

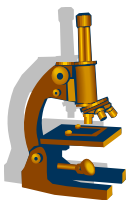
Marine Academy of Technology & Environmental Science



Eleventh Research Showcase

Abstract Guide

February 22, 2017



February 22, 2017

We are embarking on the research expo a couple of months earlier this year so that we can include more projects in the upcoming Jersey Shore Science Fair. We will be embarking on our “science fair” season this March. But, our students have been busy this past fall presenting at professional organizations. One of our juniors, Rachael Staino, presented her research as a poster at the American Society of Hand Therapist 39th National Conference in Washington, D.C. Rachael will be presenting her research poster at the South Jersey Junior Science and Humanities Symposium in late March. Another junior, Riley Nevil, and senior, Colleen Cochran, presented their posters at the American Shore and Beach Preservation Association in October. Riley took home the best poster award. In late October, three of our seniors, Anna Francisco, Samantha Orndorff, and Olivia Schailey, and one junior, Alaina Perdon, presented their research at the American Fisheries Society – Mid-Atlantic Chapter meeting. We are moving toward including more student presentations in professional organizations. In terms of this Expo, all freshmen and transfer students were required to conduct an independent experiment. Once completed, the students completed a poster culminating in the poster session on February 22, 2017. Many hours went into the projects as the first year MATES students will be presenting their posters. All posters will be displayed in alphabetical order of their last names in eight categories. They will also be judged based on their category.

We would like to thank the students for their project presentations this year. The students worked hard and it will show in the following abstracts, and during their poster session. Mr. Jason Kelsey, fellow student research coordinator provides the students with tremendous insight on research. A special thanks to our Research Assistance and Development (RAD) Team that spent hundreds of hours working with the students that started back in the summer 2016. Thanks RAD for all that you do! Thanks to the MATES Parent-Teacher-Student Organization that was generous in providing funds for materials for numerous projects. Also, thanks to SUEZ, Exelon, the EIFF Foundation and to the Fish Hawks for their contributions to our research program. We wish to thank our Ocean County Vocational Technical School Board of Education, Administration (Mr. Hoey, Ms. Weber-Loeffert, Mr. Frazee, and Ms. Carroll) and MATES Staff, especially Mr. David Werner (research advisor). Every one of our MATES Faculty has contributed to the success of this Expo. Also, many thanks to Ms. Katie Manna, Ms. Esther Gallacchio, and our wonderful maintenance staff, Roman, Gino and Matt, for all of their support and assistance.

Thanks to the parents who have contributed much time and effort in making the projects possible. Without their support, this research would not be possible. I would like to point out that this year’s Research Class (sophomores) helped to organize logistics at the Expo, And, last, but not least, a very special thank you to all our judges who volunteer to provide our students with constructive feedback about their projects.

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

Sincerely,



John Wnek, supervisor,
Science and Research

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BARNEGAT BAY AND MARINE SCIENCE:

101. HOW DO CHANGES IN PHYSICAL PARAMETERS AFFECT PHOTOSYNTHESIZING RATES IN ZOOXANTHELLAE?

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

Human pollution is the origin of many catastrophic events that occur on the Earth, including coral bleaching. Coral bleaching is the process by which corals expel the algae that live endosymbiotically within their cells, which are responsible for photosynthesizing and disposing of the coral polyp's waste. This process can be triggered by both increased and decreased photosynthesizing rates. This is caused by water turbidity and temperature increase, two factors that can be altered by various forms of pollution. The objective of this study is to explore the effects of changes in turbidity and temperature on photosynthesizing rates in zooxanthellae algae; the effects were determined by observing changes in pH levels in test subjects exposed to a higher temperature and varying turbidity levels. Each test subject consisted of a cup containing 6 mL of mock seawater and 3 mL of zooxanthellae culture suspended in sodium alginate. The zooxanthellae culture was grown and concentrated over a period of 27 days using a combination of aeration, lighting, and algal enrichment solution. PH measurement was selected as the method of result analysis due to the alkalizing nature of photosynthesis; by reducing carbon dioxide, an acidifying compound, the pH values in a liquid will increase. As time passed between collection periods, the pH values of the heated test subjects had shown to increase at a greater rate in comparison to the control group, meaning the heated test groups had photosynthesized at a higher rate. The data collected from the samples with altered water turbidity, however, showed only slight and inconsistent variation in pH values than between the different turbidity levels, possibly due to the fact that the turbidity values were not altered enough; the different turbidity levels may have been too similar to significantly alter the results. Further testing is required to determine the exact effects of increased turbidity on coral bleaching. The reef environment is crucial to us, and understand the results of this experiment can increase awareness of the negative effects of human pollution on coral bleaching and death.

102. THE EFFECTS OF DIFFERENT HERBICIDES ON TRIFOLIUM AND THE BARNEGAT BAY

Andrew Beck, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Jason Kelsey

Many people who live on or near the Barnegat Bay face a common problem. There are always weeds growing in their lawns, patios, gardens, etc. As a result, they use herbicides to kill off these weeds. What they do not know is that these herbicides can have a deadly effect on wildlife in the Barnegat Bay. In my project, I tested three different herbicides: Roundup, Dr. Earth, and a formula I created myself consisting of vinegar, salt and Dawn Dish Detergent, on clovers, shrimp, and mummichogs. I sprayed the allotted amount of herbicide on different pots of clover and then extracted the runoff water and inserted it into tanks containing different specimens. I observed that the Roundup effectively killed off the clover, fish, and shrimp, Dr. Earth had no effect on any of them, and my formula killed off the clover more efficiently than the others while not harming the fish or shrimp. This experiment was important because it shows that Roundup, one of the more popular herbicides, is not as effective nor as good for the environment as a natural homemade herbicide.

BARNEGAT BAY AND MARINE SCIENCE (CONT'D)

103. THE EFFECT OF COLOR ON *PAGURUS LONGICARPUS* LOCATION

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

Long-clawed Hermit Crabs, scientific name *Pagurus Longicarpus*, are soft bodied crabs that live in mostly salt or brackish waters, and live inside snail or whelk shells for protection. My experiment tested whether these crabs were more attracted to the red or blue glowsticks placed into their tank. My hypothesis was that the crabs would be more attracted to the blue light, for many crustaceans, such as lobsters, cannot see red light. To test this hypothesis, I placed two red glowsticks in the left side of the tank, and two blue glowsticks in the right side of the tank, waited thirty minutes, and recorded the number of crabs on each side of the tank. I collected twenty (20) points of data for this test, as well as twenty points of data for a test done with only red glowsticks, then only blue glowsticks. My results showed that, contrary to my hypothesis, the crabs appeared to be more attracted to the red glowsticks, and/or repelled away from the blue glowsticks. One possible cause for this outcome is the fact that red light wavelengths are the longest of any color, so they can pass through the water more easily than the much shorter blue light wavelengths. This data gathered is important because not much research has been done on this species, and the vision of other crustaceans has been studied and been used to make advancements in technology.

104. GROWTH RATES OF THREE DIFFERENT TYPES OF ALGAE

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

All algae need specific factors to be able to have success and thrive. They require food (nutrients), a water temperature, a pH level, light for photosynthesis, and a specific salinity of water. Water was provided with the specific needs that red algae, green algae, and diatoms require for growth, in 24 ml of water, for the duration of 34 days. During this period of time algae was monitored and checked for growth. It was originally hypothesized that green algae would have the higher growth rate and that diatoms would have the lower growth rate, but after the completion of this experiment it was observed that no algae sprouted in any of the three containers. It is hypothesized that this probably occurred due to the lack of enough oxygen in each of the containers which was needed in the growth of the three algae types. It is also hypothesized that the lack of a starter and the small amount of space each received contributed to the results as well. This experiment could have contributed in the making of biofuels and biofertilizers. In the end, although the experiment was not a success and no algae germinated, a type of green protist did develop.

105. THE BIOLUMINESCENT COLOR PREFERRED BY MARINE LIFE

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

Bioluminescence is the production and emission of light by a living organism. Some colors produced by bioluminescence, such as green and blue as opposed to red and yellow, are more observable to marine organisms. But are certain colors more favorable than others? Organism's' response to each color can impact behavior such as feeding. This study determines the color preference of Atlantic silversides while feeding. The bioluminescent colors used in this study mimicked natural bioluminescent colors including: blue, green, red, and yellow. Each of the four colored glowsticks was placed at each corner of the tank. The fish were fed once in the morning and once in the evening. When the fish were fed, food was sprinkled at each corner of the tank to observe which color the fish were more comfortable taking food from. The data showed that more fish took food from the corners with the colors blue and green than the others. This study showed that these marine bioluminescent colors, blue and green, were more favorable than red and yellow.

BARNEGAT BAY AND MARINE SCIENCE (CONT'D)

106. ENVIRONMENTAL CONDITIONS THAT CHANGE QUANTITIES OF PLANKTON IN BARNEGAT BAY

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

Barnegat Bay faces threats in water quality, habitat and environment changes, and impacts to its organisms including microorganisms such as algae and zooplankton. What kind of weather affects these microorganisms and how does civilization affect the plankton quantity? To test if there is a connection between weather and plankton quantity, samples of plankton were collected using a plankton net and several environmental conditions were measured. The quantity of plankton was estimated using a turbidity meter to measure turbidity. The results showed that turbidity was significantly higher in the southern region of Barnegat Bay where there has been less development. It was found that air temperature, water temperature, salinity, and pH were factors that changed the plankton. In conclusion, measuring and comparing the amount of plankton can predict the amount of development and environmental change in Barnegat Bay.

107. THE HABITAT PREFERENCE AND EATING BEHAVIOR OF ATLANTIC SILVERSIDE (*MENIDIA MENIDIA*)

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

Atlantic Silverside (*Menidia menidia*) is a common species of fish that is distributed worldwide. Due to wave currents, many habitats become buried by the shifting of another habitat. Throughout the ocean, there is an exorbitant amount of diverse habitats that are naturally preferred by specific organisms. My research focused on the habitat preference of Atlantic Silversides as well as which habitat they favor feeding in. 20 Atlantic Silversides were placed in a 5 foot tank with 5 different seafloor sediments: mud, sand, rocks, shells, and sea lettuce. Each day, data of each silversides location was recorded in the morning and at night for a length of 25 days along with a recording of their location in the afternoon when they were fed. All data was separated into 2 different tables. One was about the Atlantic Silversides preferred habitat to live in and the other was their preferred habitat to feed in. To analyze my final data, I averaged the amount of fish in each specific sediment for both their preferred feeding and living habitats. As a conclusion of all my observations, it appears that Atlantic Silversides prefer to live and feed in a sea lettuce habitat opposed to the other seafloor sediments.

108. EFFECT OF EELGRASS DECOMPOSITION ON THE NITRATES, PHOSPHATES, AND SULFATES IN BARNEGAT BAY

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

Zostera marina (a type of eelgrass) is a widespread submerged aquatic vegetation that is often mistaken for seaweed. Beds of eelgrass are home to a variety of species of marine life, and they supply these organisms with the food, shelter, and nutrients necessary to survive in their environment. When *Z. marina* deteriorates, it releases chemicals such as phosphates, nitrates, and sulfates into the surrounding water. The objective of my experiment was to analyze the amount of these chemicals being released into the Barnegat Bay. This information could be used to explain the effect of these chemicals on the marine life living in the bay, both positive and negative. I conducted my experiment by collecting samples of eelgrass from four different locations throughout Barnegat Bay. Tubs of eelgrass were set up and tested weekly for nitrate, phosphate, and sulfate contents. The results showed that there was a positive correlation between time (in weeks) and nitrate levels. However, there was no correlation in phosphates and sulfates.

109. HOW SALINITY AFFECTS THE GROWTH OF *CHRYSAORA QUINQUECIRRHA* POLYPS IN BARNEGAT BAY

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

Chrysaora quinquecirrha are a type of jellyfish that have become a nuisance in Barnegat Bay in recent years. Their growing populations have become a large problem for the bay's ecosystem, but no one understands why these stinging jellyfish are flourishing. One deciding factor could be salinity. To determine if salinity is significant, *Chrysaora quinquecirrha* polyps were placed in three tanks with a salinity of 15 ppt, 20 ppt and 25 ppt respectively. The polyps were then fed and counted daily and this data was documented and compared to observe which salinity the polyps grew the most in. It was discovered that the polyps in the 25 ppt tank grew the most. This means that the salinity of Barnegat Bay could be a significant influence as to why this specific species of jellyfish is thriving in the bay. This research could be a beneficial starting point for future Barnegat Bay researchers because it gives information to reference and gather ideas from. With this research and any future developments we will hopefully one day control the jellyfish populations and restore Barnegat Bay.

BEHAVIORAL AND SOCIAL SCIENCE:

201. SUBJECTIVITY OF SOCIAL COGNITION IN MALES VERSUS FEMALES

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

People often make the claim that males and females act and think differently. Research shows that males and females have different amounts of white and gray matter in their brains, which causes them to perceive situations differently. To determine if the research could be supported, I distributed a survey electronically to 35 people. The test contained questions pertaining to pre ingrained concepts like trust and authority figures. I broke down the results into males versus females to see if there was a significant difference. An average, highest, and lowest score was collected for both genders, which all showed that females were better at cognitively understanding social interactions involving the theme of control and power. This is important to understand because gender is a key factor in how humans view the world and interact with people around them. Knowing that will benefit our understanding of why different genders make certain choices.

202. THE PREVENTION OF HOMOPHOBIA

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

One of the most openly expressed forms of prejudice is homophobia, an irrational fear or hatred of LGBT people, most commonly homosexuals. Despite occasional claims to the contrary, it is widely accepted that homosexuality is, in fact, natural and not subject to harsh treatment, it is also believed that homophobia is impossible to rid of. Or, people act in a burst of seemingly justified hatred, a method that has been ineffective as long as there have been people choosing this method; therefore, is there an effective way to prevent homophobia? To find a possible answer to this persistent question, "The Homophobia Scale (HS)" by Wright was slimmed to a ten question questionnaire and distributed to twenty-seven individuals to measure three components of attitude: affective, behavioral, and cognitive. The results were further divided between those who showed homophobic tendencies and ideas and those who did not. Data was then analyzed and graphed to show a predominance in cognitive affect, showing that homophobia is likely based on exposure to similar, if not stronger, attitudes over time. Therefore, action should be taken to express acceptance more widely and narrow exposure to excessively negative behavior.

203. WHAT THE GENERAL PUBLIC LIKES THE MOST ABOUT B&M ROLLER COASTERS

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

There are five roller coasters at Six Flags Great Adventure that are manufactured by Bolliger and Mabillard (B&M), and they are widely considered as some of the best roller coasters in the park. On a worldwide scale, B&M is considered as one of the best roller coaster manufacturing companies there are. But what is it that makes their products so enjoyable and popular? The idea of this research is to find out what the general public likes the most about the B&M roller coasters at Six Flags Great Adventure so B&M can continue to make use of these aspects or use them more often. To figure out what the general public liked the most about these roller coasters, I surveyed 50 park guests per roller coaster, making it a total of 250 surveyed park guests. Superman: Ultimate Flight, Bizarro, and Nitro all had clear favorite aspects, while two aspects of Green Lantern got a similar number, and three aspects of Batman: The Ride got a similar number.

BEHAVIORAL AND SOCIAL SCIENCE (CONT'D)

204. HOW DOES AGE, GENDER AND LEARNING STYLE AFFECT SHORT-TERM MEMORY?

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

Short-term memory, or working memory, is where information is stored in chunks of 7 ± 2 units. Short-term memory has also been described as a section in working memory that is responsible for information that is received, processed, and used within sixty seconds. In this experiment, forty participants were asked to memorize eight different series and to recite them after each series to the capacity of their memory. Four of the series' were on flashcards, and four series were on an online slideshow. In each set of four, there were one of each of the following: shapes, numbers, letters, and words. In each series, there were seven units; therefore, each participant had a score from zero to seven on each section. Analysis of data showed that age, gender, and learning style had all significantly affected short-term memory. Males are better at remembering "shapes," "numbers," and "letters," whereas females excelled with the section of "words." Participants of the younger age group performed better than the older age group in both analog and digital testing, and visual learners were the most successful of all of the learning styles.

205. EFFECTS OF ATHLETIC PARTICIPATION ON STUDENT ACADEMIC ACHIEVEMENT

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

It is expected of students in this day and age to be well-rounded through sports and other extra-curricular activities, while maintaining high grades. However, in many forms of media, it has become stereotypical for the athlete to be less intelligent than their peers, but is that how it is in the real, day to day life? Because exercise such as school sports is shown to increase cognitive ability and other areas of mental health, I sought to show that student-athletes would have equal, if not higher, grades compared to their non-athletic peers. With the participation of 20 students, I gathered and analyzed their first marking period grades with respect to their athletic participation for that season. In the end, athletes did seem to overall have higher grades than students who had not participated in athletics, but only by a slim margin. The small gap shows that participating in sports sometimes will bring a benefit in regards to better grades depending on the individual student, not the exercise and sport itself. So while exercise does empower the brain, participation in sports is neither appreciably detrimental nor beneficial to a student's academic achievement.

206. THE INFLUENCE OF TERROR ATTACKS ON THE RESULTS OF THE UNITED STATES PRESIDENTIAL ELECTION.

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

In recent years, terror attacks have been on the rise, causing massive amounts of fear to thrive in individuals. Those individuals seek out refuge and security in their political leaders, such as the candidates for the presidential race of 2016, with Hillary R. Clinton and Donald J. Trump. I noticed this occurring after watching a national debate, and from there I hypothesized whether or not terror attacks influence the results of the United States presidential election. To determine if my hypothesis was faulty or truthful, 55 surveys, that had ten questions pertaining about terrorism and our government, were given to people ranging from the ages of 25 to 73. After obtaining all of the completed surveys, I compared the results to the standpoints of Secretary Clinton and business mogul Trump and the results suggests that yes, terror attacks do indeed influence the results.

BEHAVIORAL AND SOCIAL SCIENCE (CONT'D)

207. HOW DOES BODY LANGUAGE AFFECT AN AUDIENCE?

Sophia Lebron, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Dave Werner and Dr. John Wnek

Body language can have a large effect on audiences, especially during speeches. The most recent election of the president for the United States is a prime example of the effect. This study was conducted to evaluate the two presidential candidates (at the time), Donald Trump and Hillary Clinton, and their body language during debates using sources from social media means and articles. To determine the results, information was recorded from body language analysts on gestures made by Trump and Hillary and how the nation as an audience deciphered them. This was then proved by the popularity of the social media accounts of both candidates. The main media account used was Twitter. It was originally hypothesized that Clinton would gain more popularity due to her less abrasive gestures, but the more dramatic gestures that Trump made captured more attention from the nation. Overall, the more expressive one speaker may be with his or her body results in more captive attention from his or her audience and may be useful to know for public speakers.

208. CAN CLASSICAL CONDITIONING BE USED TO CONQUER PHOBIAS WITHIN ANIMALS?

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

Ivan Pavlov's method of classical conditioning was used to train his dogs to react to the ringing of a bell and pair it with dog food. He also performed the method of "Unconditioning," where an unconditioned stimulus (the bell) and a conditioned stimulus (the dog food) are no longer linked together, thus leading a subject to cease reacting to the stimulus. In this experiment, both of these methods were used in an attempt to reverse phobias within two animals subjects (a dog and chinchilla) toward two different stimuli (a balloon and specific human). The first half of the experiment consisted of using "Unconditioning" on both subjects in order to "reset" their fear and stop negative reactions toward the conditioned stimulus. The second half of the experiment was spent on reconditioning the conditioned stimulus through classical conditioning. This was performed by presenting each stimulus with an unconditioned stimulus that each subject enjoyed (in this case, a chinchilla treat and a dog treat). These methods were conducted within rooms that lacked any other distractions. This experiment supported that it is possible for animals to weaken, and possibly overcome, their phobias; however, time is a significant factor and can impair the process completely. The results from this study can be beneficial in aiding animals suffering from traumatic experiences that developed phobias, such as shelter animals who were victims of abuse, and help them overcome their trauma.

BEHAVIORAL AND SOCIAL SCIENCE (CONT'D)

209. CAN A PERSON'S SLEEPING HABITS AFFECT THEIR SHORT-TERM MEMORY CAPACITY?

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

Short-term memory is the small amount of information humans are currently aware of. It is the capacity for holding, but not manipulating information in a readily available state. Short-term memory is very brief and is often limited to only 30 seconds or so. According to Miller's Law, the average number of items a person can hold in working memory is seven, plus or minus two. Sleeping habits can affect a person's memory, among other things. This experiment simulated a short, custom 16-word memory test derived from the "Psychologist World" website, an educational platform based on psychological explanations and theories. 100 people were issued the same memory test, with ages ranging from nine to adult. They were also asked how many hours they slept each night on average. The data was then analyzed and graphed based on age and hours of sleep and how it correlated with their results. The score was determined based on how many words they remembered correctly out of 16. The data suggested that sleeping hours, in this case, did not have a significant effect on the memory results.

210. A FOREIGN SCHOOL PUNISHMENT THAT IS BENEFITING STUDENTS

Yug Yadava, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Dave Werner

Superbrain yoga originated in ancient India and has evolved over the past centuries. This form of yoga is still used today in rural India as a form of punishment for students who do not behave or get an answer to a question wrong. Although many people find it hilarious to witness students doing this yoga, it is actually benefiting them. In this research project, I investigate the effect of superbrain yoga on the students' ages, 8-11 and 14-16, to see whether or not their accuracy improves on fast facts tests on multiplication. Over the course of 12 weeks, October-January, students from both, high school and elementary school, participated in this research. In order to investigate further about this topic, I decided to split the two groups into sub-groups. These include day vs night and male vs female. Both age groups were given a break during Thanksgiving, November 24-27, and the winter holidays, December 24-January 2. The study concluded on January 7, 2017. The results showed a significant difference between the control group and the participants. The high school participants did better than the elementary school group, the night sub-group did better than the morning sub-group and the males performed better than the females in both age groups. The final factor was proven by the stats showing that this superbrain yoga is only a temporary effect. As many parts of the world begin to interact, many cultures and their rituals are dying out. By remembering these rites, humans can help one another in case if advanced technologies fail to help mankind in the coming years.

BOTANY:

301. MAGNETIZED WATER AND ITS EFFECTS ON *OCIMUM BASILICUM*

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

A phenomena where like charges repel and opposites attract is produced by the motion of electric charge, resulting in attractive and repulsive forces between objects. Water is affected by this phenomena because it is a polar molecule meaning one side is more negatively charged than the other. This study was conducted to see the effects of magnetized water on *Ocimum basilicum* to determine whether or not it was beneficial to the plants. Basil was used because it doesn't take long to germinate and is a popular plant. There were two groups, the control and the experimental group. One was watered with the magnetized water and the control utilized normal water. Both were kept in a controlled environment to lessen the number of variables. At the end of the study, the results suggest that magnetized water did have a beneficial effect on the plants.

302. EFFECT OF PERMANENT MAGNETIC FIELDS ON THE GROWTH OF PEA PLANTS

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

All plants respond to many different environmental factors, all of which impact growth. Gravity is one of the major factors, and if something that cannot be seen affects growth, then do magnetic fields contribute to plant growth? In order to determine if magnetic fields affect plant growth, 72 plants were grown from seed, split into three trials of six groups, each containing four plants. Two groups had magnets below the seed with North Pole facing up, two groups per trial had magnets below the seed with South Pole facing up and two groups were planted with no magnets. Data was analyzed, and all groups were shown to statistically have no significant difference.

303. GROWTH DIFFERENCES BETWEEN WILD SOYBEANS (*GLYCINE MAX*) AND GENETICALLY MODIFIED SOYBEANS

Zachary Koziol, Block 3 Science Class, Marine Academy of Environmental Science (MATES), Advisor: Mr. Jason Kelsey

Genetically modified plants (GMOs) are rapidly taking over the farming industry for the benefits they bring to the table. Even with the benefits of GMOs, many people are skeptical if the benefits outweigh the risk of GMO crops. One of the main benefits of GMO crops is that they are designed to be more productive than their original crop. Do GMO soybeans actually grow at a better rate than wild soybeans? I grew GMO soybeans as well as wild soybeans to compare their growth. Three GMO soybean plants and three wild soybean plants were grown in a controlled environment over the course of nine weeks. The GMOs grew at an average rate of 7.9 centimeters a week whereas the wild plants grew at an average rate of 7.1 centimeters a week. It was concluded that the GMO plants grew at a better rate than the wild plants.

BOTANY (CONT'D)

304. WILL MICROWAVE RADIATION BE ABSORBED BY PLANTS THROUGH MICROWAVED WATER?

Gregory Leifert, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Jason Kelsey

In this day and age, society has become dependent on the microwave for heating and cooking quick meals for busy schedules. However, many people believe that the microwave can leak a substantial amount of microwave radiation in microwaved food. The microwave works by exciting water molecules contained within objects being microwaved, and that energy produced gives off heat in order to cook or heat food. Three different tests were devised using different plants and techniques of providing light to the plants, and a variable group was fed water that had been microwaved to determine if any potentially danger electromagnetic radiation was absorbed. An electromagnetic field (EMF) meter was used to record data daily on the individual plants and these values were compared to the values produced by the control group, which had been sustained under normal growing conditions. According to the data that was collected, the microwaved water had little to no effect on the intensity of the EMF produced. Not only were the values between the variable and control groups similar, but also the values of the intensity of the EMF produced do not have enough energy to harm humans in the ways proclaimed in many of these new articles.

305. THE EFFECTS OF A SALT-WATER MIXTURE ON COMMON PLANTS: A COMPARISON

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

It is commonly believed that most edible plants are not able to thrive while in an environment where salt is present. To test this theory, an experiment was carried out using six commonly found plants. Three were lettuce plants, and three were cress plants. All of the plants were treated equally, they all received equal amounts of sunlight and water. All of the data was collected at the same time on the same dates. Two of each plant was experimented on, and one of each plant was kept as a control plant. This experiment sheds some light on what would happen if a slightly tolerant plant was introduced to several different environments with different levels of salt. At every level of salt, there was an impact of plant growth.

306. THE EFFECTS OF MAGNESIUM CHLORIDE AND CALCIUM CHLORIDE (BRINE) and SODIUM CHLORIDE (ROCK SALT) ON ATLANTIC WHITE CEDARS

Larisa Paxton, Block Science Class; Marine Academy of Technology of Environmental Science (MATES),
Advisor: Dr. John Wnek

When it snows in the winter, brine (Magnesium Chloride and Calcium Chloride) or rock salt (Sodium Chloride) is spread on the roadways to melt ice and snow. These chemicals runoff roadways and increase the salinity of the soil that trees use to get water and nutrients. My experiment involved the replication of these treatments and the effect of these chemicals on Atlantic White Cedar (*Chamaecyaris thyoides*) seedlings. I hypothesized that the brine would raise the salinity in soils more than rock salts, cause desiccation, and leaf burn to the trees. I created three environments using the trees in three pots. I added solutions of brine, rock salt, and water and observed how they effected the trees. I also measured the salinity, pH, and moisture content of the soil. The experiment showed that my hypothesis was partially correct. The brine treated trees showed leaf burn; however, the rock salt treated trees also had leaf burn. In addition, analyzed data revealed there was no correlation between the constant and the brine or rock salt, concluding that they were not significant.

BOTANY (CONT'D)

307. HOW DOES THE PLANT BASE OF A BIOPLASTIC AFFECT ITS TENSILE STRENGTH?

Logan Potts, Block I Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Traditional plastics are made out of non-renewable resources. In recent decades, bioplastics have been proposed as an alternative, being derived from renewable plant resources. Finding a resource that creates a strong bioplastic is important when trying to make a product exclusively out of bioplastics. They are commonly made out of starches. Agar powder has also been used to create plastics. Starch is more common, but is it stronger? To come to a conclusion, five types of plastics were made using both corn starch and agar powder. One plastic was purely corn starch, another was exclusively agar, and the other three contained a mixture of corn starch and agar powder in different ratios. Five strips were cut from every single one of the three plastics that solidified. They were attached to a spring scale, and the scale was used to determine the weight required to break each sheet of plastic. The average strength for each of the three varieties of plastic was calculated. After analyzing the data, it was clear that there was a correlation between agar and tensile strength, but not corn starch and tensile strength.

308. USING AN ARDUINO TO REGULATE HYDRATION OF *ANETHUM GRAVEOLENS* INDOORS

Charles Roth, Block 2 Science Class, Marine Academy of Environmental Science (MATES)
Advisor: Mr. Jason Kelsey

Common Dukat Dill, or *Anethum graveolens*, is a popular indoor herb for garden enthusiasts. Many of these people, however, have little time to tend for their indoor herbs and flowers over the winter. I aimed, with my research, to solve this problem by designing and constructing a microcontroller-based automatic watering system that monitors soil moisture and waters indoor herbs when necessary, and to determine the efficiency of this system against watering herbs by hand. My hypothesis was that the microcontroller system would be more cost and time effective, being both cheaper and more efficient in water usage. However, the system was much more difficult to set up than expected, and it was nearly impossible to tune the programming to output water at the right moisture level. In addition, the results of the growth of Dukat Dill were unexpected: the plants in the micro-controlled system grew worse than the hand-watered plants. In conclusion, the microcontroller-based watering system was unsuccessful at saving the time of the common indoor gardener because it cost more and took more time. However, this system could be worth it several years in the future if the programming could be more fine-tuned.

309. CAN LIGHT TUBES AND MIRRORS ALLOW FOR GROWING PLANTS IN A LAYERED STRUCTURE?

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

Growing plants usually takes up lots of space. One way to alleviate the space used is to stack the plants on top of one another, and the only difficulty then is getting enough light to grow all of them. Could mirrors do the job well, or possibly light tubes? An apparatus containing both methods was constructed, and seeds of colonial bentgrass, perennial rye, bermudagrass, and bahiagrass were planted on each of five layers. They were then cared for and measured daily. No difference was found between the use of mirrors or light tubes in the growth of the plants.

BOTANY (CONT'D)

310. WHAT IS THE EFFECT THAT *SALICORNIA VIRGINICA* HAS ON SALT WATER OVER TIME AND COULD IT THEN BE USED TO WATER OTHER NON-HALOPHYTE PLANTS?

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

Pickleweed (*Salicornia virginica*) is a type of aquatic plant that removes salt from the water it absorbs; but can it decrease the salinity enough so that water can be used by other non-halophyte plants? To answer that question *Salicornia virginica* was planted in sporadic to densely populated groups in three different substrates (sand, gravel, and mixed). Saltwater (~60-65ppt) was then run through the system and later collected where it was then used to water the secondary plant samples. The secondary samples included tomato plants and Kentucky Bluegrass. The difference in salinity of the water, the *Salicornia virginica*, and the secondary sample plants from the beginning to the end of the study was then recorded and analyzed to find how significantly it changed. After the data was analyzed it was found that there was no correlation between the the original salinity of the water and the salinity of it after being run through the plants. There was, however, a correlation between the salinity of the secondary samples before and after the study.

ECOSYSTEM BOTANY:

401. THE EFFECTS OF SAND-SILT RATIOS ON GROWTH OF THE FROSTY FERN, *SELAGINELLA KRAUSSIANA*

Samuel Bersch, Block 2 Science Class, Marine Academy of Technology and Environmental Sciences (MATES);
Advisors: Mr. Jason Kelsey and Dr. John Wnek

The Frosty Fern, *Selaginella kraussiana*, grows quickly and can either be a ground cover or a houseplant. It requires humid air around it to thrive; it also requires a high nitrogen level to be banded into the soil. Soil is a mixture; it is made up of three main components: clay, silt, and sand. I did not touch the clay amounts, nor did I record the clay amounts. My hypothesis was that the soils with less sand and more soil would do better than the plants with more sand than dirt. My reasoning behind this hypothesis was that silt would be less coarse than sand; therefore, the water would not be able to flow through the soil quicker, and the plant would absorb more water which would help its growth. There were eighteen plants: four 25-75, 75-25, and 50-50 sand:silt ratios, with three 100:0 and 0:100 sand:silt ratios. All of the plants died before I could collect any data; however, further research into this subject can help aid any gardener's, whether it be a farmer or not, choice in soil mixture.

402. HOW DO REPLENISHED AND NATURAL DUNES AFFECT VEGETATION GROWTH?

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

Even though most of the dunes and beaches on Long Beach Island have been replenished, the dunes oftentimes fail and need constant upkeep. In my project I compared many of the factors that contribute to vegetation growth in replenished and natural dunes. I took ten samples from each of my testing sites, Beach Haven, Ship Bottom, and Barnegat Light. Beach Haven is most recently replenished, then Ship Bottom. Barnegat Light has not been replenished at all. I used a soil sieve to test the grain sizes of my sand samples. Medium and fine sand were the most predominant grain sizes. Based on my results, Barnegat Light had more fine sand which is usually better at holding nutrients and water. I also conducted organics testing by using a muffle furnace to burn off organics. My data showed that the dunes are starved of nutrients. Beach Haven had the highest percentage of organics by a small margin. This research is important because it shows what makes dunes successful and how beach replenishment compares to naturally formed dunes. The success of a dune over time will greatly impact the safety of coastal housing, businesses, and tourism.

403. MOST EFFECTIVE PLANT SPECIES FOR SOIL EROSION PREVENTION

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

Soil Erosion is a growing problem in the world today. Many scientists are trying to find an optimal plant for prevention. What is the most effective grass species to prevent soil erosion? In my experiment I tested three different plant species and grew them for 50 days. At the end of the growth period I took them out of the soil and washed them so they were free of any soil. After they were washed, the roots were dried and weighed to determine the biomass. I also measured the length of the roots to see how they numbers correlate to the biomass test. The conclusion to the project was that the grass species with the greatest biomass and length was the best at soil erosion prevention. One observation relating to the numbers was that the biomass data did correlate with the length data. The results were that the Perennial Ryegrass was the best at prevention whereas my hypothesis of the Tall Fescue grass was false.

ECOSYSTEM BOTANY (CONT'D)

404. HOW DO GENETICALLY MODIFIED SOYBEANS AFFECT THE SOIL?

Madison Linton, 4th Block Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey

Soybeans are one of the most commercialized genetically modified crop in the United States. These GMOs can have very harmful effects on organisms and the environment. In my studies, I had planted three organic seeds, along with three genetically modified seeds to observe and compare their effects on the soil. The aspects of these effects were pH and the levels of nitrogen, phosphorus, and potassium. I hypothesized that these levels will in fact decline in GMO influenced soil because of chemicals that are released to repel pests. After three weeks of planting, I had concluded my experiment and discovered that the nitrogen, phosphorus, and potassium levels of the GMO soil had significantly dropped from high to very low. These results had led me to believe that since these levels had lessened, then they would negatively affect the environment, and thus our health. This experiment is important to us humans because of the effects that it could have on our health and well-being.

405. THE EFFECTS OF RHIZOBIUM AND NITROGEN FERTILIZERS ON TRIFOLIUM

PJ Losiewicz, Block 2 Science Class, Marine Academy of Technology and Environmental Sciences (MATES);
Advisor: Mr. Kelsey

Nitrogen is an extremely important element to plants, and it is needed for rapid plant growth. However, this form of nitrogen (N_2) cannot be utilized by plants in this form. Nitrate and ammonium are both compounds that can be used by plants. These compounds are either present in fertilizers, or they are converted into by a nitrogen-fixing bacterium known as Rhizobium. In this project, I applied a nitrate fertilizer and Rhizobium to clover seeds, and I grew the seeds to maturity. There were four groups of plants: a control group, one with just nitrogen fertilizer, one with just nitrogen bacteria, and one with fertilizer and bacteria I watered the plants three times a week and applied fertilizer twice, once every four weeks. After eight weeks of growth, I measured the nitrate levels in the soil. The control group had the least amount of nitrogen, followed in order by the group with just fertilizer, the group with just Rhizobium, and finally the group with the fertilizer and the bacteria. The group with just fertilizer also had the healthiest plants grown, as well as the longest average length. The group with fertilizer and bacteria turned out to be the least successful, showing signs of over nitrification and burn out from the fertilizer. The results of this project reflects that a natural alternative, such as the Rhizobium, can prove more efficient and less costly than the conventional nitrogen fertilizer.

406. COMPARING LONGEVITY OF BENEFITS TO PLANT GROWTH FROM VARIOUS FERTILIZER TYPES

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

Fertilizers are used in agriculture to provide additional nutrients to soils that benefit the growth of the plant. However, the effects of some fertilizers are noticeable for longer periods of time after each treatment. The purpose of this experiment was to compare the longevity of the benefits of three different fertilizer types. The fertilizers that I used were liquid dissolved quick release, slow dissolving solid fertilizer, and worm castings. My hypothesis was that at the end of the experiment, the worm castings would continue to provide benefits to the plant growth while the other fertilizers would cease to show benefits. To determine fertilizer effectiveness, first, I treated three sets of soil with each respective fertilizer, while leaving set of soil and plants untreated as a control. After 25 days of regular measurement of plant growth, the plants were removed and a soil sample was tested for nitrogen. After comparing the growth rates in the trials, the slow releasing fertilizer and the worm castings had a slightly faster plant growth rate than the untreated and quick releasing fertilizer. When soil tests were conducted, quick and slow releasing fertilizers had slightly more nitrogen (ANOVA, $p=0.063$). If the experiment had been conducted longer, and the plants were able to be kept in the soil longer, I believe that more conclusive results would have been found.

ECOSYSTEM BOTANY (CONT'D)

407. HOW DO DIFFERING SOIL COMPOSITIONS AFFECT THE GROWTH OF *DIONAEA MUSCIPULA*?

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

Dionaea muscipula, commonly known as the Venus Flytrap, is a species of carnivorous plant native to the subtropical wetlands of the eastern United States. While it thrives in soils with varying compositions in the wild, no research to date has explored the optimal growing conditions for Venus Flytraps in cultivation. Some gardeners have argued that Venus Flytraps grow best in a mixture of $\frac{2}{3}$ peat and $\frac{1}{3}$ sand, however, they lack the empirical evidence to support their proposition. To test the hypothesis proposed by gardeners, I randomly assigned 120 Venus Flytrap seeds to one of six conditions (growing mediums with varying distributions of peat and sand). Each seed received ample water and light for one month, in order to facilitate growth. While the limited vertical growth in my Venus Flytrap seedlings prevented rigorous statistical testing, preliminary evidence suggests that Venus Flytraps grow best in a soil mixture containing 20% peat and 80% sand.

408. DOES A RISE IN SOIL TEMPERATURE IMPACT THE RATE OF GERMINATION IN STAPLE CROPS?

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

Due to climate change, there is an expected increase in air temperature by about 4.5°F during the next century in the United States. Temperature increase causes changes in germination rates due to new soil temperatures, watering conditions, and sun exposure. A rise in air temperature could potentially impact crop production; more specifically, it may cause a shift in growing seasons and lessened growth rates. To test this theory, three groups of plants were grown under different temperatures and monitored to see if there were any changes in their growth: one planter was maintained with a high temperature of 71.6°F (22 °C), one was brought to 76°F (24 °C), and the other was brought up to 85°F (29 °C). The plants were hydrated with water at different temperatures so their soil temperatures could rise to the desired high. These changes in temperature had a minor effect on the plants' germination rates, but the plants brought to 85°F (29 °C) had a slightly more successful growing rate, contrary to previous theories. These tests showed that climate change shouldn't heavily impact growing seasons of plants in the near future.

409. CAN HOMEMADE PLANT FOODS AID THE LIFE OF *Dianthus caryophyllus*?

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

When someone purchases a bouquet of flowers from a store a small packet comes with it. In this packet are a mixture of different things essential to a plant's survival. The purpose of this experiment was to see whether a homemade concoction along with trimming the stems of the flowers would aid the plants the same as a store bought one. In order to reach a conclusion a homemade plant food of sugar, lemon juice, and bleach was added to two samples of *Dianthus caryophyllus* (carnations). The results of individual ingredients (bleach lemon juice and sugar) were analyzed along with the mixture. Also averages of the samples were found to be in line with the suggested results of Mary H. Meyer of the University of Minnesota a homebrewed concoction did not extend the flower life. However if this project was done again more samples would be recommended.

ENVIRONMENTAL AND SPACE SCIENCE:

501. THE IMPACT EMISSIONS FROM EXPOSED SEDIMENT HAVE ON THE ATMOSPHERIC CARBON DIOXIDE LEVELS

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

The bottom sediment in areas such as bays and estuaries is made up of sand, silt, clay, and organic material. This organic material comes from the decaying remains of organisms and accumulates in the sediment over time. However, when sediment is exposed to the air through the process of dredging or by a tide change, the organic material begins to biodegrade and release carbon dioxide into the atmosphere. An excess amount of carbon dioxide and other greenhouse gases in the atmosphere is the primary cause of global warming. An experiment was conducted to determine the significance of exposed sediment emissions. The bottom sediment from Beaverdam Creek was collected along with sand to act as the control group. The sand and sediment were tested for organic material percentages, fractions of sand, silt, and clay, and for conductivity ($\mu\text{S}/\text{cm}$). Equal amounts of the material were then distributed into plastic containers and tested periodically with a carbon dioxide analyzer for emitted carbon dioxide levels (ppm). The results showed that the emissions of carbon dioxide from the exposed sediment were significantly high and exceeded the limit of the carbon dioxide analyzer at some points. Knowing the significant impact sediment has on the atmosphere can aid in better understanding the causes and effects of Global Climate Change.

502. ANALYSIS OF WATER QUALITY IN OCEAN AND MONMOUTH COUNTIES

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

In freshwater lakes, good water quality is essential for the organisms that inhabit them. Throughout a period of six weeks water samples were collected from eight different lakes in Ocean and Monmouth Counties. These water samples were tested for pH and the turbidity. The pH of water is a measure of how acidic the water is; the measure of hydrogen ions. The relative clarity of water is the turbidity, which is measured in Nephelometric Turbidity Units (NTU). When the pH or turbidity of lakes are at a dangerous levels, it can be harmful for fish and wildlife. The pH results were compared to the statewide standards for New Jersey; the data was analyzed to see if the results met the standards. For turbidity, past turbidity readings were collected in Ocean County by the NJ Department of Environmental Protection. The results showed that while most lakes met turbidity standards, lakes near development had higher turbidities. The pH values generally did not change unless rainfall had occurred in the period of time between collection dates.

503. WHICH CARBON TO NITROGEN RATIO PRODUCES THE MOST NUTRITIOUS COMPOST?

Luke Hult, Block 1 Biology, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Dr. John Wnek

Composting is a natural process that occurs when you allow organic materials to decompose in an aerated container with the help of micro and macroorganisms. The primary makeup of compost is of carbon and nitrogen materials. Carbon materials include dead leaves, while nitrogen materials include grass clippings. When composted, soils with different ratios of dead leaves to grass clippings produce varying levels of certain nutrients. The question is, which carbon to nitrogen ratio produces the most nutritious compost? To acquire an answer, four five-gallon paint bins with air holes were purchased and grass clippings and dead leaves were collected. Each bin was filled with varying C:N ratios; 3:1, 1:3, 2:2, and 4:0. Following the composition process, soil was extracted from the decomposed bins and tested for the nitrate levels. The results proved that the most nutritious compost, based on nitrates, was a ratio of three carbon for every nitrogen.

ENVIRONMENTAL AND SPACE SCIENCE (CONT'D)

504. CARBON DIOXIDE'S EFFECT ON THE TEMPERATURE IN 2050

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

Climate change is having an increased effect on the Earth's atmosphere. Carbon dioxide is the greenhouse gas with the most effect on the Earth's atmosphere due to how much is present. How much would all of the carbon dioxide in the atmosphere increase the temperature of the Earth by? This study focuses on how much more heat carbon dioxide traps than regular air. In order to create a conclusion of how much more heat carbon dioxide traps than oxygen, different amounts of carbon dioxide were used in 4 16.9 fluid ounce plastic bottles were used to keep the gases inside. Data on the levels of carbon dioxide to determine how the temperature of the Earth would be affected by how much carbon dioxide there was in the atmosphere. This data was inconclusive because there was no temperature difference between the containers with carbon dioxide and the container without any carbon dioxide.

505. OPTIMIZING THE GROWTH OF *NANNOCHLOROPSIS OCULATA* FOR BIOFUEL PRODUCTION USING COMMON FERTILIZERS

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

As the amount of fossil fuels on Earth is decreasing and demand for them is increasing, scientists are trying to find alternative sources of energy. One solution is extracting the lipids contained in algae. Algae does not take up a lot of space, it grows quickly, and has a high lipid content. Nutrients such as nitrogen, phosphorus, and potassium can increase the growth of algae and are commonly used in fertilizers. The goal of this experiment was to test which of these fertilizers increased the growth of *Nannochloropsis oculata* the most. In this study, algae species *N. oculata* was grown in a simple bioreactor. Each bottle contained various concentrations of nitrogen, phosphorus, or potassium fertilizers. There was also a control which received no fertilizer. The fluorescence of the algae was measured using a fluorometer which measured the light absorbed from the algae. The more light that was absorbed the greater growth. *N. oculata* grown with the phosphorus fertilizer grew the most, but there was no correlation between the different concentrations. The growth of *N. oculata* grown with the nitrogen fertilizer decreased as the concentration of nitrogen fertilizer increased. *N. oculata* grown in potassium fertilizer grew less than the control in lower concentrations. The growth of *N. oculata* was generally greater than that of the control. It was concluded that phosphorus fertilizer added to a bioreactor can increase the growth of *N. oculata* the most.

506. THE EFFECT OF PLANT TYPE ON DEAD ZONES

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

In recent years the amount of dead zones in waters across the world have been increasing. These hypoxic regions put the lives of aquatic organisms at risk. Aquatic plants cover the ocean floor and produce a large quantity of the oxygen many other organisms utilize to survive. A large contributing factor of dead zones is the excessive amount of nutrients provided from pollution which augment the growth of algal blooms that block sunlight from reaching this ocean floor. When these aquatic plants are given all the same resources, do they utilize it the same way? In this experiment, region specific plants were observed to detect any difference in the amounts of oxygen produced and their region in correlation to dead zones. Oxygen produced by the plants was captured in submerged vials and the water displaced was recorded in 12 hour intervals over the course of five days. It was hypothesized that *Ceratopteris thalictroides*, otherwise known as Watersprite, would displace the greatest amount of oxygen given these circumstances. The results of the experiment support this hypothesis, with *Ceratopteris thalictroides* producing the most oxygen which displaced the greatest amount of water in the vial.

ENVIRONMENTAL AND SPACE SCIENCE (CONT'D)

507. THE EFFECTS OF VARYING WIND SPEEDS IN DUNE HEIGHT AND ACCRETION IN REINFORCED AND NATURAL DUNE SYSTEMS

Owen Regehly, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES);
Advisors: Dr. John Wnek, Mr. David Werner and Mr. Jason Kelsey

Coastal dunes are important forms of protection from hurricanes, blocking water from coastal communities. Dunes can better protect coastal communities from storms with specific heights and slopes. Human replenishment of dunes is intended to optimize these dune slopes, but natural dunes may be more effective. The purpose of this analysis is to test the efficiency of replenished dunes versus natural dunes. To conduct this experiment, a natural dune in Barnegat, New Jersey and a replenished dune of Bay Head, New Jersey were measured for dune height, length, and slope angle over a four-week period. The results showed a negative correlation for the replenished dune, meaning that the slope angle decreased over time. The natural dune, not replenished nor bulldozed, appeared consistent with a neutral vertical correlation. The study concluded that natural dunes were more efficient due to more accretion and less maintenance. However, the results of this experiment may have varied in a different time of year, as some months are stormier than others.

508. THE DOMINANT FACTOR IN A METEOR IMPACT

Ryan Savin, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Jason Kelsey

Meteor impacts can cause extensive destruction, such as injuring or killing people, structural damage, generating tsunamis and even triggering mass extinctions. So what factor of a meteor strike decides the level of damage a meteor will cause? The factors that were tested were surface, velocity and density. To test these factors, 3 balls of varying materials were dropped from 4 different heights into 2 different surfaces. In sand, the averages of aluminum ranged from 5.83 cm to 8.13 cm, the averages of zinc ranged from 6.76 cm to 8.8 cm and the averages of lead ranged from 7.36 cm to 9.6 cm. In flour, the averages of aluminum ranged from 3.4 cm to 5.56 cm, the averages of zinc ranged from 3.5 cm to 7.36 cm and the averages of lead ranged from 3.36 cm to 8 cm. Although the answer to which is the dominant factor remains inconclusive as of now, the dominant variable in each factor was found. Flour provided more variety than sand, the highest velocity of 6.264 meters per second had the greatest effect and the dominant density was the 2.7 g/cm³ of aluminum, beating out zinc and lead.

509. HOW MUCH ALGAE IS BEST TO PRODUCE A LARGE AMOUNT OF DISSOLVED OXYGEN?

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

Algae produces Dissolved Oxygen (DO), microscopic oxygen bubbles mixed within water, through photosynthesis. In order to convert light into energy, algae releases oxygen and consumes carbon dioxide. On the contrary, algae consumes oxygen in times of darkness and when the population is too dense. The density of algae, water temperature, and air temperatures all can and will affect the amount of DO produced. In order to answer questions about how much algae is best to produce the maximum amount of DO, I conducted an experiment involving six bins of pond water with five containing algae. The bin without algae was used to determine how much oxygen was entering the bins. The other five bins had the same amount of water from the same source and had different amounts of algae. The results were taken over the course of 15 days were DO in each bin as well as air and water temperature. The results were then analyzed and exhibited that the algae actually reduced the amount of DO in the bins and had a consistent decline as more algae was added with the exception of bin #5.

510. THE EFFECTIVENESS OF *LEMNOIDEAE* AS A FILTER FOR NITRATE AND AMMONIA FILLED WATER

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

Lemnoideae, more commonly known as Duckweed, is an aquatic plant that has the ability to grow in lakes and ponds, and its subspecies are found in most areas of the United States. It is a very small, clover like flowering plant that is known for growing at extremely rapid rates. As such, it grows invasively in the bodies of water it inhabits. However, *Lemnoideae* has been utilized in the form of a mosquito repellent, a source of biofuel, and, for this project, a cheap and effective water filter. In this project I intended to remove ammonia and regulate pH levels in polluted water. I did this by diluting two tanks with a conventional lawn fertilizer. One had *Lemnoideae* growing in it, while the other had a biological aquarium filter, commonly known as a biobag. After a month of testing, I found that *Lemnoideae* was much more effective at cleaning the polluted water than my filter, being able to absorb more ammonia in a shorter amount of time. Levels of pH were regulated by both mediums at about the same rate, with 7.2-7.4 being the consistent reading in both tanks.

HEALTH, MEDICINE AND SPORTS:

601. THE EFFECTIVENESS OF HAND SANITIZERS AND THE OPTIMAL PLACEMENT OF DISPENSERS IN SCHOOLS

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

There are bacteria everywhere on the Earth; however, there are places where these microbes are not welcome, such as one's hands. Cleaning one's hands decreases the amount of bacteria, reducing the spread of disease. While it is generally agreed upon that using soap and water is the best way of cleaning one's hands, hand sanitizer has provided a method of sanitation without soap or water; however, there are many different types of hand sanitizer with potentially varying degrees of efficiency. The location of the sanitizer dispensers may also affect the amount of people using them, also decreasing the spread of disease. Testing was done on the hand sanitizers and research was done on their optimal dispenser location and the results were that different hand sanitizers mostly performed within relative similarity to each other with regard to efficiency. Optimal locations for the dispensers e.g. near doorways, entrances, and exits were established.

602. HOW ADDING WEIGHTS TO SOMEONE'S RUN IMPACTS THEIR HEART RATE

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

Every person has a resting heart rate which is generally between 60 to 100 beats per minute (BPM). When someone begins to exercise, their heart rate begins to increase because their heart must pump more blood to their muscles. My goal for this research project is to test whether adding weight to the run has an impact on their heart rate. Each runner ran with a different amount of weight held in their hands, and then directly after, their heart rate was recorded. After testing ten different people, there was no correlation between the weights and the heart rate of the individual. I tested four different weights: zero lbs., two lbs., six lbs. and ten lbs. Among all four weights the heart rate varied between each person. However, based on this procedure, it is possible that there could be a one to two beat miscount on the total heart rate of each person.

603. THE EFFECTIVENESS AND CONVENIENCE OF VARIOUS CLEANING METHODS ON TOUCHSCREEN SMARTPHONES

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

Our modern society has seen the rapid increase of mobile smartphone use recently. However, most smartphone consumers are unaware that their touchscreen devices are exceptional fomites, or harborers of bacteria. This bacteria can be removed by cleaning the surface of a smartphone, but it is not known which of many methods is most effective in this. Thus, this experiment was designed to discover which of three common cleaning methods removes the most microbes and which is the least time-consuming for busy, everyday lives. Each of the three tested cleaning methods functioned in specific ways: a handheld UV-C wand served as a disinfectant, an adhesive rubber roller served as a physical abrasive, and a microfiber cloth/sprayable cleaner combination served as a combination of disinfectant and physical abrasive. Four smartphones, each of which were subjected to different daily conditions, were cleaned with each method three times in a week and then sampled for any remaining bacteria, which was collected and grown in petri dishes. The results showed that the combination cleaner was the most effective at removing germs, and was also the most simply designed, making it the most convenient as well.

604. THE EFFICACY OF AQUEOUS OZONE AS COMPARED TO THE CURRENT CHEMICAL CLEANERS USED ON VARIOUS HARD SURFACES

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

Chemical cleaners, such as Oxivir® Tb Wipes, Virex® II 256, and Glance® NA, have presented harmful risks to children, pregnant women, adults, and the environment. Dwell times are also an important part of the usage of chemical cleaners that users often do not follow. Dwell times are the amount of time a chemical must lay on a surface to effectively destroy the pathogens on that surface. In comparison, aqueous ozone is everyday tap water infused with ozone (O₃) molecules. Aqueous ozone is a disinfectant that has no deleterious side effects to users or the environment. Various hard surfaces were tested to determine the level of contamination at the Marine Academy of Technology and Environmental Science (MATES) using chemical cleaners and aqueous ozone. The Hygenia® luminometer tested the pre- and post-contamination levels of the surfaces after cleaning with various chemical cleaners and aqueous ozone. The efficacy of each cleaner was measured using the average of the percent of decrease of contamination levels post-cleaning. Aqueous ozone was found to be a more effective cleaner and disinfectant on the hard surfaces cleaned when compared to each of the various chemical cleaners used in the experiment. Aqueous ozone can be used as a cleaner and sanitizer in schools, restaurants and other institutions without the negative side effects chemical cleaners present.

605. THE EFFECT DIFFERING LACROSSE SHAFT MATERIALS HAVE ON THE DISTANCE AND SPEED AT WHICH A BALL IS THROWN

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

Lacrosse is one of the fastest growing sports in America, bringing in thousands of new players each year. The high speed game has evolved since its beginnings as a Native American war ritual. Despite the sports recent popularity, unbiased research is hard to come by. To many experienced players, the materials used in their stick matters greatly. The problem for these players is figuring out which material will give them the heightened performance in specific areas such as strength or stiffness. My goal was to determine if certain materials provided better speed and distance when used in similar circumstances. Multiple materials were used ranging from wood to carbon fiber. These sticks were all tested ten times on the same thrower which was not altered in anyway throughout the project. The same head was used on each shaft as to not skew the results due to a poorly strung pocket or a broken head. My hypothesis was that the stick with the most flexibility would deliver the greatest distance while the lighter shafts would grant higher speeds. When I analyzed the data I found that the polycarbonate shaft provided the best distance, consistently throwing the ball upwards of 150ft (46m), while the carbon fiber allowed for greater speed, at about 40mph (64km/hr.) every shot. This study is important because it provides lacrosse players with insight as to what materials will impact their game in a positive way.

HEALTH, MEDICINE AND SPORTS (CONT'D)

606. THE EFFECTS OF *LAVANDULA ANGUSTIFOLIA* AND *MENTHA PIPERITA* ON CONCUSSED VERSUS NON-CONCUSSED

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

Essential oils are used to help people with their physical health. These oils are used to lower blood pressure in patients with higher blood pressure. *Mentha piperita* increases reaction time and causes heart palpitations. For this reason, it is used to improve reaction and attention. *Lavandula angustifolia* calms anxieties and therefore creates a slower reaction time. Essential oils trigger an increased blood flow of oxygen to the brain. Those that have suffered brain trauma are prone to being affected by essential oils due to this. There have also been studies that found a correlation between essential oils and the placebo phenomenon. In order to conclude if *Lavandula angustifolia* or *Mentha piperita* had an effect on physical health, this experiment was conducted. Participants had their heart rate, reaction time, and blood pressure collected before and after being placed in a room with an essential oil diffuser. After six trials, the data was analyzed to find that reaction time in the *Mentha piperita* trials were faster and the *Lavandula angustifolia* had slower reaction times. The placebo trials had similar results to the beginning trials as well.

607. DO THE MATERIALS AND STRING ORIENTATION OF A WOMEN'S LACROSSE STICK AFFECT THE SPEED AND DISTANCE A LACROSSE BALL IS THROWN?

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

Over the years, women's lacrosse has become more and more of a mainstream sport. As its popularity continues to grow, the complexity of string designs in lacrosse sticks has also increased, however, does string design really affect the quality of a stick? In order to determine if it does, an experiment was conducted where I threw a lacrosse ball using five different lacrosse sticks, each with varying string designs, and recorded the distance and speed of the ball. Two trials were conducted and the order in which sticks were used was randomized to ensure accurate results. After collecting and analyzing the results from both trials the graphs showed that there was significant difference between the stick that performed the best and worst. Due to the fact that there was a noticeable difference between the performances of the sticks it can be concluded that the string orientation does affect the speed and distance of a lacrosse ball.

608. THE PHYSICS AND BEHAVIORAL SCIENCE BEHIND THE ABILITY TO THROW A FULL

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

Tumbling is a very strenuous activity to complete. There are many factors that go into the ability to "throw" a tumbling class. When trying to do a roundoff backhandspring full, which are types of back flips, it is required that enough lift, power, and twist are done so that it can be landed without falling or acquiring an injury. Tumbling is mostly done by gymnasts and cheerleaders and some injuries they can receive are sprains, strains, broken bones, and concussions to name a few. This research was done to find out if the barometric pressure and the way a subject is feeling truly affects the way the subject completes his/her full and whether or not they land their full. The results concluded that on most days that the subject's feelings were negative, their tumbling was not as high, powerful, or well landed on these days compared to the days that they were feeling well. Although, with the more practiced participants that have been doing this skill for longer, there was not much of a difference when they were not feeling so well.

PHYSICAL SCIENCE, ENGINEERING AND MATH:

701. HOW DOES WATERLOGGING AND WEIGHT AFFECT DIFFERENT WOOD SPECIES OVER A LONG PERIOD OF TIME?

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

Wooden planks are commonly used as construction materials in structures like houses, bridges, and buildings. To keep these structures strong, wood has to be able to withstand weight over a long period of time and when used outside, wood has to be able to resist the effect of waterlogging. There are hundreds of species of wood used as construction materials and carpenters have a difficult time in choosing what wood would be best at withstanding weight and water over a long period of time as a factor of cost. I exposed eight wooden planks to weight by hanging buckets full of water from their midpoint over a 30 day period. I took two planks of Maple, Oak, Poplar, and Pine wood to use for this experiment, separating them into two groups of waterlogged wood and dry wood by taking one plank of each species into the two groups. The group I labeled as waterlogged I kept wet with a soaked towel, wetting the towel every day to effectively waterlog the wood. The results showed intense bowing and bending of the wood from both parties of wet and dry wood. In the dry wood group, maple wood resisted the weight the best, however when the wood was waterlogged, the oak wood resisted the weight the best. This happened with the wet wood because oak is very porous so when it was waterlogged the wood actually expanded and counteracted the force bending it down.

702. THE EFFECT OF THE DISTANCE BETWEEN MAGNETS IN A GAUSS RIFLE ON THE LAUNCHED BALL (BALL-X)

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

Magnetic acceleration is the use of magnets to increase the speed of the object, which can be used in the entertainment industry. In the case of the Gauss Rifle the objects that are being accelerated are steel balls. Two balls are placed on each magnet on the side that is facing the launched ball. The initial steel ball is released and is pulled by the magnet increasing the speed. When the steel ball hits the magnet the energy moving forward is transferred through the magnet and the first ball and into the second ball. The energy then has enough power to pull it away from the magnet at around the same speed the first ball had when it hit the magnet. It repeats all the way up to the launched ball (Ball-X). The last ball has nothing to stop it so it flies forward and that is where the results were received. It was observed that as the length increased so did the distance traveled all the way up to 5 cm and then after 5 cm the distance traveled started to decrease. For 4 cm the average distance was 37.085 m, for 5m the average distance was 39.89 m, and for 6 cm the average distance was 34.71 m. The thought now is that all magnets have a prime distance between each magnet to get the farthest distance. This data represents that if companies are looking to use magnets they should look into what the optimal spacing distance that will obtain the best results and save be the most economically.

703. WHAT MATERIAL IS THE MOST RESISTANT TO CORROSION?

Dylan Del Sontro, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisor: Mr. Dave Werner

In the construction of buildings, resistance to environmental damage, or corrosion, is crucial. This can be said especially for coastal structures that are constantly exposed to salt, wind, and other environmental damages. Out of three metals, one would be shown as the most corrosion resistant in multiple salinities. Three of each metal, aluminum, steel, and stainless steel, were placed into three different salinity values for five weeks. Each week, the metals were taken out, dried, and examined using an analytical scale, and then placed back into freshly made water of their assigned salinities. After five weeks, the changes of mass were calculated, and the least amount of change determined the most corrosion-resistant metal. Aluminum was the most resistant for one week, while stainless steel was the most resistant overall for two out of the three weeks. Stainless steel ultimately was the most resistant metal of the three metals tested, due to its abundance of chromium.

704. GENERATING RANDOM NUMBERS USING VIDEO GAMES

Nicholas Genardi, Block 2 Biology Class, Marine Academy of Technology and Environmental Science (MATES)
Advisor: Mr. Kelsey

Random numbers are used in many places, in credit card numbers, for IP addresses, for video and online poker, and so many other things relating to security, technology, and entertainment. The purpose of this project was to see how random different random number generators are and if better random numbers could be generated without the use of external hardware or a third-party generator service. A total of six generators were tested in this project. To get the results, the generators had to manually activate to generate 30 numbers each, one of the generators using a video game called Destiny. After the data was collected, an ANOVA test was conducted on all 6 groups at the same time. The p-value generated was not statistically significant, meaning it might be plausible to make a generator in Destiny or any other game that has a similar technique in generating numbers for any reason.

705. THE WEIGHT CAPABILITIES OF THE SWEEPED BACK AND TAPERED STRAIGHT WING DESIGNS

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

Aerodynamics is a field filled with variables and risks. Over time several people have attempted at making the *best* design. Two of the best and most popular designs are the Swept Back wings and Tapered Straight wings. Throughout the project, my goal was to see which wing design was better at holding more weight and where it benefitted it the most. At first, I thought that the Swept Back wings would beat the Tapered Straight wings in every category. Swept wings are the common everyday wings that you can see on a commercial airliner or a jet. Tapered wings are the wings of a stunt plane or old WWII planes. Eventually, after I had started testing, I began to realize that the Tapered wing beat the Swept wing when there was less weight and that the Swept wing beat the Tapered wing when more weight was introduced; specifically, the nose of the plane. Another part of my tests were to see where the weight should be distributed in order to improve the performance of each of the gliders. After analyzing all the data, I have realized that the swept back wings are more susceptible to stall due to the large surface area of their wings, and to counteract this setback weight should be added to the front of the plane (the nose cone) to hold the nose of the plane down in order to make it more difficult for the glider to stall. The tapered straight wings are less susceptible to stall due to the lack of surface area on the wings; however, it struggles to uphold a lot of weight due to the lack of surface area which results in instability. Therefore, the swept back wings are more useful because of their stability and ability to overcome their high risk of stall; however, tapered straight wings are more agile and unstable making them unfavorable for traveling but still is safer when it comes to an increased risk of stall.

706. VERTICAL AXIS WIND TURBINE DESIGN

Eric McGivney, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),
Advisors: Mr. Jason Kelsey, Dr. John Wnek and Ms. Jessica Olsen

Wind turbines are very relevant in renewable energy, but some wind turbines are designed better than others. Traditional horizontal axis wind turbines can kill birds, are top heavy, need to be shut down in high winds, are expensive, and have an efficiency limit. Other designs, like vertical axis wind turbines, can be made cheaply with fewer parts and can handle certain conditions effectively. They also do not have an efficiency limit. The objective of this study was to operate a custom built vertical axis wind turbine under varying weather conditions to determine the negative or beneficial effects on power output. It was hypothesized that the materials used would be sturdy and strong, and that high winds would not damage the turbine. The results show that the turbine was strong and handled weather conditions well, supporting the hypothesis. Increasing wind speed also increased the voltage, supporting the hypothesis. Voltage ranged from 0.15V to 2.5V. Design flaws did not support the hypothesis. The belt system that was used caused the turbine to be unable to operate unless in high wind speeds, along with other design flaws. These results are important in wind turbine design for what materials to use depending on what conditions the turbine is going to put in, and how to go about putting together the turbine. The results of this study indicate that more efficient turbines should utilize, lighter, more flexible materials, such as aluminum for the blades and frame, bearings to reduce friction, elastomer belts, and plastic or metal stands rather than heavier, cumbersome wood stands. Optimal weather conditions for maximum voltage output are wind speeds starting at 5 mph, and ideally no precipitation, as water can damage the turbine, especially wooden components.

707. HOW ACCURATELY CAN A SELF-MADE ROCKET SIMULATION PROGRAM PORTRAY A REAL-LIFE MODEL ROCKET LAUNCH?

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

Launching model rockets is a hobby that tons of people in many different places enjoy. It can be done almost everywhere and it is relatively cheap-that is, until the rocket gets lost. This is a huge problem for anyone living near trees, water, or private property that the rocket can land on. In this experiment, I launched about 25 rockets using various rocket engines and collected the height recorded for the launch by the altimeter, as well as where the rocket landed in relation to where the launchpad was. I also recorded the wind speed and direction on that day. During this time, I made a program that calculated the height of the rocket based on the engine used and the mass of the rocket. The results showed that the program's height results were, on average, off by 24.16% compared to the actual launches. Because the landing locations were too erratic, I concluded that the landing location of a model rocket is too erratic to be measured with wind.

708. CAN A HOMEMADE FUEL CELL/HYDROGEN GENERATOR BE USED TO CHARGE UP REGULAR APPLIANCES

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

Fuel cells convert chemical energy into hydrogen rich fuels that can efficiently charge up technology. When a hydrogen rich fuel such as clean natural gas or renewable biogas enters the fuel cell stack, it reacts electrochemically with oxygen to produce electric current, heat, and water. This produces almost zero harmful emissions, meaning there is little to no worry of pollution. However, the downside is that this does not produce the energy as quickly as combustion can, and fuel cell creation is both very expensive and takes time, making it impractical. To test a fuel cell's effectiveness on a small scale, I experimented by using a homemade fuel cell generator, using copper wire, to power a small cellular device as well as a light bulb. I also created a 2nd generator using steel wire to see if it could produce enough voltage to power the same items. Each generator was charged with a 9 volt Rayovac® battery and watched under equal conditions and time. The final result showed that the steel wire generator conducted more electricity, but neither was capable of charging either appliance.

709. THE EFFECT OF DURABILITY AND ELASTICITY ON ACRYLONITRILE-BUTADIENE-STYRENE AND POLYVINYL-CHLORIDE PLASTIC WITH TEMPERATURE CHANGES AND WATER ACIDITY

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

Water, whether it be contaminated or clean, hot or cold, can slowly expand the pipes of the walls in a house with the power of an accidental pressure influx. Two main sources of piping are used in the twenty-first century: Acrylonitrile-butadiene-styrene (ABS) and Polyvinyl-chloride (PVC), but contractors and plumbers need to make the right choices of installation in order to prevent leaks of pipes. Although polyvinyl-chloride is much more durable in its molecular makeup, acrylonitrile-butadiene-styrene is elastic and can withstand the strain of expansion of water. Initially, six testings of pipes were examined (three of each), and three different factors were placed in the water: hot water, cold water, and lemon juice. After all of the data was collected and correlated, the results showed that warmer water would expand the ABS pipe, but the cold water made the PVC pipe brittle. In the end, acrylonitrile-butadiene-styrene did not withstand the maximum forces applied to the rupture points of the polyvinyl-chloride in five of the tests, with the exception of one test showing otherwise. There is indeed an effect of durability and elasticity between water temperature and acidity in these pipes.

710. CAN A MORE ENERGY EFFICIENT STRUCTURE BE CREATED OUT OF RECYCLED MATERIALS TO REPLACE CONVENTIONAL HOME CONSTRUCTION?

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

Heat from the outdoors enters a home mainly through two ways: convection and thermal radiation. Convection is the transfer of heat through fluids, occurring when warmer areas of the gas or liquid rises to cooler parts of the fluid, and cooler gas or liquid takes its place. Radiation is a form of energy transport consisting of electromagnetic waves traveling at the speed of light. Insulation is a material or substance that is used to stop heat from going into a home during the summer and prevents heat from escaping in the winter. Insulation is the use of materials that provide resistance to heat flow. This study was conducted to observe the potential of recycled materials to be used to insulate and create an energy efficient structure. In this experiment, four walls were constructed and used to build a structure, each wall using a different type of recycled material: cardboard, plastic, tire rubber, and fiberglass as a control. A heating lamp was placed inside the structure as temperature in and outside of the structure were measured over an hour period of time at six 10-minute intervals. Five tests were conducted, the first being a control test where all four walls had a layer of foam insulation board attached inside the structure. In the next four tests, one layer of foam insulation was removed and the wall was then “active,” meaning the recycled insulation of that wall was being tested. In each test the “active” wall alternated until all four walls were each individually “active” and tested. It was discovered that tire rubber insulated better than plastic products and cardboard, but not as well as common fiberglass insulation. Cardboard was also shown to be a good insulator, but not as successful as tire rubber or fiberglass insulation. Of all the materials tested, plastic products were the least successful in insulating the structure.

ZOOLOGY:

801. CARAPACE AND PLASTRON SIMILARITIES OF TERRAPINS WITHIN THE SAME CLUTCH

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

Terrapins are one of the most intriguing reptiles on our planet, but due to lack of research, it seems as if there is an extensive amount that we do not know about these creatures. For example, the similarities between the shells (scientifically known as carapaces) of different terrapins is a topic that has almost never been looked into. To finally examine this topic a little, this project analyzes the carapace and plastron similarities of terrapin hatchlings that come from the same clutch. To go about this task, two different clutches of terrapins were examined by means of photographing both the carapace and plastron of each hatchling from about six inches away, and then seeing how each one related. Both sample sizes were originally 20 terrapin hatchlings, but were both cut down due to some of the pictures being blurred. Noticeable different types of carapaces and plastrons were described by their details, and were quantified based on how many terrapins possessed each certain type. The data showed that each group had a diverse amount of carapace and plastron types, and often ended up having one type appear far less than the others. To conclude, determining a terrapin's clutch or origin by its carapace or plastron type is not too far-fetched, and could perhaps help identify terrapins that have been stranded outside of their habitats.

802. EFFECTS OF COMMON DETERRENTS ON BACKYARD BIRD AND SQUIRREL SPECIES

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

Birds are vertebrates that can be found almost everywhere, in some places more common than the grey squirrel. These bird species can be named and counted for frequency in a specific area, especially if bird feeders are present. Many homeowners do not like squirrels, because they tip over birdfeeders and nest within their homes. A common problem for them is finding a deterrent for squirrels that does not affect the birds. My experiment tested two different deterrents, sound waves and seasoning. An experiment was conducted to determine the most effective deterrent between four different types of seasoning, high frequency sound waves, and the both together. Four of the same type of bird feeders were each filled with three cups of birdseed and _ cups of seasoning; one containing no seasoning and the others containing one of four different seasoning. The seed used in this experiment were black oil sunflower seed. The species and selection of seed was recorded every day between the hours of four and five in the afternoon for two months. In the end, the birds and squirrels both did not eat from the seed coated in seasoning as much as the uncoated seed, and when sound was introduced, both birds and squirrels were scared off.

803. ANALYZING THE FACTORS THAT IMPACT THE QUALITY OF DIFFERENT VARIETIES OF CHICKEN EGGS

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

Chickens have played a major part in the food industry. They are raised for their meat and for their eggs. Most people buy eggs from stores. Some people buy organic eggs, and others collect them from chickens that they raise. Is there a difference between those eggs? To determine the differences between the eggs, one dozen white store eggs, one dozen brown store eggs, two dozen organic eggs from different companies, and one dozen eggs from my own hens were used. Eggshell thickness was measured in each egg and the yolk color of each egg was assessed. It was found that eggs from my own hens had the thickest eggshells and the darkest yolk color, with organic eggs in second and regular store eggs in third.

ZOOLOGY (CONT'D)

804. THE MEMORY SPAN OF THE *APIS MELLIFERA CARNICA*

Julia Kuzan, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisor: Dave Werner

The Carniolan honey bee, *Apis mellifera carnica*, is a subspecies of the western honey bee that is known for its gentleness, resistance to pests, and overwintering success. After a long period of weather that prevents them from flying, honey bees can be seen reorienting their geographic location outside of their hive. This behavior may indicate that they form new memories from experience. Worker bees were collected from a hive and placed into the refrigerator to onset hibernation. Once the bees were sorted and awake, they were tested six consecutive times for their ability to complete the task of climbing from one jar to the next through a hole in the divider between the jars. When the bee climbed through the opening, it was rewarded with honey. After the data was collected, it was found that the times increased and decreased at no set rate. Due to the lack of a pattern in the times and the small sample size, it was concluded that there is no correlation with the amount of times through the course and the amount of time it took to complete the test.

805. WHAT IS THE EFFECT OF COMPETITION ON THE FOOD SIZE PREFERENCE OF *MALACLEMYS TERRAPIN TERRAPIN*?

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

The Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) is a turtle native to brackish water environments like Barnegat Bay. Obtaining food requires energy, and the energy obtained must be more than the energy expended. The Optimal Foraging Theory states that the animal, in this case being the Northern Diamondback Terrapin, looks for the most energy gained with the least amount of effort possible. Therefore, it is thought that animals will think that there will be less energy expended in groups pursuing small food, rather than pursuing larger food. Turtles were assembled into groups of 1, 5, and 10, and they were given 0.1 grams of each type of food per turtle. It was observed that turtles when in no group, chose to pursue larger food. When they were in groups of more than one, the turtles preferred smaller food. This is important while studying feeding habits of terrapins. It was found that competition makes turtles pursue smaller food when in groups.

806. THE EFFECTS OF WATER ACIDIFICATION ON *FUNDULUS HETEROCLITUS*

Rebecca Mastrola, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES); Advisors: Mr. Dave Werner and Dr. John Wnek

The acidification of water occurs for a variety of reasons, including pollution, increased levels of carbon dioxide, and increased water flow. As the pH of the water lowers, the repercussions for fish become more severe. The species used in this study, *Fundulus heteroclitus* (mummichogs), were separated into two 10 gallon tanks with eight in each one. The control tank had a balanced pH generally between 7.2 and 7.4, while the experimental tank was given $\frac{4}{5}$ teaspoon of pH down every other day. Over time, the fish in the experimental tank suffered from loss of appetite, decreased activity levels, and a decreased respiration rate. By pH 5.5, it was noted that their gills had expanded more than normal and seemed to be working harder. It was also observed that the dorsal fins on the fish became flimsy. The data collected by the research experiment confirmed that as the water acidifies, the *Fundulus heteroclitus* suffer serious health issues that could potentially be fatal.

ZOOLOGY (CONT'D)

807. THE ANALYSIS OF TEMPERATURE VARIATION WITHIN A DORMANT *APIS MELLIFERA* HIVE

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

The ubiquitous *Apis mellifera* plays an essential role to the environment. With their recent large population decline, it is important to maintain healthy hives and monitor important indicators, such as temperature. In the winter, when a beehive goes dormant, the bees form a cluster around the queen to maintain heat inside the hive. As winter temperatures vary on the outside of the hive, how does temperature differ within the hive? Do internal temperatures vary with exterior temperatures? In order to find out, temperature data was retrieved from inserted thermocouples. Two different types of hives, Langstroth and Warre, were monitored from November 13, 2016 to January 29, 2017, providing thirty data points per location. The temperature data was analyzed with t-tests, regression tests, and correlation tests to ascertain that temperatures within both hives have a strong, positive relationship with the exterior temperature, and correlate with each other. Both hives showed higher temperatures than the outside air temperature, concluding that honey bees are active in the winter and the dormant hives are thriving.

808. DIRECTIONAL PREFERENCE OF THE DIAMONDBACK TERRAPIN, *MALACLEMYS TERRAPIN*, HATCHLINGS AT BARNEGAT BAY, NJ

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

The Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) is a native turtle species to the east and Gulf coasts of the United States. In recent years, there have been many conservation efforts for the protection of this species as well as research done to better determine populations. Terrapins nest on shoreline areas along Barnegat Bay and hatchlings emerge from the nests, then make their way to salt marshes. After emergence, do terrapins use visual cues or is there a form of magnetic imprinting that will provide the hatchlings with a sense of direction to the nearest salt marsh? To answer this question, that the hatchlings have a natural directional preference based on the nesting locations, I determined the orientation of 113 terrapin hatchlings from North Sedge Island. Hatchlings were placed in a large circular bin (arena) to determine their directional movement as related to the initial nest site on the Island. Each terrapin was placed in the center of the arena, under an opaque container, then released and monitored to see their first directional instinct. A majority of the hatchlings heading in the direction that the nearest salt marsh was located in on the Island. This study was performed with hatchlings that emerged from eggs in nests on the Island and from hatchlings that emerged from eggs that were incubated at school. It was concluded that there was a correlation based on the location that the terrapins hatched and the direction that they vacate the nest. This study indicates that terrapin hatchlings possess some type of magnetic field detection ability.

ZOOLOGY (CONT'D)

809. HOW DOES *PALAEMONETES VULGARIS* REACT TO SIMULATED BIOLUMINESCENCE OF COLORS ON THE VISIBLE LIGHT SPECTRUM?

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

Bioluminescence is a frequently observed phenomenon in both terrestrial and marine organisms. It describes the ability of a living thing to emit light as a product of a biochemical reaction commonly involving a light-emitting compound and an enzyme, luciferin and luciferase respectively. Many scientists have proposed different theories on the subject of the contribution of bioluminescence as an adaptation to the continuation of a species: as a survival mechanism, to attract a mate, or for feeding purposes. *Palaemonetes vulgaris* is a species of shrimp that grazes upon bioluminescent algae. This research experiment aimed to see how *Palaemonetes vulgaris* would respond to differently colored light in the dark. 100 shore shrimp were kept in a tank divided into a 2 cm by 2 cm grid system with a total of 4 rows, 1 being closest to the light source and 4 being the bottom of the tank. An LED circuit of red, orange, yellow, green, and white was flashed once a second for a minute over the open top of the tank each with a total of 10 trials per color. Then, a count of the number of shrimp in each level was recorded along with a tally of those that jumped out of the water. My hypothesis was that the greatest reaction would be observed as a response to the green or white flashes due to blue-green and white light being the most common color of bioluminescence in the ocean, and that the shrimp would gravitate towards the light mimicking their prey. An ANOVA test was run on the data from each level of the tank in relation to the light and although the averages for the two levels closest to the light were highest for the white and green light, a statistically significant difference was not found. This means that the difference in the means of the number of shrimp in response to each color for each level was not notably divergent from that which could be expected and predicted.