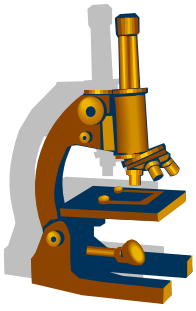
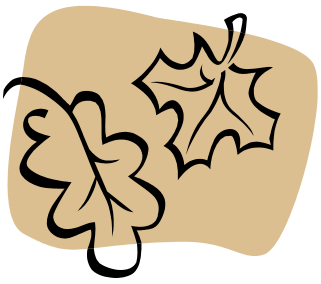
Marine Academy of Technology & Environmental Science

# Ninth Research Showcase

## Abstract Guide

## April 29, 2015





**April 29, 2015**

**It is our ninth year of the MATES Research Expo! This was a great year for student research outside of MATES with 18 projects presented at the Delaware Valley Science Fair and seven posters presented at the Rutgers Junior Science and Humanities Symposium and Monmouth Junior Science Symposium. 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 29, 2015. 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 separate 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 the poster session. 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. Jason Kelsey and Mr. David Werner (both advisors), Mr. Michael Bixler, Mr. Brian Jones, Ms. Maryann Minnier, Ms. Mia Dill, Mrs. Kelly Kelsey, Mr. Adam Sprague (advisor), and Mr. Brian Coen who contributed to the success of the project. Also, 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 helped to organize the Expo, and a special thanks to senior Michael Signorelli for helping the young researchers for the outside fairs and the 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 2015 MATES Research Expo a true success.**

**Congratulations to all of the students listed in this guide.**

**Sincerely,**

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

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## BEHAVIORAL AND SOCIAL SCIENCE

### 101. WEATHER AND ITS IMPACT ON THE NEW YORK STOCK EXCHANGE

Andrew Chinique, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Kelsey

Stock investors are always looking for new ways to get an edge over their competitors. One possible method for predicting the rise and fall of stock prices is based on the weather. In this experiment, weather data (temperature and barometric pressure) was collected daily, along with the closing price percent of change for the three major indexes in the New York Stock Exchange -- Dow Jones Industrial Average, NASDAQ, and S&P 500. This data was compiled into a table, and subsequently into a chart, to observe any correlations in the data. Upon examination of the data it was determined that there is a correlation between temperature and the daily closing price; when temperature dropped or increased, the closing price of each index would rise or fall in accordance with this. There was no significant correlation between barometric pressure and closing price. The data shows that investors are more willing to buy stocks in colder weather than they are in warmer weather.

### 102. POPULAR HOROSCOPES AND THE "BARNUM EFFECT"

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

Billions of people worldwide check newspapers or online websites to read their daily horoscope, a forecast of their future based on their zodiac sign. Zodiac signs are "scientifically" derived from the relative positions of the stars and planets at the time of a person's birth. Many people turn to their horoscope for advice or outlook on how they should live their lives. This is called the Barnum effect –the validation in which a person finds personal meaning in statements that could apply to many people. An experiment was conducted to test the Barnum effect on high school students, ages 14 to 15, and to determine if gender or zodiac sign affects the outcome. A general daily horoscope was given to each participant and asked for the relevance of that horoscope to his or her daily life on a scale of 1 to 10. A second survey asked the participants to read a personality description based on their zodiac sign and rate it on a scale of 1 to 10 on how accurate the description is to them. It was discovered that females rated both the daily horoscope and personality description higher than males. For the personality description based on zodiac sign, those with the sign Capricorn had more of a connection to their description while those with the sign Libra had the most disconnect with their description.

### 103. FONTS FANTASIA

Andrew Pardes, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Dave Werner

Fonts are a vital part of any paper, assignment, or typed document, and the font that is being used can severely affect the effectiveness of the document, completely changing the mood of the paper. An experiment was conducted testing if fonts changed the comfort levels of the reader and legibility of the font depending on sex, age, and dominant hand. Four fonts were used: a sans font, a sans serif font, a script font, and a decorative font. In the end, generally speaking, the sans and sans serif fonts were the ones that participants felt more comfortable with, and also felt were the most legible. The decorative font was found, by far, the most difficult to read, and the font the general population felt was the least comfortable. While there were results font to font, the results basically stayed the same from sex to sex, age to age, and hand to hand, showing that while fonts do make a difference, it is not dependent on other variables. This can be related to modern studies on the male brain versus the female brain, and tied into the issue in society of sexism.

## BEHAVIORAL AND SOCIAL SCIENCE (CONTINUED)

### 104. WILL PEOPLE CHOOSE TO READ AN ARTICLE WITH AN OPTIMISTIC HEADLINE OR A PESSIMISTIC HEADLINE?

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

People often say to each other that they prefer to hear good news rather than bad news. For example, somebody would probably prefer to hear that someone got into the college they wanted rather than about the actions of a terrorist group. However, the world today seems to be extremely focused on bad news about topics like ISIS, hate crimes, and other things that would be considered "bad news". Many studies have concluded that this is because people are generally attracted to bad news more than good news. This project was a study with the same goal. A survey was handed out to students; it had ten questions and each had two headlines for students to choose from—one optimistic, one pessimistic. Students were asked to pick which headline they would rather read out of the two for each of the ten questions. However, the data had very mixed results. Some questions suggested optimistic headlines were favored, others suggested pessimistic headlines were favored, and some were roughly even with results. With mixed data, it was impossible to make a definite conclusion.

### 105. AN AGE COMPARISON OF WHETHER OR NOT MEDIA INFLUENCES PEOPLE'S PERCEPTIONS OF WORDS

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

In the United States, the media has a massive influence on how Americans perceive certain topics. This is due to constant bombardment on the public's subconscious psyche. A study was conducted, testing how different age groups interpret specific "buzz-words" commonly found in the media today. Fifty participants, 25 under the age of 20 and 25 over the age of 20, were given a list of 20 words, and asked to record how each word made them feel. With an extreme variety of responses, there was no clear-cut discovery overall. However, specifically for "Soldier/Terrorist", both age groups thought of "Soldier" to be a generally positive term, and "Terrorist" to be a strictly negative term. As well as this, it was found that for "Democrat/Republican", participants under the age of 20 were generally un-opinionated for these words, while participants over the age of 20 had strong opinions for both words.

### 106. COMPARISON OF READING MATERIALS: ON SCREEN VS. PAPER

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

Because of the rapidly advancing technological age, the ways in which we read are changing. While many scientists have taken notice of this change and have begun investigating the effects of reading by electronic means, their findings are mostly inconclusive. Those that did obtain results favored paper to screen. This research was conducted to see whether more textual mistakes are identified while reading on paper or on a screen. Three age groups were established including ages 14-18, 30-45, and 65-80, and there were twenty subjects per age group. Each age group was divided in half, so ten participants read a passage with textual mistakes on the computer and the other ten read the same passage on paper. They were then asked how many errors of each type they saw. The results concluded that the age group from 65-80 performed significantly worse on the questions after reading the passage on the computer. This can be attributed to the reader having a lack of manipulation or control of the article.

### 107. DO DIFFERENT ACTIVITIES AFFECT TIME PERCEPTION IN HUMANS?

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

People perceive time in multifarious ways based on activities performed. A test was conducted to see if different activities affected the way people perceive time. Each person had to perform a task and was told to estimate the amount of time that passed since they had begun the task. It was concluded that activities do have an effect on human time perception; however, each person tested perceived time differently. When performing a task that is perceived as more enjoyable, or wherein one feels more pressure, the person usually thinks that time is passing quicker. When the task is perceived as boring or tedious, people tend to get distracted and think that time is passing slower. Overall, activities do affect the way that people perceive time.

## BOTANY:

### 201. EFFECT OF ELECTROMAGNETIC RADIATION ON PLANT GROWTH

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

Electromagnetic radiation is used constantly in our daily lives. Where ever we go we are always exposed to several forms of electromagnetic radiation; does this affect living organisms? The purpose of this project was to discover if different forms of electromagnetic radiation affect plant growth. In the project four plants and a control plant were isolated in their own faraday cage to prevent any outside disturbances of other electromagnetic radiation from affecting the plants. A television (≈64MHz), Wi-Fi router (2.4GHz), infrared light (≈28THz) and black light (≈10PHz) were each placed inside a faraday cage with each plant along with a grow light. Over a period of one month each plant was subjected to the electromagnetic radiation being emitted from the device in its cage. During this time each plants growth and chlorophyll levels were measured. The experiment concluded that electromagnetic radiation when exposed directly has a negative affect towards the plants growth.

### 202. HOW DOES ACID RAIN AFFECT THE STOMATAL DENSITY OF PLANTS?

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

The problem of acid precipitation and its effect on the botanical world has been plaguing scientists for decades. Acid precipitation occurs when airborne pollutants mix with atmospheric moisture to form rain that has a lower pH than normal. The goal behind my research was to find how acid precipitation affected plants' stomatal density. Stomata are the porous openings on the underside of a leaf used for carbon dioxide-oxygen exchanges. I had three pothos plants, each labeled A, B, or C, and watered them with solutions of varying acidities. I predicted that by the end, Plant A, which was watered with a neutral solution of distilled water (7.0 pH), would have the highest stomatal density, and Plant B, which was watered with a solution similar to acid rain (4.3 pH), would have the lowest stomatal density. However, Plant A's stomatal density was very close to that of Plant C, which was watered with a natural rain-like solution (5.3 pH). Ultimately, Plant C had the highest stomatal density and Plant B had the lowest, showing that acid rain does affect the stomatal density of plants.

### 203. EFFECTS OF DIFFERENT WATER TREATMENTS ON A PLANT'S GROWTH

Allison Cameron, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Werner

Typically a common airy houseplant, such as umbrella trees (*Schefflera arboricola*), would be watered with tap water, but the tap water they are watered with may not be as pure as one believes. Tap water can be exposed to electromagnetic radiation from ultraviolet (UV) sources and microwaves. There was a debate as to whether the tap water used to water plants can have an effect on the vertical and horizontal growth of plants. A lab was conducted to test the vertical and horizontal growth of umbrella trees (*Schefflera arboricola*). Fifteen umbrella trees were used for this experiment. The tap watered plants showed increasing growth and a strong body. The distilled watered plants, unlike the original hypothesis, significantly decreased in growth and health. As was originally speculated, the microwaved watered plants ultimately decreased in growth and health. At the end, it was determined that the nutrients in the tap water caused those plants to grow, the lack of nutrients in the distilled water caused those plants to die and the deformed molecules in the microwaved water did not fully supply water to feed the plant.

**BOTANY (CONTINUED):**

### 204. HOW MUCH SALT CAN THE COMMON CABBAGE PLANT WITHSTAND?

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

Soil salinity is a large factor when growing and planting crops. The soil salinity can decrease the water intake of plants, and interfere with the uptake of essential nutrients needed for a crop to grow. Factors that can affect soil salinity include the natural amount of salt found in the planting region's soil, the amount of fertilizers applied, and any irrigation system. This study was conducted to determine how much salt an average cabbage plant can withstand to pass its initial germination stage. Varying amounts of salt was added to different cups containing the same amount of soil. The salt content was calculated and cabbage seeds were added to each cup. Every two days, the samples were watered regardless of any outside factors. After a few weeks, all of the seeds in the cup samples that had soil salinities below about 2 dS/m had germinated to some degree and the seeds in the cup samples having above that 2 dS/m had not germinated. It was hypothesized that the cabbage plant, being a commonly grown mass produced vegetable, would be able to withstand salt contents of over 3 dS/m. The cups with salt content closer to 0 had cabbages that grew much more than cups with salt contents closer to the limit.

### 205. WHY LEAVES ARE NOT FALLING OFF DECIDUOUS TREES

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

Deciduous trees lose their leaves every year when the seasons become unfavorable. The release of hormones when the temperature drops and the shortened day length causes the formation of abscission cells. The cells weaken the connection between leaf and branch, causing the leaves to fall off. However, it seemed leaves were staying on the trees well into the winter. The effects of dry soil causing marcesence, or if it is an adaptation, have been investigated; however, it was investigated how day length may be a factor. Species such as *Quercus alba, Quercus marilandica*, and *Sassafras albidium* were studied at three locations with varying distances from developed areas such as towns with a population of about 20,000. It was hypothesized that trees closer to developed areas would hold their leaves longer because the trees are tricked into thinking the days are still long, therefore not releasing hormones at the proper time. Location one was about ten miles away from development, and all the leaves dropped by January. Location two was about two miles away from development, and all the leaves dropped by February. Location three was zero miles from development and almost all the leaves dropped by March. This shows that trees closer to more developed areas hold their leaves longer. The light pollution emitted from the towns make the days seem longer, making trees hold their leaves for a longer amount of time.

### 206. WHAT FERTILIZER HAS THE GREATEST EFFECT ON THE RATE OF ALGAE GROWTH?

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

The purpose of this experiment was to see which group of algae sample's growth was affected by the fertilizer the most. The fertilizers used in this experiment were, Jack's Classic Professional Water Soluble Plant Food, Scotts Turf Builder Lawn Food, Miracle Grow, and All Purpose Water Soluble Plant Food. The final set of samples was the control set which used no fertilizer. Four rows of three glass jars were set up in front of a UV lamp which was used to further grow the samples indoors. Every other day the row that was previously in the front was rotated to the back and 0.5 tbs of each fertilizer was added to their respective glass. The experiment showed that the control group of no fertilizer did over ten times better than the groups with fertilizer, which seemed to hinder the growth of the algae. This experiment shows that the fertilizer and its supposed algae growing chemicals have failed to live up to their reputation of being algae growth enhancers because the control group grew at a much faster rate. To further this experiment, a more effective way of exposing the sample sets to the UV lamp could be used.

**BOTANY (CONTINUED):**

### 207. THE EFFECT OF WATER PURITY ON THE GROWTH OF PLANTS

Carter Mishura, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Werner

In order to grow successfully, plants require nutrients, sunlight, and water. In this experiment, distilled water and tap water were used to test the effect of water purity on plant growth. Eight marigold plants were monitored over the course of four weeks, half receiving distilled water, and the other half receiving tap water. Each plant received the same amount of water, and an equal amount of sunlight to each other plant. The experiment found that each day, when taking the average of each plant's height, every single time the tap water plants had grown larger, or were larger, than the plants watered with distilled water. It can be concluded that the lack of nutrients in the water were a key factor in the growth disparity between the two sets.

### 208. ARE PLANTS GROWN IN AN AQUAPONICS SYSTEM MORE NUTRITIONAL FOR CONSUMPTION THAN PLANTS GROWN IN SOILS?

Logan O'Donnell, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Dr. John Wnek

Aquaponics is not a new practice, but recently it has been gaining popularity in the eyes of many farmers and even gardeners. By combining both fish and radishes in a symbiotic relationship, and growing more radishes in soil, I will determine which growing method provides the healthiest and most nutritious plant. To do this, I set up my own aquaponic system, using goldfish bought at a local pet store, and a separate pot filled with soil. Radishes were planted at the same time in both setups. When they finished growing, I harvested both plants and tested them for chlorophyll content, vitamin c content, average plant height, and leaf size. With testing complete, the results showed that the radishes grown in the aquaponic system were taller, had larger leaves, had a higher chlorophyll content, and contained more vitamin c. This information shows that the plants grown in aquaponics are both healthier and more nutritious for consumption.

### 209. WHAT ARE THE EFFECTS OF XENOBIOTICS ON PLANTS?

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

Everyday people do not properly dispose of unused xenobiotics, such as acetaminophen and ibuprofen, causing xenobiotics to make their way into the environment. For example, throwing them in the trash, flushing them down the toilet, or washing them down the drain can cause them to get into undesired locations. Xenobiotics can cause damage to ecosystems and can get into the water supply. These medications in the water supply can affect human health. For this project, the color ratios of typical house plants, Philodendron (*Philodendron scandens),* were examined on Microsoft Paint. Nine plants were used and were watered with two types of xenobiotics- acetaminophen and ibuprofen, with three concentrations of each, along with just regular tap water. All plants were watered with forty milligrams of their assigned concentrations once a week in a location with moderate sunlight. This experiment had lasted nine weeks, with the plants constantly growing, without any implications.

**BOTANY (CONTINUED):**

### 210. HOW OCEAN WATER AFFECTS TERRESTRIAL PLANT GROWTH

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

After Hurricane Sandy, thousands of homes along the East Coast of the United States were ruined. An experiment was conducted to observe how home-grown plants - plants with little tolerance for salinity - would grow with the factor of salt water. Four containers of plain organic backyard soil were set up in a room-temperature, well-lit room. Two of these containers were saturated with salt water taken directly from the Atlantic Ocean. The other two containers were left alone; no salt water was added. After all the water had absorbed into the soil or evaporated, seeds were planted in each of the four containers; eight groups of seeds in each container. They were watered every 2-3 days, and after 5 days, seedlings sprouted in the containers that were left untouched by salt water. The plants grew for approximately four weeks, and after this period was over, the seeds in the salt water container still hadn't sprouted at all, whereas the other plants were thriving. The salt water greatly affected the plants. It did not stunt the growth, but instead prevented growth altogether.

## EARTH AND SPACE SCIENCE:

### 301. CORRELATION BETWEEN AVERAGE TEMPERATURE AND TOTAL PRECIPITATION, AND CLIMATE

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

The El Nino Southern Oscillation Event (ENSO) is a weather phenomenon that occurs irregularly at about three to six year intervals. ENSO consists of two opposite phases: El Nino and La Nina. For the northeast United States, El Nino brings uncharacteristically wet and warm oceanic and atmospheric temperatures from October to March.
This investigation's purpose is to contrast precipitation and average temperature totals for Ocean County, New Jersey during the 2014-2015 El Nino season to support the theory of climate change and global warming. After analyzing the trends in the collected data, it was discovered that the total precipitation amounts are increasing, as well as the average temperatures. This experiment proves that El Nino's are increasing in severity. Furthermore, this data strongly supports and confirms the theory of global warming and climate change.

### 302. COMPARISON OF WATER RETENTION BASINS IN THE BARNEGAT BAY WATERSHED

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

Water retention basins are facilities that are constructed in permeable soil and provide temporary storage of runoff by allowing the water to permeate the soil surrounding it, and provide safety from floods to its surrounding inhabitants. Two factors that contribute to the basins' efficiency are soil compaction and their water penetration rate. However, the efficiency of local water retention basins is not known to the general public. To investigate this issue, an experiment was conducted on 10 water retention basins that are under 10 years of age, to collect information on the efficiency of a sample of the total amount of water retention basins in the Barnegat Bay watershed. The 10 water retention basins were then categorized into three categories (groups) depending on their area and then compared to each other and the other groups in order to get a basic understanding of how efficient the majority of the basins with similar area. It was found that the "D" group (large basins) had the most efficient water penetration times, followed by the "A-B" group (small basins) and the "B-C" group (medium basins) had the lowest soil compaction overall, followed by the "A-B" group. The results found that the different basin categories had their own individual strengths and weaknesses for a variety of reasons.

### 303. DOES A LANDFILL DECOMPOSE ORGANIC MATERIAL AT A FASTER RATE?

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

This study determined differences between a closed compost and open compost systems. The open compost would contain more organic material than the closed compost because it was hypothesized that the open compost would be able to keep the soil more moist than the closed compost. The experimenter tested the experiment by setting up an open compost and a closed compost in exactly the same conditions. Every month samples were taken from both composts and were tested for amount of organic material in the soil once every four weeks. This was done two times, and there was a base sample tested. In the end, the closed compost contained more organic material when the weather was warm but when the frigid temperatures of the winter came the closed compost lost its internal heat and was not able to support as much organic material in the soil. In the end, the hypothesis was proven wrong. If the open and closed composts were able to be held in warmer conditions then the results would be far more accurate.

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

### 304. THE EFFECT OF WORMS ON THE pH AND NITROGEN AVAILABILITY OF VARIOUS SOIL MIXTURES

Max Gorlach, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES);
Advisor: Mr. Jason Kesley

The effects of worms on nitrogen availability and pH of various mixtures of soil and peat moss, straw, compost, and horse manure, as well as the effects the soil has on the worm's health were tested to determine how worms can positively affect their environment. Nitrogen availability is very important, because it helps plants and wildlife grow, and pH determines which plants can grow in certain areas. This is huge in agriculture, because many crops that are produced need these two components to be ready to harvest for human consumption. After the 30 day period of testing average weight, pH, and nitrogen availability in each of the 12 sample bins, it can be concluded that worms do have a positive effect on soil, but this varies with the type of mixture. Also, the worms grew as well, which was another positive sign. The changes were only very small, having the worms grow on average less than 0.5 g, but with a larger amount of worms, as well as more factors that affect these processes in real environments, it can be concluded that they have an even larger impact in the wild than in these controlled environments.

### 305. EFFECTS OF DIFFERENCES IN SOIL COMPONENTS ON LILY PAD DISTRIBUTION

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

It was observed that lily pads grow only in a certain area of Oakford Lake in New Egypt, New Jersey. A study was conducted to examine three aspects of soil samples from areas with lily pads and areas without lily pads to see any possible differences in the samples that could lead to the plant distribution. The samples were examined for organic matter content, pH levels and number of bacteria colonies. It was hypothesized that soils from areas with lily pads would have less organic matter and bacteria than those with lily pads. After examining the data, no significant differences (according to p value) were found in any of the three categories between the samples from lily pad areas and those not. However, some possible trends were examined. Samples from areas that did not contain lily pads tended to have a higher organic matter content and higher pH level than those that did have lily pads. Therefore, the hypothesis was partially proven although no correlation was found in the bacteria.

### 306. DO GEOMETRIC SHAPES AND SPIRALS APPEAR IN NATURE AS EVOLVED ADAPTATIONS OR AS THE STRUCTURAL RESULT OF OTHER FACTORS?

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

Geometric Shapes, specifically those that are approximately regular, and spirals appear in nature in numerous places, including certain mollusk shells, honey combs, and compound eyes in insects and other arthropods. Now, have organisms taken advantage of the properties of these shapes through evolution, or have other aspects of the organism caused these shapes to appear? For example, regular hexagons can easily be placed together in a way to produce an infinite field of them, so it would be logical if organisms evolved to make flat structures composed of many units have hexagon shaped units. On the other hand, one study suggested that the hexagonal pattern of honeycombs is a result of properties of the material used to make them, rather than because of the bees' intentions. In order to determine if the majority of geometric shapes and spirals occur as a result of evolution or other factors, a large group of samples was collected where each sample had a shape present in it. Then, what structure each shape or group of shapes was a part of was determined, and the samples were grouped according to what role the shapes in them were playing. Finally, this knowledge was used to do more research to gather enough information to make an educated judgment as to whether each shape or group of shapes appeared where it did as a result of evolution or as a result of other factors. It was concluded that these shapes don't appear specifically as results of evolution or as results of other factors; also, spirals had the most occurrences as the results of other factors.

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

### 307. THE JERSEY SHORE'S HISTORY THROUGH SEISMIC LINES

Cassandra Meltsch, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Brian Jones

Seismic lines taken from offshore continental shelf locations can be utilized to determine the history and movement of sediment over time. Sediment is eroded and deposited by the rise and fall of the sea level as time progresses. To obtain seismic lines, seismologists send out ships to collect data using sound waves projected by air guns towed by the stern. The sounds are received by sonobuoys. Seismic lines were printed out from geomapapp to collect and organize this data. Unconformities and paleo-shelf-breaks on each seismic line were identified and color-coded in order to correlate them. Color-coding revealed the continuity of certain unconformities in the sediment layers. These traceable unconformities were then used to produce a map of their location. This, in turn, allowed the determination of relative age and the historical development of the continental shelves through changes in sea level.

### 308. IS NEW YORK OR PENNSYLVANIA MORE ACCURATE IN PREDICTING THE WEATHER OF PLACES SUCH AS NEW JERSEY?

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

For the average person, checking the temperature and the chance of precipitation for the week is a part of their daily routine; however many times the meteorologists make inaccurate predictions. There are no major weather stations in New Jersey, so New York City, New York and Pittsburgh, Pennsylvania stations are what is primarily used due to their close proximity. However two different states' stations means two contrasting predictions, so which one is more accurate at predicting New Jersey's weather; New York, or Pennsylvania's weather stations? Due to the fact Pennsylvania is closer to the area being tested, it was hypothesized that Pennsylvania's prediction would be more accurate. To test this hypothesis, the predicted temperature of a specific spot in New Jersey, which was Toms River, was recorded for the upcoming week every Sunday from the two stations in New York and Pennsylvania. The prediction of the chance of precipitation and its form were also recorded. Then, each day, a weather station which included a thermometer, rain gauge, and barometer located in Toms River sent the data to a tablet. The data was then transferred to an excel spreadsheet, adjacent to the original predictions to show the contrast of the forecast provided and the accurate weather. From this data, it was concluded that New York has a more accurate weather prediction for the weather of Toms River, NJ. Results showed that the New York station had more accurate weather predictions 43 out of the 77 days tested, and the Pennsylvania station had more accurate predictions 34 out of the 77 days tested. Since the New York station predicted the weather more accurately 56% of the time while the Pennsylvania station predicted the weather more accurately only 44% of the time, the hypothesis of Pennsylvania being more accurate was not supported.

### 309. THE CORRELATION BETWEEN WIND AND WEATHER

Matthew Orlando, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES)
Advisors: Mrs. Michelle Colon and Dr. John Wnek

Weather is a phenomenon that we all experience every day and is made up of several factors including temperature, atmospheric pressure, wind and precipitation. Having the ability to accurately forecast weather several hours to several days before it occurs has many benefits in both business and social settings. In this study, meteorological data was collected and analyzed over a nine month period (June 2014 through February 2015) covering three meteorological seasons: summer, fall and winter. In each season, wind direction, wind speed, barometric pressure, and precipitation amounts were analyzed to see if wind speed and/ or direction correlated to temperature, changes in barometric pressure and rain amounts. When analyzing wind characteristics by season, there was some correlation between season, temperature and predominant wind direction. For example, the winter season had more days with winds coming from the north while the summer season had more days with winds coming from the south. However, when the data was analyzed to see if the days with higher wind speeds correlated to the days of larger pressure changes, no correlation was observed. Also, wind speed did not correlate to days of rain as compared with days of no rain.

## ENGINEERING/CHEMISTRY:

### 401. FIRE DURABILITY OF METAL GUSSET PLATE TRUSSES VERSUS FINGER-JOINTED TRUSSES

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

Around the world firefighters are risking their lives to save the lives of others, and many have died because of roof collapses. The main structure that holds up a roof is called a roof truss. An experiment was conducted to see whether metal gusset plate trusses or finger-jointed trusses would be the most ideal to use if a fire were to break out. Three finger-jointed trusses and three metal gusset plate trusses were tested. One at a time, each truss was placed over fire and timed until they broke, and therefore failed. It was discovered that finger-jointed trusses held up for the longest amount of time, and therefore are the most ideal to use. Once the wood charred underneath and around the gusset plate, the metal gusset plate trusses failed and collapsed; whereas, the adhesive had to melt and loosen in the finger-jointed trusses before they failed.

### 402. THE CORROSION RATES OF INTERIOR AND EXTERIOR NAILS WITH EXPOSURE TO WATER

Keith Chinery, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Kelsey

Nails are exposed to a variety of interior and exterior environmental factors. This study focuses on such exposures. Initially, only interior nails were tested to determine how quickly they corroded and lost mass. However, after realizing that enough data would not be collected, exterior nails were added to the mix of test subjects. The nails tested were categorized in two ways: exterior and interior. The four types of exterior nails were: (1) Hot Dipped Galvanized nail, (2) Aluminum Trim White nail, (3) Roofing nail, and (4) Bright Common nail. The four types of interior nails were: (1) Wire nail, (2) Weather Strip Nail, (3) Escutcheon Pin, and (4) Molding Nail. The nails were driven into 4 different trees near a lake, so that they would be in a waterfront environment. This provides a similar environment to that of a waterfront property home, such as a lake house or a beach house. Total corrosion was measured in mass change (g), no matter how insignificant the change was. The interior nails were found to corrode much more quickly than the exterior nails, as expected. This is because they are meant to be installed inside of homes where they are not constantly exposed to a harsh environment or any water environment. It was found that only one exterior nail, the Bright Common nail, was corroded (within one day). This is because the nail is meant to hold together pieces of frame together in the structure of the home. The final discovery was that interior nails reach a point where they no longer corrode and lose mass because of the core of the nail. The materials used on the inside of interior nails are similar to the materials (stainless steel) used in most of the exterior nails. Overall, exterior nails should be used all over a house, as they do not corrode nearly as quickly and are more stable for safety in waterfront homes.

### 403. DOES HEAT RESISTANT PAINT FORM A FIRE BARRIER ON INSULATION?

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

The fire resistance of insulation has been a problem for years causing unwanted house fires which can cause deaths. Some people believe that heat resistant paint could prevent house fires once applied to insulation. To determine if heat resistant paint could really prevent a devastating house fire, melamine foam insulation was gathered and half of the samples were coated four times with heat resistant paint. They were then tested using a blowtorch to heat up the substance and a high temperature heat gun to examine the ignition point of the substance. The data was then collected and analyzed leading to an unusual occurrence. When using the heat resistant paint the insulation stayed on fire without fully burning through. The non-coated samples instantly went out once the high temperature flame was removed from the surface. From the experiment it was decided that the heat resistant paint actually sustained the flame on the surface which would allow other fires to start. This helped conclude that the heat resistant paint would assist the house fire by spreading it throughout the house at a higher speed.

**ENGINEERING/CHEMISTRY (CONTINUED):**

### 404. WHAT WAS THE IMPACT OF THE INCREASED USE OF STEEL IN THE SECOND INDUSTRIAL REVOLUTION?

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

The Second Industrial Revolution saw the invention of many new devices and materials as well as new ways to create old ones, such as steel. The influx of the use of steel in the second industrial revolution due to the Bessemer Process led to great leaps in the steel industry, allowing steel to be mass produced more efficiently. This in turn allowed for an increase of supply of steel for steel rails, which was more favorable, as it is more flexible and durable than previous materials. This also led to other machines and objects being created. The newly acquired amounts of steel were used for making more railways around the country, nearly doubling the amount of railways in the United States by the turn of the century. These railways made transportation easier than ever, leading to the effect of a more connected and easily accessible United States of America.

### 405. DOES SODA ASH OR BAKING SODA AFFECT FLAMMABILITY?

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

Soda ash and Baking Soda are both fire retardant, so: if soda ash or baking soda is added to paint, will it make the paint more fire resistant? My hypothesis was: If the soda ash or baking soda is added to paint, then the paint will be fire resistant because both baking soda and soda ash are fire retardant. My hypothesis was proven correct after my experiment was completed. Both baking soda and soda ash retarded the burning of the wood. The materials that were used in the experiment were as follows: 100g baking soda, 100g soda ash, 100 popsicle sticks, a can of white paint, a lighter, weighing paper, a balance (grams), a paintbrush, and bowls for mixing. By recording the volume of the burned popsicle stick, I was able to conclude that Soda Ash and Baking Soda do help to make paint more fire resistant. Also, the physical properties of the paint were observed as the experiment was going on. It was not as smooth as regular paint, which is probably why baking soda or soda ash isn't used in all paints.

### 406. STRENGTH AND RESISTANCE OF MATERIALS USED IN SEWAGE AND SEPTIC PIPING

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

This project's goal was to research and test the different materials used in creating piping for sewage and septic systems. In 2012, due to Hurricane Sandy, sewage pipes broke and released billions of gallons of untreated sewage water. This contaminated water poured into nearby waterways. This killed a lot of wildlife and caused a true health concern for the citizens around these areas. The main purpose of this project was to determine which of the four main materials used to create sewage piping was the most resilient to breakage. By knowing the best type of material to use, these breaches could potentially be prevented in the future. The materials tested were copper, aluminum, PVC, and steel, all with a volume of 1 $in^3$. To test the strength of these materials, they were exposed to a 20% calcium chloride solution in water over a period of 2 weeks. This compound was used to corrode the materials and simulate the underground and acidic environments in which these materials would be used. The mass was measured before and after, and the percentage lost was calculated. In conclusion, the stainless steel sample had the most resistance to this corrosion as it had lost the least amount of mass and lost the smallest percentage of its original mass. The PVC sample lost the highest percent of mass, but not overall mass. In contrast, the copper sample lost the most mass but not the largest percentage. In conclusion, steel is the strongest and most resilient material used in sewage and septic piping and is the best type of material to use when installing these pipes.

## ENVIRONMENTAL:

### 501. ARE HOMEMADE, ENVIRONMENTALY FRIENDLY PESTICIDES AS EFFECTIVE AS INDUSTRIAL HERBICIDES?

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

Barnegat Bay is host to a variety of different wildlife, many of which are vulnerable to deadly chemicals. Many people along the waterside use industrial herbicides to destroy any plants which creep into unwanted areas of their lawn or yard. Unfortunately, the chemicals utilized by herbicides often get into the bay alongside runoff from rain, allowing for the exposure of the wildlife to these chemicals. It was tested see the yields of other, less harmful homemade solutions, and to do so four plants were acquired, three to test, and one for control. The solutions were applied daily: a homemade solution comprising of vinegar, salt, and water to one plant, boiling water to another, and the Industrial herbicide "DuraZone" to the third. The fourth plant was watered, all plants given equivalent amounts of solution. In the end boiling water was the most affected after 14 days of testing; however, the homemade solution was affected the quickest, dying within five days as opposed to boiling water's seven. The industrial herbicide died about 12 days into testing and the control showed no signs of dying. This data shows that homemade solutions can be vastly more effective than industrial means.

### 502. CHANGES IN WATER QUALITY THROUGHOUT THE NORTHERN BARNEGAT BAY

Jack Kelly, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Kelsey

Barnegat Bay has become extremely polluted in recent years. Whether it has been because of natural causes, or reasons due to mistakes or abuse from humans, it is getting out of hand. Water quality is very important to the health of the animals living in the ecosystem, or the health of people who use the water as a drinking source. In the experiment, different pieces of the Water Quality Index (WQI) standards were used to determine the "cleanliness" of the water in different parts of the northern Barnegat Bay. The "northern" Barnegat Bay stretches approximately from the Mathis and Tunney bridges in Toms River to northern most point of the bay in Bay Head. In the experiment, water temperature, dissolved oxygen, and acidity were tested at four locations across the bay. These locations were spread out evenly across the northern bay in attempt to cover the most area possible. The four locations were in Toms River, Mantoloking, Chadwick Island, and Bay Head. At each site, the temperature of the air and the water would be taken first, and then the acidity of the water would be taken. Once both temperature and pH were taken, the dissolved oxygen kit would be used to determine the D.O. of the water. Each site was visited 10 times, and 38 trials of each measurement were completed. All of the results were all put into a data table and then graphed based on the days that the data was recorded. The data was relatively variable, and did not have much change throughout the trials. However, it was noted that when acidity increased, the D.O. tended to increase along with the pH. Based on the WQA (Water Quality Association) standards, the amount of acidity in the water was very slightly above average, and the D.O. amounts were above average in the water. This allowed for the conclusion to be drawn that the water quality of the Barnegat Bay is worse than many other sources of brackish/freshwater, but it is not quite as terrible as many people make it out to be.

**ENVIRONMENTAL (CONTINUED):**

### 503. WHICH ANTI-FOULING METHODS WORK THE BEST IN PREVENTING BIOFOULING?

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

Barnacles and bio fouling have been a problem for people for many years. It affects fisherman, as well as the ordinary boater. Microorganisms that grow and live on substrates in the intertidal zone are what cause bio fouling. These microorganisms and bacteria can collectively be called biofilm. Biofilm is extremely sticky and acts as an adhesive for crustaceans such as barnacles. There are many different types of products that can be used to stop bio fouling, but which one works the best and why? For this project different forms of anti-fouling methods were tested to see which one works best. There were four different methods tested: an oil-based bottom paint, a water-based bottom paint, marine grease, a rough textured surface, and a constant. The three products were painted onto PVC piping and glued onto a float along with one pipe with an extremely rough texture and one constant and then placed in water over the course of four months to test the growth that would accumulate. It was found that the water-based bottom paint worked the best at preventing growth. The water-based bottom paint, followed closely by the oil-based paint, had the least amount of growth.

### 504. HOW DO TRACE AMOUNTS OF PHARMACEUTICAL WASTE FOUND IN GROUNDWATER AFFECT MACROALGAE?

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

Pharmaceuticals used by humans are not fully metabolized and end up seeping into our groundwater via sewage treatment plants. Living organisms are then exposed to this contaminated groundwater and people have wondered whether or not the waste has a strong effect on these organisms. To see how this waste affected living organisms, samples of sea lettuce (*Ulva lactuca)* were placed in ten gallon aquarium tanks filled with brackish water obtained from the Barnegat Bay. A small amount of Diclofenac, an anti-inflammatory drug, was mixed into the water of one tank while the other was left as a control. Each day for two weeks a 1-10 scale was used to determine the condition of the samples. At the end, the overall average condition was found for each sample along with the average at the end of week one. The averages showed that the sample exposed to the pharmaceutical was healthier at the end of the experiment, and that the contaminated water has a positive effect on these organisms.

### 505. EFFECTS OF BIOFOULING FOR ROCK WEED

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

Biofouling is the process of marine organisms using a ship's hull as a substrate. When marine animals attach themselves to ships problems occur. Bio fouling can damage a ship's hull of other parts of the water craft. In addition, the ship will have multiple organisms on it resulting in a heavier weighted craft. This will cost more to move the ship since it will take more fuel. Time will also be eaten up from hauling a heavier ship around. To solve this predicament ship captains but copper on their iron hulls of boats to prevent bio fouling. Now the boat has a copper coating that brushes off into the water along with the iron. These metals make their way in plants such as rock weed. When rock weed is put in a bucket with water along with copper and iron, the plant dies quicker than just a regular bin of rock weed and water. At first the plants were decaying at a steady, even rate since they were taken out of their natural habitat and relocated in buckets. The plants with the copper and iron added started to decay very rapidly after the first three weeks. The plants absorbed the metals at first and then they couldn't absorb any more metals and started to wither. Biofouling preventions will sooner or later destroy the sea.

**ENVIRONMENTAL (CONTINUED):**

## 506. MANIPULATING THE GROWTH OF CYANOBACTERIA USING VARIOUS CHEMICAL TREATMENTS

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

Cyanobacterial algal blooms are primarily formed within freshwater habitats and estuaries when there is a surplus supply of nutrients within the atmosphere and the body of water. These algal blooms are particularly difficult to control because species of Cyanobacteria are highly adaptable in terms of their biological demands. For instance, Cyanobacteria have the ability to "fix" nitrogen levels in their environment. These algal blooms are detrimental to marine ecosystems because they increase turbidity levels and are harmful to various organisms. This research investigation analyzes what chemical is the most effective in manipulating the growth of Cyanobacteria found in water samples collected from the Barnegat Bay Inlet in Long Beach Island, New Jersey. Each water sample was injected with dosages of randomly assigned chemicals each varying in composition; the samples underwent a treatment process lasting 22 days while chlorophyll concentrations were calculated periodically to regulate population growth and chlorophyll health. When the 22 day treatment period concluded the samples were exposed to UV radiation in an effort to coerce the remaining Cyanobacteria to photosynthesize; afterwards, chlorophyll concentrations were calculated to determine which sample was the best at recovering from chemical exposure. It was hypothesized that the chemical *GreentoClean* would be the most effective in the overall manipulation of Cyanobacteria because it was the only chemical to contain sodium, which was predicted to force the Cyanobacteria to undergo a hypertonic reaction.. The chemical *GrrentoClean* which was injected into Sample 1, was statistically the most productive in the overall manipulation of the Cyanobacteria in terms of population and chlorophyll decline after chemical treatment and ultraviolent radiation.

## 507. WATER FILTRATION USING PEAT MOSS

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

Peat moss is known for its ability to absorb up to twenty times its mass in water and nutrients. The purpose of this experiment was to determine if it is possible to use peat moss to absorb nitrogen (tested as nitrates) from Barnegat Bay. To test this, little floats filled with peat moss were built, and added to a container filled with five gallons of bay water. Colorimeter tests were run every day to test the nutrient levels. Originally, the nitrogen level in the water was approximately 2 ppm. After one week of being filtered through the moss, the nitrogen level was 0 ppm, proving peat moss can be used to filter contaminants from water. In the future, peat moss can realistically be used to remove nitrogen – as well as other contaminants – from bodies of water. Larger versions of the floats built for this experiment can be easily attached to the bottom of navigational buoys in Barnegat Bay, or attached to pilings in local marinas to stop runoff at the source.

## 508. DO FERTILIZERS AFFECT ALGAL GROWTH?

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

Algae growth can be harmful to the environment. The excessive growth of algae causes the depletion of oxygen, leading to the death of many organisms and the decrease of populations. In a lake, and any waterway, fertilizer runoff adds nutrients to the water, such as nitrogen and phosphorus, which when in excess, are detrimental to the water body. These nutrients increase the growth rate of algae and decrease the levels of oxygen. To see how fertilizers affect the growth rate, water samples from a nearby lake were collected. Then, different concentrations of fertilizers were added to the water samples, put in cups, to measure the algae growth over a period of time. After six weeks, the cup with the highest concentration of fertilizer had over four times as much algae as the cup with no fertilizer. In conclusion, fertilizers increase the rate of algal growth. In order to improve water quality, methods to decrease the release of excess nitrogen and phosphorus should be implemented.

**ENVIRONMENTAL (CONTINUED):**

### 509. WHICH DEICING AGENT HAS THE LEAST NEGATIVE IMPACT ON THE ENVIRONMENT?

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

In colder regions accustomed to winter months with an abundance of snow and ice, deicing agents such as road salts and brine solutions are utilized to ensure the safety of motorists and pedestrians. With the application of such deicing agents, it is inevitable that the solutions will eventually be introduced to the environment, impacting vegetation and other forms of wildlife. An experiment was conducted to assess which common deicing agent would have the least negative influence on vegetation. Five deicing agents with varying compositions were tested. Seeds were watered with solutions of each deicing agent and ice to determine which of the deicing agent was safest and thus enhanced plant growth. It was discovered that the deicing agent containing methyl alcohol and denatonium, known as Rain-X® De-Icer™, had the least effect on the vegetation tested as evident by the plant growth. It was observed that the minimal impact of Rain-X® De-Icer™ is due to the fact that it was the only deicing agent tested that was purchased in the liquid state, and therefore the salt content of the agent was already diluted.

### 510. CHLORAMINES IN MUNICIPAL WATER SOURCES OF OCEAN COUNTY TOWNSHIP

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

Chloramines are secondary disinfectants used in treating many municipal water sources and are formed when adding ammonia to chlorine. Although the EPA considers this disinfectant to be virtually unarming, there have been reports of respiratory, skin, eye, and digestive problems in areas where chloriminated drinking waters are used. An experiment was conducted to find out if chloramines were present in municipal water sources and to see if the amount of chloramines was enough to adversely affect the human body. Another aspect of the experiment was to see if there was a buildup in the amount of chloramines present in the first flush of water compared to the second flush. This was done by collecting first and second flush water samples from various Ocean County townships. Water was then tested for chloride and ammonia to see if chloramines were present. Once data was collected, it was evident that there were no chloramines present in the municipal water sources. It was concluded that there were very miniscule amounts of ammonia in the water sources; therefore, few chloramines could form. Results also showed that there was not an increase or decrease in the amount of chloride or ammonia in the first and second flushes of water.

## HEALTH AND NUTRITION:

### 601. THE PRESEVATION OF POTATOES AND ONIONS

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

Potatoes and onions can be stored in a myriad of ways. This experiment tested four of these ways: a brown paper bag, a perforated brown paper bag, a Ziploc bag, and no baggage at all. The potatoes degraded at a normal speed as most root vegetables would, except the potatoes in the Ziploc bag, which degraded slower. As the experiment came to its closing weeks, wrinkles on the potatoes developed in all but the Ziploc bag. The onions were preserved for the entirety of the experiment, due to this; onions can be stored in any cool dark place and last for a long time. As for potatoes, the best way to keep them fresh and wrinkle free is to run down to a local super market and pick up a container of Ziploc bags.

### 602. EFFECT OF MUSIC TEMPO ON PARTICIPANTS' VITALS AND REPETITIONS DURING EXERCISE

Madison Desmond, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Werner

In one lifetime, people are exposed to music of different genres, tempos, and popularity. Many people tend to integrate music into their daily routines; for example, listening to music while exercising. Several studies have shown correlations between heart rate and music and between music and exercise proficiency. But does the tempo of music affect the participant's vital signs post exercise? The purpose of this experiment is to see how the tempo of music affects someone when exercising. Subjects had their blood pressure and heart rate measured before exercising, then did an exercise for a minute listening to either fast, slow, or no music. Their blood pressure and heart rate was then measured again along with the amount of repetitions they completed. These "before and after" measurements were then compared and their differences were compared to that of the other music types. The results of this experiment were inconclusive when comparing the change in blood pressure and heart rate, with patterns seen in some participants. However, the amount of repetitions completed for each exercise was consistently greater when listening to face paced music than when listening to slow paced or no music. This shows that listening to music while exercising may not affect the change in blood pressure and heart rate the same way for everyone, but it seems that it consistently affects the amount of repetitions completed.

### 603. HOW DO VITAMIN D AND VITAMIN C AFFECT BONE DENSITY?

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

Our bones are a vital part of our everyday lives and without healthy ones, we would not be able to carry out everyday actions like walking and running or protecting internal organs like the heart and lungs from injury. The purpose of conducting this experiment was to see how Vitamin D3 and Vitamin C affect bone density, thus also affecting bone strength and health. Nine different chicken bones of equal size were measured at the beginning of the experiment and then once a week throughout the month of January 2015. The bones had there masses and volumes measured using a balance and a graduated cylinder. The densities of the bones were calculated using the density formula of D-M/V. Then they were placed in filled plastic containers with 600mL of distilled water with the dissolved vitamin tablets. The densities were then measured again and the data from pre and post vitamin exposure was compared to reveal that there was in fact an increase in bone density. If this study was continued, bones would be exposed to higher doses to see how bone density would change

**HEALTH AND NUTRITION (CONTINUED):**

### 604. ANTIBACTERIAL RESISTANCE OBSERVED IN HOUSEHOLD BACTERIA

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

Antibiotic and antibacterial-resistant bacteria, "superbugs," have emerged in recent years with the increasing overuse of products to kill bacteria. Superbugs are threatening the effectiveness of modern medicine by making it difficult to treat bacterial infections with available medications. The dangers of superbugs raise the question: Can antibacterial-resistant bacteria develop from household cleaners? To investigate this, 15 agar plates containing bacteria collected from a computer keyboard were exposed to an antibacterial cleaner at varying intervals— daily, twice a week, weekly, every two weeks, and every three weeks. There were 3 controls that were not exposed. After one month, all of the plates, including the controls, were exposed to twice the amount of cleaner and left untreated for two weeks; this double treatment was repeated with a one month waiting period. Throughout the first month, bacterial growth was observed in all of the plates. During the two-week break, only samples exposed to the cleaner daily had growth observed in all three plates. After the two-week break, no growth was observed in any plates. Although growth stopped after the first month, the initial results suggest that bacteria more often exposed to antibacterial products will have a greater resistance than bacteria exposed less often.

### 605. DO BREATHING TECHNIQUES ACTUALLY WORK?

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

Some people say that taking deep breaths helps people to relax and de-stress. To test this hypothesis, the blood pressure was taken of forty- one high school students before and after a breathing technique to see whether the blood pressure decreased, meaning the subjects relaxed. There are two parts to blood pressure, there is systolic which measures the pressure in the arteries between heart beats, and diastolic, which measures the pressure in the arteries between heartbeats. Thirteen of the students had just their systolic decrease; eight students had just their diastolic decrease, nine students had both their systolic and diastolic decrease and the other eleven had both their systolic and diastolic increase. The data was further analyzed to find any correlations to see who this technique worked best for. It seemed that this technique worked best for teenage females because male subjects showed more of an increase in both of their systolic and diastolic. Most of the students had their blood pressure lowered in some way and trying anything to reduce stress is worth a shot.

### 606. DIFFERENCE IN CONCUSSION RATES BETWEEN LEATHER SHELL AND PLASTIC SHELL FOOTBALL HELMETS

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

The purpose of this study was to determine whether modern plastic shell football helmets reduce concussion rates significantly more than old, leather-shelled ones. In order to determine the effectiveness of each, the parts of the helmets were broken down and compared to the same parts on the other helmet. It was immediately evident that the modern plastic helmet had a more intricate structure specifically designed to lessen the likelihood of concussions. Data and statistics regarding concussion rates for each helmet type were then compared from several different resources. In the data collected between the part comparisons and the statistical analysis, it was determined that while modern helmets did not improve concussions from jerking and twisting motions, they do significantly improve concussion rates from blunt forces to the head. This improvement alone accounts for an approximate 60% decrease in concussions between old-school leather helmets and modern plastic ones.

**HEALTH AND NUTRITION (CONTINUED):**

### 607. DOES COLOR HAVE AN EFFECT ON SOMEONE'S FOOD CHOICE?

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

Every day, without knowing it, we make choices. Colors and other aspects of visual appearances play large roles in these choices. Many businesses, including the food industry, depend on marketing teams to make sure that their products appeal to the group that they are selling to. A study was conducted to see if there was a correlation between the color of a food item that someone chose, and how old they were. Three age groups consisting of ages 5-9, 14-18, and 35-45 were surveyed. Each participant was asked to select one of each food item provided: cookies, biscuits, and mashed potatoes; with each food consisting of the colors: red, yellow, green, and purple. Each color was assigned a value 1-4 so they could be averaged for numerical data. The group displaying the highest correlation was the 14-18 age division, which showed a preference for yellow foods. The 5-9 age division fell into the middle of the three as far as correlation goes, with scattered data; but a larger amount of them picked yellow and green foods. The division with the most widespread data and least correlation was the 35-45 age division. These results could have been scattered as a result of the wider age range.

### 608. THE EFFECTIVENESS OF EGG SUBSTITUTES IN VANILLA CAKE

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

Egg substitutes are important to people with egg allergies, people who live a vegan lifestyle, and people who have simply run out of eggs while baking. There are some widely known egg substitutes that are commonly used, but were never tested. I wanted to determine the effectiveness of different egg substitutes in a cake. I did this by making many cakes to test many different egg substitutes. Using the data collected from baking with existing egg substitutes, I came up with an improved egg substitute. Based on qualitative factors, the egg substitute with baking soda, vinegar, banana, and baking powder most closely resembled a cake made with actual eggs. This will be very helpful to people even if they do not realize it. It may even be a business opportunity in the sense that a new egg substitute could be put out on the market for consumers to buy.

### 609. THE EFFECTS OF TEMPERATURE ON BACTERIAL GROWTH IN ROTTING FRUIT

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

The process of fruit ripening and subsequently rotting varies depending on the fruit in question, but most often revolves around proteins in the fruit breaking down starch into the sugars that make fruit sweet. This decay of starch does not stop until all the starch has decayed into sugar. This decay is more commonly called rotting. Rotting gives way to bacterial infection in fruit which makes it unhealthy or even dangerous for human consumption. In turn, this sometimes causes food-borne illnesses and immense economic damage due to lost produce. However, multiple factors have been determined to accelerate, slow down, or even stop the rotting of fruit for extended periods of time; one of the most prominent factors being temperature. When tested, the room temperature fruits rotted the fastest and had the highest bacteria count overall. This contradicts the belief that the heated fruit would rot the fastest.

**PHYSICAL SCIENCE:**

### 701. A COMPARISON OF THE THERMAL MASSES OF POTENTIAL BUILDING MATERIALS

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

Every object or substance in the entire universe absorbs and emits heat in the form of thermal energy at different rates. Thermal mass is an object's tendency to hold in thermal energy or heat; objects with more thermal mass will change temperature slowly and objects with a low thermal mass will take in heat with more speed. With that in mind, infrastructure built with thermal mass objects will be more environmentally sound in temperature control. To find an object that has good thermal mass to take advantage of in building, practical substances (water, sand, compacted earth, air, and glass in the form of marbles) in equal volume were heated in a solar oven at temperatures of 93 degrees. The internal temperature of these substances was taken every five minutes until change was unable to be recognized. The materials were then cooled, measuring again in five minute intervals until change did not occur at a measurable rate. Data was analyzed, graphed and compared in properties of average change per minute, total time of temperature change, variance in rate of temperature change and the rate of change in cooling versus rate of change in heating. Liquid water was the slowest in absorption and emission of thermal radiation. Dirt had the second best absorption and emission rates, preceded by sand, glass, and air, respectively.

### 702. EVALUATION OF SURFACES FOR GREATEST EARTHING EFFICIENCY

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

Despite footwear being used as protection and style, the question referring to their overall health remains. With the absence of footwear and barefoot treading of Earth, the biological process known as grounding occurs. Because the Earth is a gigantic electromagnet that emits free roaming electrons, only through direct contact with skin and the Earth's surface can grounding, or the absorption of these electrons, occur. Earthing (or grounding) has been proven to cleanse, heal, and calibrate many components of the human body, including bioelectrical stress, electrophysiology, immune system functions, circulation, synchronization of biorhythms and other physiological processes. The science behind grounding's success is the fact that the electron's absorbed will stabilize free radicals within your body. If these free radicals are not stabilized they will continue to abscond with the electrons of the nearest stable molecule, causing another free radical to be created, ultimately "leading to cell damage and homeostatic disruption". In an effort to decipher between the most successful locations for grounding, test subjects walked thirty minutes on three different terrains: grass, asphalt, and the beach. Within an hour after each trial an oxidative stress test was taken to determine the grounding effects of each terrain. Through this experiment, it was concluded that grounding on the beach was the most effective because of its closeness to the highly conductive ocean.

### 703. WHY DO SYNTHETIC AND CANE REEDS DIFFER?

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

The purpose of this experiment was to compare synthetic and cane saxophone reeds and figure out why they are different. It was hypothesized that there will be a difference in response, playability, and tone quality due to the cane reed being made up of natural fibers, while synthetic reeds have fabricated fibers. The difference in material greatly changes the way the reed will vibrate, thus changing the sound. To begin the experiment, a synthetic reed was acquired (Legere Signature) and a cane reed was acquired (Vandoren Java). Both reeds were tested by playing a piece of music and playing a series of whole notes. Response, tone, and playability were recorded. Afterwards, a visual analysis was conducted and color, texture, and structure were recorded. The results showed that the two reeds were drastically different in both the play and visual tests. Despite research into why the reeds played differently, no credible sources relating to the hypothesis could be found. It is believed that the composition of a cane reed cannot be mimicked by any sort of man-made material. For this reason, the cane reed has an "imperfect" makeup that affects the vibration of the reed which, in turn, affects the sound and distinguishes it from the synthetic reed.

**PHYSICAL SCIENCE (CONTINUED):**

### 704. ELASTICITY AND DURABILITY OF DIFFERENT TYPES OF WOOD

Suzie Kuhne, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Kelsey

One of the most important, as well as abundant building material in the modern world is wood. Nearly every house, building, structure, etc. has some kind of wood incorporated into its design. The strengths of different kinds of wood are relatively well-known and easy to find out; Most people know that oak is strong and sturdy, while pine is much weaker. However, since oak is stronger than pine, it does not necessarily mean that oak will be able to hold more weight. Pine may be weaker, but it is more flexible than oak, bringing to light the question: Is this advantage in flexibility enough to allow pine to hold up more weight than a stronger material such as oak? The experiment that was conducted tested how far a piece of wood would be pulled down by an increasing amount of weight. This was done by hanging a bucket from the wood and filling it with more and more sand while measuring how far the wood bends down. After the results were collected, it was found that on average, the stronger woods bend the farthest and last the longest. This information can provide more insight when people need to know about these properties of the material, and can help them decide which material to choose while constructing something.

### 705. WOOD BATS – WHICH TYPE LEADS THE PERFORMANCE LINEUP?

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

An important task for baseball players is choosing the right bat – it is a tool of their trade. This experiment was designed to determine the best performing wooden bat. A two part procedure was utilized to obtain data from wooden bats made of maple, ash, birch, and bamboo. Part one used a homemade stationary bat device to measure ball distance off of each motionless bat; where part two used three live batters to measure ball distance from their hits to account for the varying swing of individual batters. Bats with consistent length and weights were used and the same distance from pitcher to bat, pitching technique, and batter age were maintained. Multiple trials were performed on the bats and averages were graphed to display results. The results of the stationary and live batter testing both show the ash bat as the best performing bat with an average stationary distance of 99.44 inches and batter distance of 65.05 yards. For any baseball player considering the use of a wooden bat, it is recommended that they use a bat made of ash wood, as it was found to be the best performing bat.

### 706. THE EFFECTS OF THE SUN AND WATER ON COMPOSITE DECKING AND WOOD

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

Most people would argue that Trex decking material performs better than regular wood. However, there is one major drawback to Trex—the price. Trex decking can cost as much as seven dollars per square foot which is more than twice as expensive as most wood decking materials. For my project, I wanted to test the actual durability of Trex to see if it really lives up to its marketing claims and high perceived value by consumers. I also studied what organisms can grow on Trex compared to wood by submerging samples of both materials into a freshwater lake and analyzing results every 2 weeks for a three month period. To test one of Trex's durability claims, I used a SunTest machine that simulates aging of materials exposed to sunlight in an accelerated timeframe. One 24 hour session simulates roughly 12 months of actual time. After the first test, the Trex appeared to be 10% lighter than its original color. I also completed the simulation process for 72 hours which is equal to approximately 3 years. After, the full 72 hours, the color of Trex was 25% lighter than its original color. Unfortunately, the results of the submersion tests were inconclusive because of the numerous climate factors. Factors such as the change of seasons from fall to winter and the excessively cold temperatures for long durations certainly impacted the expected organism growth.

**PHYSICAL SCIENCE (CONTINUED):**

## 707. MOST EFFECTIVE VELCRO FOR WRIST ORTHOSIS

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

In standard wrist orthoses used to support sprained or broken wrists, the use of Velcro hooks and loops are necessary in order to set and adjust straps that hold orthosis together for comfort and support. To be able to construct the most effective and durable wrist orthosis, the strongest materials are needed. The purpose of this experiment is to determine which are the most durable types of loop and hook Velcro strapping to produce the most secure custom fabricated hand and wrist orthosis. Two different hooks and five different loops were tested. Another question to be answered by this experiment is if the certain kinds of Velcro strapping loops break under repetitive removal and securing of certain different Velcro hooks. If the loops break with both the removing and securing from the hooks, it would cause the amount of force needed to remove the Velcro strapping loops to decrease. Therefore, the Velcro loops would not be held securely enough to the hooks to create a stable hand and wrist orthosis.

## TECHNOLOGY AND ENERGY:

### 801. CAN SMALL-SCALE HYDROELECTRIC GENERATORS BE USED EFFECTIVELY IN EXISTING CANALS?

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

Water is the most abundant resource this world offers. In more recent years, it has been used for more than housing aquatic wildlife and sustaining life in the world, it has proven to be a well-received, renewable source of electricity. Dams and underwater turbines are able to harness energy created through the constant motion of water and convert it into electricity. Hydroelectric generators can be profitable for the manufacturers, as well as beneficial for local economies and reducing the local carbon footprint. In this project, I tested a miniature hydroelectric generator in a canal where water currents and waves were not as common as they would be near an ocean. The generator was tested to see if it would function in the waters of a canal, leading to a success. Using a faucet turned on different settings, the amount of electricity generated was recorded. From this, it was concluded that hydroelectric generators would indeed be effective in existing canals. This data can help businesses such as marinas or even local power grids that exist near canals to profit from storing energy.

### 802. GENERATING RANDOM NUMBERS USING SOCIAL MEDIA

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

This project investigates how random different random number generators are. A total of five random number generators were tested. Testing began November 3rd and lasted until January 10th. During these tests a script would continuously create random numbers and add them to a database. Each test collected three to four million random numbers. The purpose of this project was to see if better random numbers could be generated without the use of external hardware or a third-party generator service. The random numbers from each test were run through several different analyses. In the end a boxplot, and the p-values from a chi squared test on each were found. The chi squared p-value shows correlation in a set of data, the higher the p-value the more random the data is. The 4th version of the random number generator that used twitter to generate random numbers was the most random with a p-value of 56235223621678.4. My hypothesis stated that using photos from social media sites that were stored in a cache and randomly selected would yield the best random numbers. Unfortunately when building the random number generators I found that it is not practical to fetch photos from social media due to request limits set by such sites. It is more practical to use tweets to generate random numbers.

### 803. AT WHAT DISTANCE CAN RFID READERS DETECT TAGS WRAPPED IN DIFFERENT MATERIALS?

Perbhat Kumar, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Kelsey

Radio frequency identification, or RFID, is a technology used in almost everything. Many objects, from credit cards, to EZ passes on the highway use RFID to process payments, or transfer data. Though RFID may sound secure, it is quite the contrary. Many RFID hackers and criminals could easily come into proximity of an RFID powered credit card, and steal data, such as a credit card number, name, expiration date, and even a billing address. With advanced enough equipment, it is even possible to clone a credit card, or even an RFID key, passport, bus pass, and many other means of identification. In a recent study done by a group of developers and hackers, it was shown that decrypting an RFID reader only required a few lines of code in the programming language known as Ruby. The study describes the dangers of being too reliant on RFID, and shows how in some cases, the credit cards from an entire store can be exploited! This experiment tested different materials that could prevent RFID data leaks, and at what distance from the reader they were detectable. Materials such as stainless steel and water were the most efficient at blocking the RFID readers, while aluminum was very helpful in protecting the cards. So, even if it is convenient to just touch a card to a scanner to process a payment, it is not very secure, and if exploited, could cost a lot of problems and money.

**TECHNOLOGY AND ENERGY (CONTINUED):**

### 804. DO PERSONAL ELECTRONIC DEVICES SUBMIT AN UNSAFE AMOUNT OF MICROWAVE RADIATION?

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

Personal devices used across the world every day emit microwave radiation. While these devices make life easier, they also may be shortening it by exposure of excess radiation. This radiation can lead to harmful effects like cataracts. This experiment is designed to test and evaluate the exposure people are experiencing from these devices. Multiple devices were observed, ranging from tablets and wireless headsets, to controllers and phones on Wi-Fi, from multiple years and manufacturers. The devices were measured inside of a Faraday cage to optimize the validity of this experiment by decreasing outside interference. The objects were placed next to a microwave leakage detector measuring from 0 - 9.99 $mW/cm^2$. Items were then tested for their emission through clothing where they would be used (laptop through jeans). The results of this experiment indicated that while many devices were below the safe 5.0 $mW/cm^2$ limit, some products exceeded this limit. The unsafe products were mainly manufactured by Apple and Microsoft and were more dangerous than newer models.

### 805. CAN AN INEXPENSIVE MICROCONTROLLER/SMART DEVICE SOLUTION SERVE AS A RELIABLE REMOTE RESIDENTIAL ENVIRONMENTAL MONITOR?

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

Among the problems of owning a vacation home along the eastern coast of the U.S., the potential for mold growth and frozen pipes is an issue that needs serious consideration. One possible solution to these problems is a WIFI-enabled thermostat that would allow you to monitor a home's temperature and humidity remotely. One of the more popular WIFI-enabled thermostats is the NEST™ ($249). The NEST™ remote monitoring solution has numerous shortcomings, such as dependence on power provided by the HVAC system, the requirement of a WIFI internet connection, dependence on a proprietary web server, and the lack of back-up cellular-based SMS text alarms. With the availability of inexpensive microcontrollers and smart cellular telephones, an inexpensive remote temperature and humidity monitoring solution should be achievable and able to address the problems mentioned above. After investigating numerous microcontroller and smart phone HW/SW combinations, a Raspberry Pi™ microcontroller (Python SW) and an Android™ smart phone (RFO Basic SW) combination was selected. When this combination was connected to an inexpensive temperature/humidity sensor, testing confirmed that SMS text alarms for temperature, humidity, and system status could be reliably sent to a remote location.

### 806. LIVING OFF THE GRID

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

The power grid is a connected system that carries electricity from the generators, such as nuclear power plants, to our homes in specific areas. However, when blackouts occur from power shortages and natural disasters, no one has power for extended periods of time. This leads to the question - Is it possible to live completely off of the power grid? To see if it is possible, I have constructed a miniature environment. The mini environment has one solar panel and battery, and three outputs, or loads: a car stereo, LED lights, and an auxiliary jack that can be used to charge a cellular phone. The solar panel provides unlimited energy to charge the battery, which then in turn powers the loads. This makes it possible to live 100% off of the electrical grid.

**TECHNOLOGY AND ENERGY (CONTINUED):**

### 807. HOMEMADE HYBRID POWER PLANT

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

Several homemade versions of wave turbines and river turbines have been made and posted on the internet. However, no one has attempted to create a design of a homemade device that would have the ability to produce power in both waves and rivers. An experiment was conducted with a device made from wood, plastic, and a toy motor held together by plastic to see if it was possible to design a homemade device that could produce power in both rivers and waves. The device was first tested in a slow moving river. While the voltage output was small, it was still able to produce power. Then, the device was tested in waves albeit a small amount of power. The device was able to gather more electricity from wave action than river action. This could have been due to the fact that the river in which the device was placed in was partly frozen in ice and was also very slow to begin with. It was concluded that it is possible to design a homemade device that can produce power in both waves and rivers.

## ZOOLOGY:

### 901. DOES THE TYPE OF SEDIMENT AFFECT THE SURVIVAL RATE OF INVERTEBRATES?

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

Throughout all the different bodies of water found in New Jersey, there are many different types of sediment as well. In all the different bodies of water, many different animals can be found living there, including brine shrimp. This study took adult brine shrimp (*Artemia salina*), and raised them in four different types of sediment (leaf litter, mud, sand, and gravel), to see if there was a change in survival rate. A count of remaining live shrimp in each habitat was done each day to calculate this rate. During this whole process, the brine shrimp were also fed yeast, and were kept in room temperature water. Through this experiment, it can be determined whether or not the type of sediment in different bodies of water affects the survival rate of organisms living in them. In this particular case, the brine shrimp did the best in the leaf litter.

### 902. *CARCINUS MAENAS*: INVASIVE OR NOT INVASIVE?

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

Patterns in nature can lead to discoveries of habit and behavior. I observed patterns in the dietary habits of crabs in Barnegat Bay. More specifically, European green crabs (*Carcinus maenas*), black fingered mud crabs (*Panopeus herbstii*), and blue crabs (*Callinectes sapidus*). The green crabs have acted as an 'invasive' species so it can be observed if they affect the environment in a negative way or not. Studying the similarities and differences between the eating habits of these crabs can contribute to discovering which crabs are being outcompeted, which species consume food faster and in larger quantities, and how long it takes for the species to reach the food. The crabs have been given different amounts of food and time was measured to observe how long it takes for all of the food to be consumed. All crab species were placed in the same tank where their behavior for space was also observed. Some variables in this experiment include the amount of food (measured in teaspoons), the approximate size of the crabs, and how long it took for the food to be consumed. The results of this experiment can help to conclude whether green crabs should still be considered invasive, whether they are out-competing other crabs for food and space, and whether or not action needs to be taken to remove green crabs from the bay in favor of other species of crab.

### 903. EVOLUTIONARY ANALYSIS OF FISH MUSCLE PROTEINS BASED ON GEL ELECTROPHORESIS

Jessica Intile, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES);
Advisor: Mr. Adam Sprague

Evolution is a theory presented by Charles Darwin which explains that all living organisms come from common ancestors but have experienced phenotypic changes over time. Some organisms are more closely related than other organisms depending on how recently they shared a common ancestor. Analyzing the relationship between organisms helps classify species and allows for a greater understanding of how life came to be. The relation of organisms can be shown by analyzing similarities in proteins. The evolutionary relationship of various species of fish was studied. The muscle proteins of six different species of fish were extracted, denatured, and separated through protein gel electrophoresis. The results show evidence that all six of the species studied are closely related. This experiment provides significant evidence of evolution and shows which species of fish are the most closely related.

**ZOOLOGY (CONTINUED):**

**904. DO PESTICIDES EXIST IN PRODUCTS FROM COMMERICIAL AND NON-COMMERCIAL HIVES?**

Cedric Jankowski, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Jason Kelsey and Mr. Michael Long

From the time they were brought to the Americas in the 1700s, honey bees have had a major impact on American agriculture and ecology. However, in recent years, honey bees in North America and Europe have been affected by a disorder called Colony Collapse Disorder (CCD). Attempts to diagnose CCD have traced the cause back to the use of pesticides in commercial farms and residential properties. Some beekeepers have used organic apiaries to minimize the loss of their beehives. This experiment aims to discover if traces of pesticides in samples of honey from commercial and non-commercial apiaries exist and if these pesticides actually affect the survival rates of the honeybees which produce that honey. In the experiment, three separate NIDS® ACE III-C Rapid Tests were conducted to detect a presence of pesticides in pollen and honey from a non-commercial apiary and raw honey from a commercial apiary. The results of these three tests showed that the pollen and honey from the non-commercial apiary both showed a negative result for a presence of pesticides. The raw, commercial honey however, showed a positive result for pesticides. These results were then compared to two tables of survival rates, one showing survival rates from the non-commercial apiary, and another showing survival rates for commercial apiaries throughout the U.S. The results from the 2013-2014 winter (90% survival for non-commercial and 77% survival for commercial) show that the organic apiary has greater survival rates for its honeybees.

**905. TESTING HOW SPONGES REACT TO CHANGES IN TEMPERATURE AND SALINITY**

Sean Martin, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisor: Mr. Werner

Sponges, such as the red beard sponge, are critical to nearly all aquatic ecosystems. They ensure that ecosystems remain healthy, and reduce the possibility of plankton and algae blooms. The experiment is based on testing how these sponges react to changes in temperature and salinity, and whether or not an extended change in weather could potentially harm sponge populations. That would inevitably lead to damage to entire ecosystems due to the increase in plankton and algae. It was hypothesized that changes in salinity would be extremely harmful, and that changes in temperature would not have much effect. Using supplies and techniques supplied by a teacher/advisor, several trials were carried out to test how these factors could affect sponges. The hypothesis was partially correct in that high salinity environments had extreme negative effects on the sponges. However, the rest of the hypothesis was incorrect, as the change in temperature also had a negative effect on the tested sponges. Low salinity environments had little to no effect on the sponges, and they remained relatively unaffected by the change in conditions.

**906. THE EFFECTS OF CAFFEINE ON BRINE SHRIMP**

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

Caffeine, a substance consumed daily by humans, has the effects of a stimulant. It is possible that when exposed to caffeine, brine shrimp would display differences afterwards. This experiment was conducted to find out what happens when brine shrimp is exposed to different concentrations of caffeine. Caffeine is one of the pollutants/toxic substances that plays a major role in the death of brine shrimp. So this experiment is very important because it is concerned with the harmful effects of chemicals released into the environment by households in low population areas. Those areas specifically have less management programs and little or no wastewater treatment plans to control the amounts of caffeine being released into the waters. Samples of this experiment were prepared by dissolving different concentrations of caffeine in water, then mixing it with brine shrimp and saline water to see the behavior/reaction of the species. After conducting the experiment, the results showed that caffeine affects brine shrimp negatively and it is definitely not something that should be released into the waters.

**ZOOLOGY (CONTINUED):**

### 907. HOW DO COMB JELLIES RESPOND TO STIMULI

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

Comb jellies, a bioluminescent marine organism, can live close to the shore, feed on planktonic organisms and sometimes are cannibalistic. Other comb jellies occupy deeper ocean waters and eat only plankton. It is possible that the species of comb jellies used in this project, Beroe's comb jellies (*Beroe sp.*) live close to shore, and within inshore estuarine waters, because of the additional light generated by human development. This project was conducted to see how comb jellies respond to different forms of light and how that might affect them. Many more comb jellies responded to an LED light than a green glowstick, possibly because of the pulsations emitted from the LED light that are similar to that of the comb jelly. The green glowstick was used because some of the comb jellies prey consists of bioluminescent plankton whose color could be similar to the green glowstick. The LED lights were used in this project because of how much more often LED lights are being used in and around New Jersey waterways.

### 908. pH-LEVELED ORGANIC MATERIAL CONSUMED BY MUD DOG WHELKS

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

Ocean acidification is occurring rapidly over the past few decades, due to air pollution. With the pH of the saltwater decreasing, the organisms living in the ocean will have to adapt to lower pH of the organic material and organisms consumed. This experiment would answer the question: Would invertebrates be able to survive off of acidic organic materials? Mud dog whelks (*N. obsoletus)* were used to observe potential changes when the organic material was submerged with acidic, normal, or basic solutions. *N. obsoletus* were equally deposited in three tanks, each with similar organic material submerged in orange juice (acidic pH tank), pure water (normal pH tank), or alkaline mouthwash (basic pH tank). *N. obsoletus* secretes an acid in order to drill into a bivalve shell to feed. Pure water's organic material had resulted in the most activity, which demonstrated that the acidic conditions did not aid in its processing of organic material, but acted as an environmental condition to deter processing.