume more Vitamin E in their diet in order to withstand the extreme cold. There was also a control group of plants in a constant temperature around 70 degrees Fahrenheit for comparison. The plants were in the cold environment only overnight so they and the control would have the same exposure to sunlight to decrease any other outside variables. The results of the experiment did support my hypothesis with not only qualitative but quantitative evidence as well, as the all plants fortified with the Vitamin E were noticeably glossier and had a more vibrant green color than the others. This experiment is important because if this method can be incorporated into crop farming to help protect them from the cold there could be less loss in food supply and overall a greater and healthier amount of crops.

**BOTANY (CONTINUED):**

### 303. HOW RADISH SEEDLINGS GROW IN DIFFERENT FERTILIZERS

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

Most fertilizers that are bought at a store contain all sorts of unnatural and toxic chemicals. If it were possible to use a more organic fertilizer for growing plants, it would have an extremely positive impact on the environment. This experiment was made to show how well radishes could grow in composted materials compared to chemical-based fertilizers. The composted materials that were tested were egg shells, banana peels, carrot peelings, and coffee grinds. Some seedlings also grew in soil without any fertilizer and soil with chemical-based fertilizer for comparison. First, I put the composted materials in their own containers to decompose. Next, I planted the radish seeds in the seed trays, along with the fertilizers, which each contained six different seeds. Then, I recorded the growth of each seedling that was the tallest of the seedlings in its fertilizer every seven days and compared their heights. The results from the measurements show that the seedlings in the banana peel soil had grown the best out of the organic fertilizers. This means that the best organic fertilizer for radishes is banana peels, which also shows that it's possible to use safer, environmentally friendly, and more organic alternatives to chemical-based fertilizers.

### 304. SEA LEVEL RISE: THE EFFECTS OF SALTWATER INUNDATION ON PLANT LIFE IN BARNEGAT BAY, NJ

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

Sea level rise is a very real event that is affecting the entire world. This global event is caused by thermal expansion and the melting of glaciers. New Jersey coastal areas, including the Barnegat Bay estuary, are already experiencing one of the highest rates of sea-level rise in the continent. Latest observations show recent rates of approximately 4 mm per year (about 40 cm per century) of sea level rise. This means that by 2050 sea level rise is expected to rise by approximately 30 cm and by 2100 sea level rise is projected to rise about 90 cm along the Jersey Shore. This event is causing soils in coastal areas to become more saline. This could be a problem for residents of Barnegat Bay since New Jersey is the "Garden State." For my project, I conducted an experiment in order to reveal the effects of exposure to saltwater on plant life. Wheatgrass and radish sprouts were both grown in three aquaponics tanks of different salinities; freshwater, 1 ppt, and 2ppt. These plants were used because they are both plants that are edible and relatively easy to manage, and they are commonly grown in gardens of coastal New Jersey residents. The plants were grown over a four-month period. The results of this experiment were that the plants in the freshwater tank grew the slowest and were the smallest, the 1ppt plants were the largest and grew the fastest, and the plants in the 2ppt tank were in the middle of the other two tanks in both size and growth rate.

### 305. COMPARISON OF *SALICORNIA* DENSITY

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

*Salicornia* is an edible, succulent halophyte; a plant that grows in water of high salinity. However, little is known about factors that result in its maximum growth. Thus, this project addressed the location in which *Salicornia* had the highest density. During the experiment, a random selection of *Salicornia* (sometimes called pickleweed) was taken on the marsh with an open quadrat. The number of sprouts of *Salicornia* were counted to determine its density within the area. Distance to the nearest water source and its depth were recorded, along with the distance to *Phragmites Australis*; one of the few plants that grows around *Salicornia*. Another species that grows around *Salicornia* is Smooth Cordgrass, but it was excluded from the experiment because the *Salicornia* grew evenly amongst it. My results indicated that the closer to the water edge and the closer to *Phragmites Australis*, the higher the *Salicornia* density. Also the ideal water depth for growth was approximately one meter.

**BOTANY (CONTINUED):**

### 306. EFFECT OF TSP ON RADISH SEEDS

Maria Dreher, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Werner and Dr. Wnek

Trisodium Phosphate (commonly known as TSP) is a harsh chemical which is banned in some states, but used as a common cleaner in others. TSP is sold and distributed as a powder which the consumer must mix with water to a ratio of ¼ cup TSP: 2 gallons water. While phosphates are known to harm plant growth, the specific effects of TSP on plant life is not included in any scientific research study or Material Safety Data Sheet that was found. This experiment helps to fill that gap of knowledge by investigating the effects of various concentrations of TSP and water using radish seeds. It was hypothesized that the control sample of 100% water would produce sprouted seeds while the sample of 100% TSP would completely stunt the growth of all seeds. Six samples were prepared using six radish seeds in each. Then samples were prepared with TSP mix concentrations of 0%, 6.25%, 12.5%, 25%, 50%, and 100%. All seeds in the solutions with TSP had discolored water and no sprouted seeds. The results indicated that TSP is devastating to plant growth even in low concentrations (supported by the solution with only a 6.25% TSP concentration and no sprouted seeds.) This new information on Trisodium Phosphate's negative effect on plant growth will further advance the country's retreat from the use of TSP.

### 307. THE EFFECTS OF DIFFERENT WAVELENGTHS OF LIGHT ON LETTUCE PLANTS

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

All plants utilize the process of photosynthesis to synthesize glucose, a source of fuel for a plant. A key component in the process of photosynthesis is light. Since light has varying wavelengths that display different colors, the three primary colors of light will be tested on lettuce plants to determine what effects each color has. Four bins of lettuce were planted and for each color of light. The lettuce was grown outside for approximately two weeks, and then brought inside where they were placed under red, green, and white LED light bulbs. The sections were blocked off to avoid light mixing. The lettuce grown under the blue light yielded the most biomass. Lettuce grown with red light had lower levels of biomass compared to lettuce grown under blue light, and lettuce grown under green light yielded the least biomass. Since blue wavelengths of light have more energy, it supplied the most during photosynthesis, followed by red. Although green light has more energy, it was reflected, preventing the plant from receiving enough energy. If more time was used to conduct the experiment, the results may have yielded more significant results.

### 308. THE EFFECTS OF HOUSEHOLD TYPES OF RADIATION ON PYCNANTHEMUM

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

Most households in America contain objects that are radioactive. The radiation emitted by these items has adverse effects on living organisms, particularly plants. In order to test this, groups of mint plants were exposed to four different house hold objects that emit radiation. The plants were treated equally and exposed to the same amount of sunlight in order to ensure that the radiation was the only variable in the experiment. Each one of the plants' height was documented on the same days. The collected data was examined and grouped according to the type of radiation the plant was exposed to. Not all of the types of radiation had impacted the plants, but the kinds that did dramatically altered their growth patterns.

**BOTANY (CONTINUED):**

### 309. HOW DO FERTILIZERS AFFECT THE GROWTH OF SUBMERGED PLANTS?

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

Every day, plant fertilizer from lawns and gardens is washed into the Barnegat Bay due to runoff from storms. This has been linked to several cases of dying and decaying plants that are needed in the ecosystem, but how does fertilizer affect the growth of submerged plants? To discover the solution, a test was carried out using a mixture of two fertilizers, one made of blood meal (nitrogen) and one made of bone meal (phosphorus). Two tanks were filled with artificial sand and tap water. Two aquatic plants of the same species were planted in the sand. Data concerning the temperature of the water and the appearance of the plants was taken over a course of three weeks. The first week, the plants were able to grow in a fertilizer-free environment. The next two weeks, one plant was exposed to a mixture of 6.3g of each type of fertilizer that was mixed into the water, while the other was not. The data over the course of three weeks showed that the plant in the fertilizer-filled tank began to decay at a faster rate than the plant in the clean tank, revealing that the fertilizer did have an effect on the submerged plant.

### 310. THE RAMIFICATIONS OF VARIOUS TYPES OF LIQUIDS ON THE DEVELOPMENT OF PLANT LIFE

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

Scallions are a part of the leafy green herbs of the allium family of bulb vegetables. They are a great food source for many, acting as a seasoning, flavoring, garnishment, and they can be added to many salads and dishes. Scallions can be grown both indoors and outdoors. They are considered to be a hardy herb that can be snipped down to the bulb, planted, grown, and snipped again to be grown over and over. The goal of this research project was to determine the best liquid for the growth of scallions. Two trials were conducted for this experiment. The first trial used natural sunlight to aid the growth process of the scallions, and the second trial used artificial light produced by sunlamps to assist the scallions in growth. Five bulbs were planted in the soil for each of six liquids: tap water, orange juice, soapy water, carbonated water, Miracle-Gro®, and rain water. The height of the sprouts were measured on a weekly basis, the soil was tested for its pH level, and physical differences were observed between the plants. All data was recorded, compared, and charted. It was concluded that in the first trial with natural sunlight, the sprouts that were grown with rain water grew the most, at a 124.9% average increase. In the second trial with sunlamps, Miracle-Gro® grew the most at a 391.6% average increase. Observations and data showed that soapy water was the least effective liquid in both natural and artificial light for growing scallions.

## EARTH, OCEAN AND SPACE SCIENCE:

### 401. THE EFFECT OF LIGHT EXPOSURE ON DINOFLAGELLATE BIOLUMINESCENCE

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

It is known by scientists that dinoflagellates undergo more intensive (brighter) bioluminescence in the middle of their night phase. However, the bioluminescence of dinoflagellates and how it is affected by light exposure is not fully understood. The experiment to test this hypothesis used three samples of dinoflagellates. These three samples were placed under three different light cycles. One had sixteen hours of light, one had twelve hours of light, and one had eight hours of light. The samples with a sixteen hour light phase and an eight hour light phase were the variable samples. The sample with a twelve hour light phase was the control group, meant to simulate a natural light cycle of night and day. They adjusted to their light cycles for one week and then were tested nightly for their bioluminescence. The data showed that the sample with a sixteen hour light phase had the brightest bioluminescence. This supported the hypothesis as the sixteen hour light phase was the longest one of all my samples. With this information, the conclusion that more light exposure leads to a brighter bioluminescence can be drawn.

### 402. FLOCCULATION CAUSED BY ELEVATED CONCENTRATION OF IRON IN THE SOIL OF THE PINE BARRENS

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

The rivers and streams of the Pine Barrens are touted as being some of the most pristine in the nation however, over the past several years there have been increased reports of “orange materials” in the rivers. Recently, it has been confirmed that the plumes are caused by flocculation. Moreover, the brownish or orangish color of the flocculant material matches the color of iron-rich soil, suggesting that the inorganic salt being washed into the water is iron. The fact that the orangish flocculant material is only observed in the streams and rivers of the Pine Barrens suggests that there is a higher concentration of iron in the soil of the Pine Barrens than other places in New Jersey. For this study, 15 soil samples were taken from five different towns in New Jersey, three samples from each town. The samples were analyzed through the separation of the minerals from the soil using distilled water and the utilization of a colorimeter to measure the total amount of iron present in each soil sample in parts per million. Finally, using the three iron measurements, the average amount of iron present in the soil of each town was calculated. The results indicated that while towns in the Pine Barrens such as Jackson and Little Egg Harbor have soil that contains high concentrations of iron oxide, towns outside the Pine Barrens such as Howell, located in Monmouth County, have soil that contain higher concentrations of iron oxide than a few of the towns in the Pine Barrens. Hence, it cannot be determined that a high concentration of iron in the soil of the Pine Barrens is the sole cause of the presence of the flocculant material in the streams of the Pine Barrens.

**EARTH, OCEAN AND SPACE SCIENCE (CONTINUED):**

### 403. THE CAPABILITY OF HALOARCHAEA BACTERIAL LIFE IN THE HYPER-SALINITY LIQUID WATERS OF MARS AND TITAN

Alex Lytle, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisor: Mr. Adam Sprague

Mars has hypersaline liquid waters on its surface at a salinity of 316 ppt. Saturn's moon Titan may hold a liquid water ocean below a thick layer of ice at approximately 350 ppt. Haloarchaea bacteria were introduced to replicated broths of these salinities (and a control) and the growth was monitored. My hypothesis was that the bacteria would grow in both the control and Mars broths, but the Titan broth would have a much smaller population (if any growth at all). The broths were made, and the bacteria were plated at Lacey Township High School. Two out of three of the populations in the control broth significantly increased; the other was halved. Two out of three plates of the Mars broth slightly declined in population; the last one increased approximately 1.5 times. Two out of the three plates of the Titan broth stayed around the same population, but one dropped to half the initial population. This indicated that my hypothesis was correct because the bacteria grew in the control broth and hardly grew in the Titan broth. The hypothesis was wrong about the Mars sample since the population declined. The conclusion of this project is that the salinity of water on other planets/moons makes it a challenge for life to exist outside of Earth. This experiment is important because if any forms of life are to exist on another planet/moon, as far as we know, liquid water is something that is essential. My project helps people better understand the challenges of the possibility of extraterrestrial life.

### 404. DOES OFF-ROAD DRIVING AFFECT SOIL NUTRIENTS?

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

Off-road driving is a common activity and is practiced in a wide array of places. It often results in damage to roots and plant life. But what about the soil underneath? Does the soil — it's nutrients in particular — get damaged in any way? The soil nutrients shouldn't deteriorate, but in order to test this an area damaged by off-road driving in Wharton State Forest, New Jersey was chosen. There, three sets of seven soil samples were taken, with each set being taken on a different date and in the exact same location. Samples were labeled as damaged, moderately damaged, or undamaged based on the amount of plant life in the sample and the distance from tire tracks. Afterwards, all samples were analyzed for nitrogen, phosphorus, and potassium in order to find a connection between off-road driving and soil nutrient levels. Based on the test results, no connection could be made between off-road driving and soil nutrients, since all of the samples exhibited some sort of change regardless of influence from vehicles.

### 405. THE EFFECTS OF GAS STATIONS ON SOIL COMPOUND LEVELS ACROSS OCEAN COUNTY, NJ

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

Urban areas are typically dependent on vehicle transportation, which is the second leading emitter of greenhouse gases. Gasoline has been known to produce greenhouse gases that pose as threats to our atmosphere and general health. Underground gasoline leakages and spills could cause soil pollution, contaminating the soil and nearby water. This makes acidity and nitrate levels in the soil change dramatically, which can be a large threat to the ecosystem. If gasoline causes the soil to exceed those limits, soil organisms can suffer mortality. The purpose of this study was to determine whether local gas stations and their surrounding environment are a contributing factor to soil contamination. More specifically, ten soil samples were collected from different locations across Ocean County (Whiting, Lacey, Tuckerton, Lanoka Harbor, Forked River and Toms River) and tested for nitrate and pH levels. My hypothesis was that the soil around gas stations (and adjacent water bodies) will have levels of nitrates and pH that are different than soils in the same areas with no gas stations. Based on the data collected, the trend indicates that the predicted hypothesis is supported, soils from the gas stations that are near any body of water have significantly higher levels than regular soil.

**EARTH, OCEAN AND SPACE SCIENCE (CONTINUED):**

### 406. HOW DOES DISTANCE AFFECT WEATHER OBSERVATIONS?

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

All people can benefit from knowing the most accurate weather forecast to keep themselves safe and comfortable each day. Meteorologists and weather stations help give accurate forecasts for the population so they can prepare for the impending weather. However, some people do not use the most reliable weather sources to get their current weather conditions. They may not realize the availability of such weather sources on the Internet or they may be relying on weather information from sources that are far away from where they live. My project consisted of collecting weather data from weather stations in, and around New Jersey, at varying distances from my house, and comparing that data to the weather information I collected. The goal of my project was to determine a trend between the accuracy of a weather station and its distance from my house in order to demonstrate that forecasts can be variable and determine the degree of variability from a known location. The majority of the results I collected during my project supported my hypothesis. The data showed a negative trend between the accuracy of the weather station and its distance from my house.

### 407. THE EFFECTS OF OCEAN ACIDIFICATION ON *POMATOMUS SALTATRIX* SCALES

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

Ocean acidification is a problem affecting the environment that has many scientists concerned. An increase in carbon dioxide in the atmosphere has caused an increase of the amount of carbon dioxide in the ocean. This has led to less calcium carbonate being formed which would affect crabs and other soft-shelled crustaceans. The purpose of this project was to see how acidification of ocean water would affect the *Pomatomus saltatrix* scales. I had three different solutions: one which had a pH of 7.84 and was the control (ocean water from Point Pleasant Beach), one with a pH of 6.6, and one with a pH of 5.0. I used all three of these and placed 1 gram (variation of 0.01 grams) of *Pomatomus saltatrix* scales inside of them. At one month time intervals, the scales were removed from the solutions, dried and then weighed. The percent weight loss was then calculated. At the conclusion of the experiment, the scales with the lowest weight were the control group. This was not expected to happen as the scales submersed in the water with a pH of 5.0 were expected to have the lowest weight as they were in the water with the lowest pH. However; I was still able to conclude that ocean acidification will cause a large decrease in the weight of *Pomatomus saltatrix* scales.

## ENGINEERING AND PHYSICAL SCIENCE:

### 501. WHICH MATERIALS SOUNDPROOF THE BEST?

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

Soundproofing is often used in recording studios for musicians, however, it can also be used for many different reasons. Some of these reasons include blocking out excessively loud neighbors in a townhouse or apartment, or it can be used to help prevent hearing loss. For this experiment, five different materials were tested for their soundproofing effectiveness. The five soundproofing materials used were cork, ridged acoustic foam, egg-crate acoustic foam, gym phone, and standard insulation foam. A box was created by using two layers of ridged acoustic foam, leaving the top of the box open. The box was then coated in spray foam, and the bottom was glued to a piece of cardboard, to make moving the box easier. To generate a noise, an app was downloaded onto a phone, called "Simple Trumpet Tuner." This app produced three tones, concert Bb, concert F, and concert A, which is Bb, F, and A on a piano. The phone was connected via Bluetooth® to an exterior speaker, which was placed in the box. Both the volume of the phone, and the volume of speaker, were on maximum volume. A tripod was set up above the box, and a decibel meter and microphone were set up approximately 18 inches from the top of the box. The microphone was connected to a laptop, with audio recording software downloaded on it. A piece of material was placed on top of the box, and the noise was produced. The noise was recorded on the computer, and the decibel of the noise was written down. The noise was also noted by how loud it sounded to the research conductor, on a scale of zero to ten, ten being the noise without any sound barrier, zero being no noise at all. The audio program provided the volume of the wave using its own scale. Each pitch of noise was tested three times per material per day, on three different days. The data was averaged, and the material with the lowest numbers was the most effective.

### 502. TEMPERATURE OF WOOD BASED MATERIALS

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

Wood based materials are present in many households and can pose a considerable threat to a house's structural integrity when on fire. While there are fire resistant materials used to create a house, it is evident by the number of fires every year it is ineffective. An experiment was conducted to observe which wood based material retains the highest temperature when aflame. The three types of materials used for the experiment were wood, corrugated cardboard, and paper without ink. The materials were heated one at a time in a safe environment, and after 1 second had passed by when the material caught aflame, the temperature was measured. Temperature was measured in Celsius ($^{o}$C). It was discovered that cardboard burned the hottest, contrary to the hypothesis, which stated wood would burn the quickest due to its high density. Due to the results stated here, it was decided that cardboard is most dangerous to structures, especially when stored in large quantities. This concluded that large storage areas and warehouses which may hold many items kept in cardboard are more likely to catch fire then a small structure carrying little wood based material.

**ENGINEERING AND PHYSICAL SCIENCE (CONTINUED):**

### 503. IS THERE A PHONE CASE MORE BENEFICIAL AND COST EFFECTIVE THAN OTHERS?

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

The use of smart phones has become a huge trend in the recent years, along with different accessories that can go along with a smart phone. One of the most popular accessories for smart phones are phone cases. These accessories are so popular due to their protectiveness for the expensive smart phones, and the different gadgets and styles each phone case has. Every phone case has its pros and cons, whether its cost or its durability, making it difficult for a customer to choose a case out of the thousands out there on the market. What if there is a way to make a phone case that can resolve these problems by making a cheap, durable, and high quality phone case for all smart phone users? That is what was attempted to be created in this project. By using a durable plastic, rubber, a phone charger, and a 3-D printer, a phone case was developed that is more durable than other cases. This phone case is able to withstand drops up to 7 feet (2.2 meters), and has a built in phone charger right into the phone case so the user can plug the case and phone into the wall. Unlike other phone cases, the phone case does not require a protection screen, since it is deep in the phone case so that the borders of the case takes the damage and not the phone. Lastly, the phone case, if sold, could be sold at a very low price, since the materials used were fairly cheap and could make multiple phone cases. Therefore, this phone case is a very good choice for any smart phone users that are in need of a cheap case.

### 504. DOES CELL PHONE QUALITY OR MODEL RESULT IN THE RADIO FREQUENCIES IT EMITS?

Brennan Hall, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey and Mrs. Kelly Kelsey

Cell phones are a popular part of everyday modern day life. For most people, they may seem essential to life, but how are they be harming us and is this being repaired with the new and upcoming generations of cell phones? The use of a cell phone is very common in today's society. Everyone tends to have or use a cellphone on a daily basis. These devices keep us connected to the world in ways that were previously only seen as a dream. Every cell phone releases some kind of electromagnetic radiation also known as radio-frequency (RF) when it is in use, either while texting or making a call. Regulations on the amount of radio-frequencies emitted by cellular devices have already been set. Agencies such as the FCC have set these standards according to what they believe is reasonable. Cell phones may pass these guidelines when first tested, but they may begin emitting greater quantities of radio-frequencies after they are considered used or older devices. Although these devices are so extraordinary, are they harming us? Furthermore, it is understood that different cell phones emit different levels of radio-frequency (RF) as well as when the devices perform different actions. Calling for a longer period of time will emit a higher and longer radiofrequency than a shorter time spent communicating with the device.

### 505. COMPARISON OF THE INJURY AND FORCE THRESHOLDS OF VARIOUS ANKLE BRACES

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

Human ankles have a certain range of motion, and once one passes that range with force, an injury can occur. Force is strength that is applied to cause change or motion. Force is applied in everyday use, and according to Newton's Third Law of Motion, for every action, there is an equal and opposite reaction. Unknowingly by many people, forces are exerted within almost every movement. When someone twists his or her ankle, he or she is applying force to the ankle, bending it outside the ankle's regular range of motion. Athletes use ankle braces to try to prevent injury, and certain braces do not help. With my project, I used force on a modeled ankle with four different ankle braces to determine which ankle brace(s) are the best for preventing injuries. My data points were analyzed using several ANOVA tests and a Tukey Post-Hoc test. The force resistance values show that Velcro® flexion and Velcro® supination, and laced up extension and laced up pronation are statistically higher than the rest. My project is significant to athletes who want to prevent injuries, as well as the doctors that prescribe ankle braces to patients.

**ENGINEERING AND PHYSICAL SCIENCE (CONTINUED):**

### 506. BLUNT FORCE TRAUMA AND THE EFFECTS OF VELOCITY AND ANGLES

Kate Killian, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. Dave Werner and Dr. John Wnek

Blunt force trauma has a huge impact on forensic science, especially since a majority of crime-related deaths are classified as some form of blunt force trauma. The purpose of this experiment was to find direct patterns in the effect that velocity and angles had on blunt force trauma. My overall goal was to discover a direct connection between the increase of velocity or change of angles of the tool and the imprint left behind. Testing began December 12, 2015 and ended on March 7, 2016. Two different tests were performed, the first with the velocity as a variable, and the trajectory angle as a constant. The second test had velocity as a constant and the trajectory angle as a variable. Each velocity test collected five data points and each angle test collected three data points. For the velocity testing, the width, length and depth of each imprint was collected and recorded along with the drop number and height the tool was dropped from. Each angle test recorded the width, length and depth of each imprint along with the height of the tool, height of the furthest side of the clay, and drop number. The fact that no two tools will make the same imprint, just like snowflakes or fingerprints, tool imprints are completely unique to their tool, which was a result of this study.

### 507. WHICH STRUCTURE OF A BRIDGE CAN HOLD THE MOST MASS?

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

Some of the most common structures for bridges are suspension bridges, beam bridges, and truss bridges. Bridges as a whole weaken after being under constant stress, and break when a major force impacts them, as a result of the weakening. These structures were tested on bridges built out of K'nex® with a constant stress of sand on them. After two weeks of constant stress, sand was added to the bridges until the pieces disconnected, then the amount of mass the bridge held was measured. My hypothesis was that the suspension bridge would hold the most mass, the truss bridge would hold the second to most mass, and the beam bridge would hold the least mass due to the suspension bridge having the most support from the cables, the truss bridge having support from the trusses, and the beam bridge having no extra support. The results showed that the suspension bridges held the most mass, the truss bridges held the second to most, and the beam bridges held the least mass, supporting the hypothesis. In conclusion, this project is important because engineers and architects must choose the best designs to use in bridges that people use around the world every day.

### 508. WHAT TYPE OF FIRE EXTINGUISHER IS MOST EFFICIENT IN SUPPRESSING A CLASS A FIRE?

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

Fire extinguishers are defined by the class of fire they are designed to put out. They eliminate one of the three elements needed to sustain a fire which is oxygen, fuel, and heat. The one element of the fire that can be changed is the fuel which is why different types of extinguishers are necessary. All extinguishers are capable of putting out a Class A fire, such as paper or wood. The only difference between extinguishers is which one is most efficient at doing so. In order to find the most efficient extinguisher, an experiment was conducted to see which one put out a wood fire quickest and using the least amount of suppressant. For this test, a three extinguishers were used: a Class ABC, Class BC, Class K and then water. These were the only extinguishers used since all others are reserved for special circumstances and firefighting. The data was analyzed to show that water put out the fire quickest and Class BC used the least amount of material. To achieve a more accurate result, a larger and more controlled experiment would be necessary, such as a fire from a gas line where the amount of fuel can be regulated and a more stable flame can be sustained.

**ENGINEERING AND PHYSICAL SCIENCE (CONTINUED):**

### 509. THE EFFECT OF STRESS ON PIEZOELECTRIC CRYSTALS

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

Due to the rise of portable devices and integrated technology, the need for low-power wireless sensors and actuators has surged in recent years. Energy reduction has become a driving for new methods of renewable energy. The search for many alternatives have found piezoelectric materials to be effective due to their sensitivity to not only ambient energy, but kinetic energy. Implementation of piezoelectric materials into highways, bridges, and locations with high ambient energy have been considered, but the fragility of the crystals generate an obstacle. To investigate this breaking point, Rochelle Salt crystals were created and their strength against pressure were tested under the stress of gram weights while voltage output is measured. The stress placed upon each crystal and discharge was analysed and charted. Results indicated that a thinner, oblong crystal was more likely to break when more than 350 grams or 3430 Newtons is applied to it. Thick square crystals withstood up to 4900 Newtons of pressure and were the most effective. These results could be utilized to establish a stress tolerance in areas of high impact with piezoelectric crystals, like bridges or landing strips.

### 510. LESSONS LEARNED FROM HURRICANE SANDY: PREPARING FOR THE NEXT STORM

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

A hurricane is “a violent, tropical, cyclonic storm of the western North Atlantic, having wind speeds, of or in excess of 72 miles per hour (32 m/sec). Throughout the world hurricanes threaten both the life of inhabitants and structures. In 2012 Hurricane Sandy Struck the NJ area dealing tremendous amounts of damage at an estimated 50 billion dollars as approximately 346,000 housing units along the coast were destroyed or damaged. Modern structural designs in dealing with hurricanes include reinforced connections between roofing and walls as well as specially designed PVC® shutter windows. These have been somewhat effective in limiting hurricane damage, but they are not always successful. To test the most suitable design for structures as we continue to rebuild along our coastal areas, four models were constructed using Revit®. Models will be subject to hurricane conditions, specifically 75 mph winds or higher. This study will provide a better indication for the optimal structural design to sustain wind damage; however, flooding may still be an issue.

## ENVIRONMENTAL SCIENCE:

### 601. DOES ACID RAIN AFFECT AQUATIC LIFE?

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

Acid rain occurs when pollution in the atmosphere is chemically changed and absorbed by water droplets in clouds. When there is precipitation, the droplets fall to earth as rain, snow, or sleet. The polluting chemicals in the water droplets form an acid by combining with the hydrogen and oxygen in the water. These acidic droplets can increase the acidity of the soil and affect the chemical balance of lakes and streams. This in theory can affect life in those bodies of water. Tests were done to show how snails and Duckweed react to different levels of pH in the water. A pH value shows the level of acid in a given sample. The Tests show that the number of organisms dropped in the lower levels of pH showing that with a great of enough change the ecosystem of the body of water can be altered completely if not destroyed.

### 602. COMPARISON OF THE AERATION SUSCEPTIBILITIES OF DIFFERENT TYPES OF WATER

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

The rapid development of Dead Zones in Earth's oceans are becoming a huge problem. Dead zones are areas of a body of water that are being deprived of dissolved oxygen, killing all marine life within that area. There are certain levels of to support marine life; however, the dissolved oxygen levels of our oceans are dissolved oxygen, or the amount of oxygen in the water, that are necessary in order dropping way too fast, resulting in the formation of numerous Dead Zones. These Dead Zones can occur naturally but recently have occurred due to the increasing amount of fertilizer runoff from the soils of farms. The fertilizer attracts plankton that feed on the nutrients of the water until it is completely depleted. It was discovered that the depletion of oxygen in the water can be avoided by using man-made aeration techniques that are continuously adding oxygen into the water. The objective of this study is to see what samples of water are more susceptible to being aerated and which sample's dissolved oxygen level will change the most. The experiment tests the dissolved oxygen levels of four samples of different types of water (tap water, ocean water, pond water, and bottled water), before and after twenty-four hours of aeration. The results showed that the pond and ocean waters were oversaturated with oxygen due to the constant aeration. The greatest dissolved oxygen change was in the tap water. The greatest concentration change was in the tap water as well. The experiment showed that tap water was the most susceptible to change in dissolved oxygen and has the ability to easily be aerated. The pond water and ocean water were constantly over saturated with oxygen. In conclusion, since the freshwater lake sample did not have the greatest dissolved oxygen change, there is not enough evidence to support the claim that its high aeration susceptibility is due to its lack of salt and the amount of water activity.

### 603. WHICH BIODEGRADABLE PLASTIC SUBSTITUTES ARE MORE EFFICIENT THAN OTHERS?

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

Plastic products such as tableware and silverware can take anywhere from hundreds to thousands of years to decompose completely. Recently, biodegradable materials have been implemented by various companies to use as alternatives to the plastic components in common household kitchen products. In order to determine which biodegradable substitutes are efficient compared to other materials, an experiment was conducted using five different products from each of five popular plastic substitutes. Each of the products were relatively similar in size and had about the same starting masses. The masses of the products were recorded before and after being left to decompose while being exposed to an average temperature of 71°F (19°C) for approximately 16 weeks. After finding the average amount of grams lost per category, products containing a substitute of sugar cane were found to have decomposed the most over the time period of the experiment.

## ENVIRONMENTAL SCIENCE (CONTINUED):

### 604. QUALITY OF POND FILTRATION

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

The experiments conducted in this project tested three separate filtration systems in a man-made pond ecosystem. In order to keep the pond healthy, filters reduce ammonia and nitrite levels, as well as keep pH levels safe. Three filters were tested to determine which one was most efficient at keeping the water clean. An ultraviolet filter, sand based filter, and man-made bog were tested individually. Each ran for two weeks before the water was sampled for nitrite, ammonia, and pH levels. It was suspected that the highest quality filter would be the bog. Nitrite levels remained the same for all three filters, as the fish living in the pond produced little waste during the experiments. However, pH and ammonia levels varied between filters, with the bog producing the most desirable numbers. The bog alone kept the water safer and cleaner for the fish then the other two filters, though all three proved to be a viable source of water filtration.

### 605. ORGANIC SUBSTITUTES FOR PESTICIDES

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

A significant agricultural problem is destruction caused by pests - both insect and mammal will destroy plants and harvest. Traditional solutions such as pesticides and poisons use chemicals which affect the ecological balance of the environment. Pesticides used on indoor plants expose all living in the home to toxic chemicals. This experiment explores the effectiveness of less ecologically invasive methods used to repel and exterminate insects, specifically whiteflies, fungus gnats and spider mites on citrus, Alpine strawberry and lavender plants that were overwintered indoors. Three sets, each containing one plant of each variety, were exposed to three different organic pest controls with one last set used as the control group. The conclusion drawn from this experiment is that while all methods had some success, the best method of repelling insects from plants overwintered indoors is to keep the plants at the optimum humidity level. The second part of this experiment investigated methods to protect produce from squirrels. Grape tomatoes were left outdoors each week for nine weeks and the tomatoes or surrounding area were altered with non-toxic repellants. The aim was to find if these repellants taught the squirrels to leave the tomatoes alone. Since the squirrels could not be tagged it was impossible to tell if there was any learned behavior since it couldn't be determined if the same squirrels or different squirrels were participating. Also since it was impossible to isolate just the squirrels, there was reasonable doubt that other mammals were not interfering with the experiment, so no conclusions were drawn.

### 606. COST EFFECTIVENESS AND EFFICIENCY OF ALTERNATE ENERGIES

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

The U.S. alone generates 67% of its energy through the burning of fossil fuels. Fossil fuels are a nonrenewable resource that releases large quantities of naturally occurring greenhouse gasses. These gasses have harmful effects on the environment and on the atmosphere. Due to this many people are switching to alternate sources of energy. Some examples are wind, solar, and hydro power. Other sources of clean alternate energy are geothermal, and nuclear energies. These sources produce little to no harmful emissions but at the cost of efficiency or being dangerous to humans. Forms of energy such as mechanical or magnetic energy can be harnessed to produce clean energy, but may be less cost effective. To determine an efficient yet cost effective source of energy, I took reading from machines and devices that harnessed solar, hydro and mechanical energies.

**ENVIRONMENTAL SCIENCE (CONTINUED):**

### 607. EFFECTS OF DIFFERENT LAWN CHEMICALS ON RUNOFF WATER

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

This experiment demonstrates the buildup of harmful chemicals in runoff water due to human interaction. The use of chemicals on lawns and in the environment affects the runoff of water that will eventually end up in the ocean or groundwater, and become harmful to the environment. To simulate the process that happens in nature of chemicals polluting runoff water, the pH of runoff water in an experiment will be measured using litmus strips over the duration of 10 days. After these ten days, it has been concluded that herbicide, insecticide and fertilizer all lower the pH levels of runoff water. The water became more acidic throughout the duration of the experiment. This means that the chemicals used to enhance lawns can be harmful to the environment.

### 608. EFFICIENCY OF COLLECTING VOLTAGE FROM WALKING

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

Running out of fuel and energy is an emerging and immediate crisis of society. To aid the end of this impending issue, everyday actions and objects can be used to accumulate energy. One of the activities people do the most and in the largest quantity is walking. An experiment was conducted using a device attached to a shoe. The device was constructed from a rewired hand-cranked, dynamo-powered flashlight and attached in a cradle to the shoe. A series of tests were then executed to prove the efficiency of the device. There was a total of 40 tests, each 5 minutes long. For 20 of them, or 100 total minutes, the shoe was not used for walking, but was instead a control test, cranking the device manually by hand; this was done at an average walking pace. For the other 20, the shoe was used for walking, to test if it would be effective enough to collect energy from. There was found to be a minimal difference between the control and the experimental groups, thus showing that voltage can be successfully collected from walking.

## HEALTH, MEDICINE AND SPORTS:

### 701. THE EFFECT OF HUMIDITY OF HUMECTANT LOTIONS

Brooke Andolsen, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Dave Werner

Almost all lotions on the market today contain and Humectant usually in the form of Glycerin. Humectants purpose in lotions is to draw moisture from your bottom layers of skin or dermis and the environment into your epidermis to revitalize your skin. It is thought that when the environment is more humid the lotions have a greater effect on your skin. It was tested by using three different types of lotions on gelatin, because the collagen has the same qualities as skin. Lotions was put into three different environments where the humidity was kept at an average thirty-seven percent, ninety- nine percent, and fifty-one percent humidity. It was observed that the lotion in the ninety-nine percent humidity environment kept the most moisture. But, between the thirty-seven percent humidity and the fifty-one percent humidity there was not significant change in the moisture that was maintained. With the data that was collected from the experiment the conclusion was that humidity does affect the efficiency of humectant lotions, but it had to be a large change in humidity for it to show a change in the results.

### 702. THE COMPARISON OF STRESS ON THE HEARTS OF MALES AND FEMALES

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

It has been demonstrated that females have relatively faster heart rates when compared to males. Also, when put under stress, heart rate increases by a substantial amount. The subject of research was to show the difference between males and females within the same age group and also to compare the results to a different age group. This shows variation between males and females of premature and maturing ages. To compare all of these variables, 10 females and 10 males from each fifth and ninth grade were tested to determine their percent of increase in heart beats per minute when at rest against their heart rate when put under a time limit (inducing stress). It was determined that females, though their heart rates were substantially higher, had around the same percent of increase that had to do with their age group. The fifth grade test subjects had higher percent increases than the ninth graders.

### 703. CORRECTING IMPROPER RUNNING FORM BY MEANS OF USING WEIGHTS ON DIFFERENT AREAS OF THE BODY

Frank D'Agostino, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. Jason Kelsey and Dr. John Wnek

Millions of people run on at least a weekly basis; either for hobby, competition, or getting healthy. This activity can be stressful on the body, especially for people who do it regularly. Running form, or the way a person composes his or herself while running, is vital for reducing the amount of stress and potential energy on a person's body. There is no proven method for correcting the running form of someone, so many people run with an incorrect form that could harm his or her body. My project analyzed the possibility of weights being an effective method of correcting a person's running form. A new method of improving form could reduce the amount of injuries and allow people to live healthier lives. I did the experiment by gathering participants 14 to 15 years old from MATES high school and making them run different trials with a weight on different areas of the body. While doing this, I recorded the participants running on a treadmill and analyzed their cadence, posture, and body lean. I hypothesized that the lower abdomen would improve running form the best because the lower abdomen is towards a person's center of gravity. The trend indicated that my hypothesis was correct in that the cadence, posture and body lean were closest to their accepted values. This indicated that the usage of weights was beneficial in helping to correct running form, which would allow people ve to reduce the strain on their bodies.

## HEALTH, MEDICINE AND SPORTS (CONTINUED):

### 704. WHAT ARE THE MOST SUCCESSFUL PLAY STYLES BASED ON QUANTITATIVE INDICATORS IN SOCCER?

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

Soccer has different styles of play which teams employ to perform their best in a match. There are many types of play including, possession, counter attacking, target man, direct play and many others. Possession is regarded as the best style of play in soccer but, statistically which play style is most beneficial for a team? Statistical analysis indicates that the counter attacking style of play was most beneficial for teams, often scoring the most goals and winning the most matches. Data on ball possession, shots, shots on goal, crosses, corners, blocks, saves, and clearances was collected from twenty-five games of the English Premier League. Analysis indicates that when winning, most teams are found to have lower percent of ball possession but more shots and shots on goals than other teams, indicating that a counter attacking style is the most successful style of play.

### 705. HOW DOES THE ANGLE OF TRAJECTORY IN THE BEGINNING OF A 25-METER SPRINT AFFECT THE TIME AND SPEED OF THE RACE?

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

Sprinters of various skill levels use starting blocks to decrease their race times and increase their speeds, but not many people know how to use them to their full capabilities. Starting blocks allow a runner to start a race at a slanted body angle which gives them both forward horizontal momentum and stretches the gastrocnemius and soleus muscles in the calves. This stretch allows the racer to commence a race in an explosive manner, which leads to significantly increased performance. Participants were asked to sprint three trials of a 25-meter distance using a starting block set at angles of 65°, 70°, 75°, and a control without the starting block. These races were captured using slow-motion video software and precisely analyzed and measured to the nearest millisecond. When the values of every participant were averaged together, it was discovered that the 75° angle provided for the fastest times and highest speeds of the three tested angles, supporting the hypothesis. However, the control was the fastest starting position overall. In short-distance races, one millisecond could be the difference between championship and defeat. Knowing the most efficient starting block angle would undoubtedly assist runners in decreasing their times and setting new personal bests.

### 706. THE EFFECTS OF SHAMPOO ON HAIR DYE INTENSITY

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

Hair dye fading is a common problem for those who dye their hair. Fading is caused by excess heat and washing of the hair, this is because shampoos strip the hair of oils but in doing so, can strip the dyes or leave it exposed to water that then can dissolve it. This project tested different types of common, inexpensive shampoos' effects on hair dye color to see which affected the color the most. Blonde, straight, natural human hair extensions were dyed a deep blue. Then, the extensions were washed with four different types of shampoos; sulfate, sulfate-free, anti-dandruff, and low pH; every other day for the best case scenario. Pictures of the effects after each wash of each shampoo sample were then taken. Blue values of photo were recorded and compared from the starting blue color value, which was the same for all samples. The range of the blue values from the beginning to end were created to compare the change in the blue values. The shampoo with the largest range was the Head and Shoulders Anti-Dandruff Shampoo, and faded the color the most. The Johnson and Johnson Baby shampoo (low pH) had the smallest range; therefore, faded the dye the least. The best shampoo for use of color-preserving without adding to the color would be a low-pH shampoo.

## HEALTH, MEDICINE AND SPORTS (CONTINUED):

### 707. THE SYMPTOMATIC DIFFERENCES BETWEEN INHERITANCE AND SPONTANEOUS MUTATION IN MARFAN SYNDROME

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

Marfan Syndrome is a rare genetic condition which affects about 1 in 5,000 people. Marfan Syndrome is caused by a change in the gene that makes the protein, fibrillin1, which changes how the protein is created. The change in the protein cause an increase in a protein called transforming growth factor beta which affects the human body's connective tissues which in turn affects places such as the eyes, heart, bones, joints, and blood vessels. You can get Marfan Syndrome in two ways; 75% get it through inheriting it from a parent and 25% get it through spontaneous mutation. The purpose of my experiment was to find whether there was a larger symptom severity between people who inherited Marfan Syndrome and people in which the gene occurs spontaneously. Data about the symptoms of both spontaneous mutation and inheritance of Marfan Syndrome was collected, averaged and analyzed. My hypothesis was that people who inherited the gene would have more severe symptoms. When the data was analyzed compared it was found that there was no significant difference between the symptoms of those who inherited the gene and those in which it formed spontaneously.

### 708. COMPARISON BETWEEN DIFFERENT COOKING METHODS TO SEE WHICH RETAINS THE MOST VITAMIN C

Stuti Patel, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mrs. Kelly Kelsey

Nutrients are important for our body to function properly and many people take vitamin tablets to keep their nutrition levels at their best. Vitamin C, specifically, is a key nutrient to keep us fit and healthy, it provides us with multiple benefits such as prevention from cardiovascular and eye disease. This experiment was conducted in order to determine which cooking method from roasting, boiling, and steaming retains the most Vitamin C for various vegetables. Potatoes represent root vegetables, green bell peppers represent fruit vegetables, and spinach are a type of leaf vegetable. Each vegetable was juiced and 1 oz. of it was mixed with 4oz. of water. Since, cornstarch reacts with iodine, cornstarch was also added to the sample mixture and drops of iodine were dropped until the color of the juice changed to a blue or purple. The number of drops were calculated as how many milligrams per 1 gram was in the sample using a reference sample. Steaming appeared to be the best cooking method for potatoes and the green bell pepper, while roasting was the best method in order to retain nutrients for spinach. However, the difference between roasting and steaming for spinach was not large. For most vegetables, steaming can be concluded as retaining the most nutrients.

### 709. HOW WELL DOES YEAST REACT WITH SUGAR SUBSTITUTES?

Vanessa Robinson, Block 4 Chemistry, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mrs .Kelly Kelsey

When sugar reacts with yeast, the microbes in the yeast break down the molecules in the sugar and reconstruct them, forming carbon dioxide and alcohol. It is known for certain that yeast reacts well with sugar; however, how well does yeast react with sugar substitutes and which sugar substitute reacts the best with yeast? To answer the previous question, yeast was mixed with warm water and various sugar substitutes, as well as two types of regular sugar. Using balloons and string, the amount of carbon dioxide emitted by the sugar substitutes and regular sugars were measured. The data collected was analyzed and compared and the result was that two of the three sugar substitutes used reacted better with yeast than regular sugar reacts with yeast. According to the data, the hypothesis that sugar substitutes would not react as well with yeast as regular sugars and that Truvia® would be the sugar substitute that reacted best with yeast was proved wrong. The data also showed that Splenda was the sugar substitute that reacted the best with yeast. Further research that could be done is the composition of sugar substitutes that led them to react so well with yeast and why Truvia® did not react with the yeast at all.

**HEALTH, MEDICINE AND SPORTS (CONTINUED):**

### 710. DEPTH OF PULL EFFECT ON SPEED AND EFFICIENCY OF SWIMMING STROKE

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

In a liquid, there are many factors and forces that determine how fast you can move through, and how much energy it will take to maintain that speed. The study of these forces is referred to as hydrodynamics. A key component to my research was the force of water pressure, as the depth increases, the water becomes denser. My method to test my hypothesis consisted of testing three different strokes for speed, efficiency, and distance per stroke. Each stroke would have a different pull, ranging from 12 inches below the water's surface at its deepest point, to 16 inches to 20 inches. Each level would have a different amount of pressure acting on the stroke, determining the speed of the stroke, and the amount of energy required to complete the 25 yard sprint tested. The results of the experiment showed that the fastest stroke was with the 20 inch deep pull, and the most efficient stroke was with the 16 inch deep pull, while the 12 inch deep pull was both the slowest and least efficient stroke. The results suggested my hypothesis correct in the regard the 20 inch deep pull was grabbing the denser water, providing more thrust forward. However, the results also suggested the hypothesis was incorrect in the regard that the 16 inch deep pull was more energy efficient than the 20 inch pull because less energy was required to control the less dense water.

### 711. AN ANALYSIS OF MILD TRAUMATIC BRAIN INJURY IN HIGH SCHOOL SPORTS AND THE EFFECT OF HEADGEAR ON THE RATE OF INCIDENCE AMONG ATHLETES

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

A Mild Traumatic Brain Injury (MTBI), also known as a concussion, is an injury caused by a blow to the head, resulting in temporary loss of consciousness, loss of memory, nausea, light sensitivity, noise sensitivity, and/or temporary incapacity. MTBI has become a growing epidemic among athletes all over the world. In lieu of this, more technologies are being created to reduce the rate of incidence of MTBI. One new technology introduced was soft headgear (not helmet) to be worn during sports, to reduce the impact on one’s head while wearing it. The research performed was on the topic of MTBI in high school sports, and the effect of wearing headgear on MTBI rates among athletes. To carry out the research, an online survey was made, and sent out to recipients. The survey’s questions retained information regarding the MTBI received and use of headgear before and/or after receiving a MTBI. Sport(s) played was also another factor recorded. As a result, 147 athletes completed the survey, and athletes of various sports were represented. The results of the survey suggest that wearing protective headgear will reduce the rate of incidence of MTBI. Sixty-eight percent of athletes that received a MTBI and wore protective headgear after did not sustain any further injury. This indicates that athletes who wear soft protective headgear may be less susceptible to sustain a MTBI in high school level sports.

## ZOOLOGY:

### 801. A BEHAVIORAL ANALYSIS OF DIAMONDBACK TERRAPINS IN A GROUP SETTING

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

The terrapins, *Malaclemys terrapin*, housed here at MATES have a much different behavioral pattern than in the wild. In the wild, they will try to escape from predators, and are normally afraid of humans. Terrapins in the wild spend a majority of their lives basking, and absorbing Vitamin C (dietary and basking). At MATES, on the other hand, they have adapted to the daily presence of humans, and now associate people with food. As the terrapins are housed in classrooms, with humans constantly circulating near their tanks, and away from them, they can be misled. While they are supposed to be basking, they are instead increasingly active. This study was conducted using a trail camera recording behavior continuously over one week to show evidence that mere human presence affects the behavior of terrapins without us conducting direct activity with their tanks.

### 802. DOES DIETHYLTOLUAMIDE EFFECTIVELY REPEL MEMBERS OF THE CULICIDAE SPECIES?

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

The family of Culicidae carry many diseases that may be fatal to humans. Many chemical compounds are sold to repel these creatures, such as diethyltoluamide, better known as DEET. The purpose of this project was to determine if diethyltoluamide effectively repels Culicidae species. In this project, four project Culicidae traps and one control Culicidae trap were placed in various places along Little Egg Inlet. Four strips of black paper were soaked in varying diethyltoluamide solutions. One is a 20% diethyltoluamide solution, one in a 25% diethyltoluamide solution, one in a 50% diethyltoluamide solution and one in a 100% diethyltoluamide solution. Each strip of paper was taped to a project Culicidae trap prior to placement by Little Egg Inlet. The Culicidae traps were left alone for 48 hours. The Culicidae traps were then weighed and compared to their weight before being set be Little Egg inlet to determine the average number of Culicidae species in each Culicidae trap. The experiment concluded that diethyltoluamide effectively repels members of the Culicidae species.

### 803. MORTALITY OF THE BLUE MUSSEL, *MYTILUS EDULIS*, UNDER VARYING SALINITY LEVELS

Matthew Brodsky, Block 1 Science Class, Marine Academy of Technology and Environmental Science; Advisors: Mr. David Werner and Dr. John Wnek

Blue mussels (*Mytilus edulis*) are bivalves that live in shallow intertidal zones of the ocean and can also be found near structures. Blue mussels can withstand many environments and conditions such as being removed from a body of water, and surviving in different salinity levels of water. Blue mussels have extreme saline tolerances, meaning they can survive in water that has various salinity levels. To determine survivorship of blue mussels in varying salinities, mussels were exposed to three varying salinity levels including: 7 ppt (oligohaline water), 19 ppt (mesohaline water), and 35 ppt (polyhaline water). Each set of 36 mussels was observed for a 21 day period to determine mortality. The hypothesis was that the mortality rate would be much higher in the oligohaline conditions. Blue mussel mortality varied depending on the salinity treatment from 100% of the mussels dying in just nine days in the oligohaline treatment, to only three mussels dying in the 21 day experiment time in polyhaline water. The results of this experiment provide better insight into the salinities necessary for optimal blue mussel inhabitance and indicates that a lowering in salinity may have adverse effects on blue mussel populations.

**ZOOLOGY (CONTINUED):**

### 804. UNDERSTANDING EASTERN MUD SNAILS AND THEIR ECOLOGICAL SYSTEM VIA THE PREVALENCE OF *PLEUROGONIUS MALACLEMYS* PARASITIC INFECTION

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

Eastern mud snails (*Ilyanassa obsoletus*) are a species of aquatic snails that live in estuarine mudflats and salt marshes on the Eastern Seaboard. These snails serve as the intermediate host to the parasitic *Pleurogonius malaclemys*; and the northern diamondback terrapin (*Malaclemys terrapin terrapin*) serves as the definite host. When these parasites attach onto mud snails, they form clear, dome-like cysts that can be seen with the aid of a microscope. Prior studies on these parasites indicate a possible correlation between the prevalence of cysts and the population of terrapins. Consequently, parasite endangerment can relate to host endangerment. This study explored the prevalence of *P. malaclemys* parasitic cysts on snails and the correlation between the physical properties of each snail (length, shell thickness, and epibiosis) and the probability of cystic infection. Measurements of 129 snails were examined for length, weight, epibiosis, and presence of cysts. Three hypotheses were created for this study: 1) The larger the snail the more likely the parasitic infection. 2) There will be a low prevalence of infected snails (i.e. low percentage of infected snails). 3) The presence of epibiosis (i.e. algal growth) will diminish the likelihood of parasitic cysts. The first hypothesis was incorrect; there was no correlation between the size of the snail (weight and length) and the presence of cysts. The last two hypotheses were correct; there was a low prevalence of infected snails overall (11%), and 79% of snails with cysts had no epibiosis while only 21% of snails with cysts had epibiosis.

### 805. AN ANALYSIS OF FAVORED BIRD SEEDS WITH BACKYARD BIRD SPECIES

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

Birds are vertebrates that can be found all over the globe. In a specific region, some species are more commonly found than others. These bird species can be named and counted for frequency in a specific area, especially if bird feeders are present. An experiment was conducted to determine the most favored seed by backyard bird species. Four of the same type of bird feeders were each filled with two cups of birdseed; each feeder was filled with a different type of birdseed. The seeds used in this experiment were black oil sunflower seed, hulled sunflower seed, safflower seed and thistle seed. The species and selection of seed was recorded every day between the hours of four and five in the afternoon for one month. As a whole, a diverse amount of birds were attracted to the different sunflower seeds. However, thistle seeds and safflower seeds were consumed by a small amount of bird species.

### 806. STRIPED BASS (*MORONE SAXATILIS*) TAGGING AND MIGRATION ASSESSMENT

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

The striped bass (*Morone.saxatilis*) is a beautiful fish. They migrate up and down the North Atlantic coast from Virginia to Maine. Striped bass should be conserved as they are a vital part of the fall and spring turnovers in North Atlantic bays and estuaries. The stock of striped bass is being depleted by regulations. Current New Jersey regulations are one fish 28 to 43 inches and one fish over 43 inches. This gives an angler incentive to catch, target, and keep the larger, egg producing fish. To show that current regulations are insufficient to keep building the stock of striped bass in the North Atlantic the migrations of striped bass were assessed via tagging and tracking. This involved the support of local bait shops and fishermen to look for the tags during the fishing season. Fish are still being tracked in New Jersey and there are some smaller fish that like to stay in the bays during the winter. In general the larger fish migrated along the coast. Information will be collected on the fish (i.e., where they are, and how big they are when they were last caught). The data will be provided to the government environmental agencies in order for them to look at the best way to conserve the species

**ZOOLOGY (CONTINUED):**

### 807. THE EFFECTS OF PHARMACEUTICALS ON WILDLIFE

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

Exhaustive research was conducted in this study to find existing data on medicine in natural water bodies. This research included the type and extent of contamination, sources of the pollutants, and the effects of the xenobiotics on wildlife. Detectable levels of over 600 pharmaceutical compounds including antibiotics, NSAID's, hormones, and other medications were found in streams, rivers and lakes throughout the United States and 70 other countries. The most common pathway for the contaminants is excretion through urine and feces of humans and animals due to the metabolic process of medications. Numerous studies have been undertaken and detrimental effects on shrimp, fish, and plants have been documented. Among the findings were stunted growth of plant roots, adverse changes in the ability of fish to reproduce, and behavior modification of fish and shrimp likely to decrease survival rates. An experiment was conducted to reproduce the behavioral changes in shrimp by introducing medicine into their environment. Shore shrimp were divided into four containers and dosed with Prozac®, Tylenol 3®, Augmentin®, or uncontaminated water. Significant changes in the behavior of all but the control group were observed.

### 808. EFFECTS OF SALTS ON BRINE SHRIMP HATCHING VIABILITY

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

*Artemia salina*, a crustacean species, is able to survive harsh conditions and environments, thriving in hypersaline habitats worldwide. The species is widely known for its eggs; the eggs are able to enter a state of cryptobiosis, in which the egg becomes a metabolic "cyst" until it reaches favorable conditions. The eggs can remain dormant for large periods of time, which is why they are often used as live food in aquaculture. One particular substance necessary for the cyst to hatch is sodium chloride, or salt. Sodium chloride is present in abundance in *Artemia*'s natural habitats, due to its ability to survive in hypersaline water. However, there are many forms of salt that are produced by humans, such as table salt, sea salt, himalayan salt, and kosher salt. Sea salt is the most often used salt in *Artemia* hatching, due to it originating from marine environments where *Artemia* would naturally be found, but it is known that iodine is present in large amounts in crustaceans and other shellfish, and many aquaria utilize iodine supplements (although it is unproven whether these actually support growth). The conclusion was made by placing 20-30 shrimp in four petri dishes containing different salt-water solutions, sea salt, table salt, Himalayan salt, and kosher salt, and then checking the progress of the hatching every 24 hours to determine the hatching viability of *Artemia* in the different salts. The *Artemia* in the table salt solution was found to have the greatest hatching viability, suggesting that something present in table salt may raise the hatching viability of *Artemia salina*.

**ZOOLOGY (CONTINUED):**

### 809. THE EFFECTS OF MICROPLASTICS ON MARINE AND ESTUARINE SPECIES

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

Plastics are used in many different products from bottles to prosthetics. However, plastics do not biodegrade, they breakdown. These particles can continue to break down until they are micro/nanoscopic). Research is being done to suggest that microplastics are very harmful to the marine and estuarine environments. However, no research has been conducted to find out the direct effects of these plastics on marine and estuarine species. My research is to observe the direct effects of microplastics on these environments. I set up two tank systems with water and representative species from Barnegat Bay. Tank 1 is a direct simulation of the bay environment, Tank 2 is the experimental tank with ground up Polystyrene. These plastic particles were put into Tank 2 in the beginning of the experiment. My research shows that the shrimp (*P alaemonetes vulgaris*) exhibit extreme signs of inflammation, lifting, irritation of the gills and particulate matter embedded in the gills. Large bubble cavities are forming underneath the carapace and inside the body systems. Shrimp, being one of the most largely consumed animals by the species in Barnegat Bay, are one of the biggest factors in bay health. When bioaccumulation of the plastics occur biomagnification will follow. Thus, the amount of plastics will grow exponentially and end up in local and global food sources.

### 810. HOW DOES THE pH LEVEL AFFECT THE BEHAVIOR AND SURVIVAL RATE OF *PALAEMONETES PUGIO*?

Christian Szablewski-Paz, Block 1 Science Class, Marine Academy of Technology and Environmental Science, (MATES) Advisor: Mr. Jason Kelsey

The grass shrimp (*Palaemonetes pugio*) is a heavily populated species in many bodies of brackish water. The species plays a very essential role in its ecosystem. Being primary consumers, grass shrimp eat much algae and other small plants in the aquatic environment. This study took adult grass shrimp, and raised them in three different levels of pH which were 7.5, 8.3, and 9.2. Behavioral and physical differences were observed along with the survival rate of the shrimp in each of the three different levels of pH. There were five grass shrimp in each of the three different bowls at the start of this experiment. Through this experiment it was determined if different pH levels affected the physical and behavioral characteristics of the shrimp as well as their survival rate. In this particular experiment, the shrimp were much more active and had a higher survival rate in the pH level of 7.5 than the pH levels of 8.3 and 9.2.