

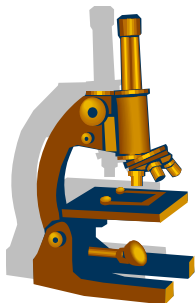
# Marine Academy of Technology & Environmental Science



## Seventh Research Showcase

Abstract Guide

April 17, 2013



April 17, 2013

It is our seventh year of the MATES Research Expo! This was a great year for student research outside of MATES with 14 projects presented at the Delaware Valley Science Fair and one of the projects moving on as a 2013 finalist in the Intel International Science and Engineering Fair. All freshmen and transfer students were required to conduct an independent experiment. Once completed, the students completed a poster culminating in the poster session on April 17, 2013. 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. However, they will be judged depending on their category.

We would like to thank the students for their project presentations this year. The students worked hard and it will show in the following abstracts, and during the poster session. Thanks to the MATES Parent-Teacher-Student Organization that was generous in providing funds for materials for numerous projects. We wish to thank our Ocean County Vocational Technical School Board of Education, Administration (Mr. Hoey, Ms. Weber-Loeffert, Mr. Frazee, and Ms. Carroll) and MATES Staff, especially Mr. Jason Kelsey and Mr. David Werner (both advisors), Ms. Maryann Minnier, Ms. Mia Dill, Mrs. Kelly Kelsey, Mr. Adam Sprague (advisor), Mr. Gary MacDonald, and Mr. Brian Coen who contributed to the success of the project. Also, thanks to Ms. Debrah Koehler, Ms. Ester Gallacchio, Mr. Gino DiGiovanni, Mr. Bob Quist and Mr. Roman Khariv 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 take this time to thank Sarah Jakositz and Meaghan Martin (both class of 2014) for organizing research mentoring sessions for the freshmen, and organizing Walker Davis '13 and Leah Goldsberry '14 to also help out. And, last, but not least, a very special thank you to all of our judges who volunteer to provide our students with constructive feedback about their projects. We greatly appreciate your time and expertise in making the 2013 MATES Research Expo a real success.

Congratulations to all of the students listed in this guide.

Sincerely,



John Wnek, supervisor,  
Science and Research

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## **BIOTECHNOLOGY AND MICROBIOLOGY:**

### **101. BACTERIA COLONY COUNT FOR MOST TOUCHED HOUSEHOLD SURFACES**

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

Bacteria are prokaryotic microorganisms that live amongst everyday life. Different bacteria grow and reproduce in all different areas. For example, every surface of any house is most likely covered in bacteria. In order to compare the amount of bacteria located throughout common households, bacteria was swabbed in two different houses and placed in petri dishes with agar. The process of total count was performed to count the amount of colonies in the petri dishes. After analyzing the data, the research showed that one surface of a house was noticeably higher than the others and the same goes for the other house. This experiment is used to show the areas of homes that contain the most bacteria and should be used more cautiously.

### **102. COMPARISON OF BACTERIAL GROWTH ALLOWED BY DIFFERENT TYPES OF EARPHONES**

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

Since people are wearing earphones more and more, it is important to study how earphones affect the bacteria in the ear. In order to determine what type of earphones increased the bacteria in the ear the most, I performed an experiment using different types of earphones- headphones, ear buds that went into the inner ear, and Apple ear buds. I had volunteers wear the three different earphone types over the course of one day, and I measured how the amount of bacteria in their ear canals changed before and after the experiment. I found that the ear buds that went into the inner ear increased the bacteria in the ear the most. Because of this, people who are concerned about bacterial growth in their ears or get frequent ear infections may want to avoid wearing ear buds that go into the inner ear.

### **103. CAN CANVAS BAGS BE DANGEROUS?**

Kate Doherty, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisors: Mrs. Kelly Kelsey and Dr. John Wnek

Often, raw chicken can contain various strains of bacteria including more harmful strains such as salmonella. The use of reusable canvas shopping bags may result in the cross contamination of other foods later if the bacteria from the chicken and its packaging remains. Tests were done to see if bacteria from the chicken's packaging would culture on its own in washed or unwashed reusable bags. Bacteria strains were observed in the washed bag cultures, concluding that the chicken purchased that week had bacteria. After being washed again, the bacteria count was again at zero, therefore washing the bag regularly is a safe way to remove of any bacteria and eliminate cross contamination.

## **BIOTECHNOLOGY AND MICROBIOLOGY (CONTINUED)**

### **104. THE EFFECT OF MEDICINAL MUSHROOMS ON *LACTOBACILLUS ACIDOPHILUS***

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

Recent movements towards natural products have reintroduced a world of healthy habits, and not much is known about the reactions between common fungi and bacteria. Therefore I wanted to know whether the antibiotic properties of the fungi would hinder the growth of the bacteria. I grew colonies of a common probiotic bacterium, *Lactobacillus acidophilus*, and put small amounts of the steeped fungi on the grown bacteria to see if it would hinder or help the bacteria's growth. I dipped small paper circles in various strengths of the steeped fungi and placed them in petri plates with the bacteria. After 24 hours at 35 °Celsius the bacteria had shown no growth differences in the small rings of extract and water surrounding the paper circles. Results of the project showed that the fungal extracts have no effect on the growth of the bacteria.

### **105. WHICH TYPE OF CUTTING BOARD HARBORS THE MOST BACTERIA AFTER MULTIPLE USES?**

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

Cutting boards are an essential kitchen item. They protect countertops from being damaged by knives, and they can conveniently carry chopped-up food from the counter to the stovetop and other places in the kitchen. Cutting boards come in a variety of materials, including bamboo, polyethylene plastic, and glass. There is often debate over which type of cutting board is the most sanitary after multiple uses. Over time, grooves appear on certain types of cutting boards which can harbor bacteria such as salmonella and *Escherichia coli*, which can both cause foodborne illnesses. This experiment tested the total number of bacteria colonies on bamboo, polyethylene plastic, and glass cutting boards after multiple uses to see how much bacteria remains on the cutting boards. Raw chicken was cut on each board and they were washed thoroughly using hot water, Dawn Antibacterial® Soap, and scrubbed with a clean paper towel. This experiment also looked at the effectiveness of properly cleaning the cutting boards in this manner. After five uses, the results show that the polyethylene plastic cutting board harbored the most bacteria and that washing the boards in the manner described above effectively removed most of the bacteria from all three boards.

### **106. VIRUSES THAT DESTROY BACTERIA: HOW TEMPERATURE AND INCUBATION TIME AFFECT THE GROWTH OF PLAQUES**

Bryan Rogers, 3<sup>rd</sup> Block Science Class, Marine Academy of Technology and Environmental Sciences (MATES),  
Advisor: Mr. Jason Kelsey, Dr. John Wnek, Mr. Adam Sprague

This project explored whether the bacteriophage T4r can be used effectively to deter or kill *E. coli* and other viruses alike. To test this hypothesis, the *E. coli* was strengthened throughout a 24-hour incubation period at room temperature. The strain of T4r was not strengthened using any means. When the diluted T4r bacteriophage and the incubated *E. coli* were combined in a petri dish, they were then incubated for a time period of 20 hours. Once the incubation sequence was finished, the colonies of bacteria, *E. coli*, were counted. From the results, it is shown that as the T4r bacteriophage was diluted, making the strain weaker, the amount of *E. coli* began to rise, thus creating an inversely proportional relationship. In total, the *E. coli*, due to the time of incubation, which strengthened the virus excessively, made it so that the T4r bacteriophage was not able to deter or slow the growth of the *E. coli*. Thus, it is shown that, under these conditions of a strengthened *E. coli* virus and a diluted T4r bacteriophage; T4r cannot be used to effectively kill or deter *E. coli* bacterial strains.

## **BIOTECHNOLOGY AND MICROBIOLOGY (CONTINUED)**

### **107. THE EFFECTS OF WHOLE GRAIN A-AMYLASE INHIBITORS ON THE EVOLUTION OF HUMAN AMYLASE GENES**

Kelly Szaniawski, Block 2 Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. Adam Sprague

Whole grains are not only a very important part of today's modern diet, but share a major role in the evolution of Human amylase genes. High-starch concentrated diets have been shown to be more prevalent in people with a high number of amylase gene copies. Are whole grain a-amylase inhibitors a major factor in amylase gene copies? To determine whether amylase inhibitors were a possible factor in amylase gene copy numbers, eight different inhibitors of whole grain species: *Triticum aestivum* (wheat), *Setaria italica* (millet), *Oryza sativa* (rice), *Aegilops tauschii* (a type of a grass), *Hordeum vulgare* (barley), *Sorghum bicolor* (millet), *Zea mays* (corn), *Avena sativa* (oats) were each compared to the genomes of the same seven whole grain species using an online protein/ nucleotide comparison tool called *BLAST*. Additionally, the origin and consumption regions of these whole grain species were compared for starch diet consumption and amylase-copy numbers. Results showed that the whole grains that had contained the most matches for other inhibitor sequences were located in areas where the population contained high amylase gene copy numbers and vice versa. Therefore, a higher concentration of a-amylase inhibitors sequences in whole grains correlates positively with a higher human amylase copy number variation.

## **BOTANY:**

### **201. THE SODIUM CONTENT OF BAY SIDE AND OCEAN SIDE PLANTS ARE A SUFFICIENT SUPPLEMENT OF SODIUM FOR A HUMAN**

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

We live right next to one of the biggest water sources in the world, the ocean. Even though the ocean is filled with salt water that human's cannot drink, plants can still use that water for nutrients, but what do plants do with the salt? That is what I researched. I tested two plants, the *Salicornia virginica* and the *Cakile edentula* and found the sodium content and whether or not it is enough to be a sufficient supplement for humans. Using an YSI I was able to record the conductivity in micro Siemens, then using a formula I calculated sodium in parts per million. After I found the sodium levels of common meal choices, I compared the data calculated and concluded that 125g of Salicornia Flower have enough sodium to substitute any of the three common meals.

### **202. THE EFFECTS OF THE FLUCTUATION OF WATER FOR THE SPIDER PLANT**

Kyle Davison, Block 3 Science Class Marine Academy of Technology and Environmental Science (MATES),  
Advisors: MR. Dave Werner and Dr. John Wnek

The growth rate and overall health of the plant was greatly affected by the amount it was watered. The more water the plant received created a greater chance of it developing root rot, but when the plant received too little water it began to wilt and die. Most people believe that watering a plant a lot of water can lead to it being healthier, but this is a misconception it could lead to the growth of a fungus that could lead to the death of the plant. Can watering plants a lower amount lead to a more mature and full plant? To test this, nine cuttings of a large plant were planted. The plants were watered a half, one, or two cups every three days. At the end of the experiment the information was gathered and graphed. One group of plants was exceptionally healthier than the other ones which lead to the conclusion that watering plants even slightly different amounts can affect their growth extremely.

## **BOTANY (CONTINUED):**

### **203. THE EFFECT OF DIFFERENT WATER TYPES ON THE GROWTH OF LIMA BEAN PLANTS**

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

Much of the food from around the world is grown. All fruits and vegetables and many more things good for you is grown from the ground. The main thing that makes these plants grow is sunlight and water. Sunlight cannot be changed but water can. In this study four different types of water were tested on one plant, the lima bean, to see which one made the lima bean grow the fastest. Over several weeks the growth of each lima bean plant was recorded. Once this was finished, it was found that the lima bean plant watered by mineral water grew the tallest over the specified time. This test was done twice, with four sets of four plants. Though not cost efficient, the mineral water would be the best choice for small gardens. Tap water, which most gardens use, did the worst in the first set.

### **204. EFFECTS OF *ELODEA* ON DISSOLVED OXYGEN**

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

*Elodea* is an invasive aquatic plant around the world. It reproduces quickly, consumes mass amounts of nutrients, and, eventually, chokes out ecosystems. One major problem caused by this pest is its “supposed” ability to drain ecosystems of oxygen dissolved in the water. Aquatic organisms use this dissolved oxygen for respiration. Similar to terrestrial organisms, a lack of oxygen will actually drown the aquatic organisms in the ecosystem; however, *Elodea* can survive this lack of oxygen and thrive in the decimated ecosystem. This experiment obtains the raw data regarding respiration and reproduction, proving whether or not *Elodea* is the oxygen-consuming monster it is renowned to be. Also, this investigates the rate of reproduction as the plants grow. Seeing how population affects oxygen levels (and in turn, reproduction) can help us to clearly see the effects (or lack thereof) of their growth and respiration. Overall, the dissolved oxygen levels remained somewhat constant; however, the plants did reproduce, but only after other individuals died.

### **205. THE EFFECT OF MIRACLE GRO AMOUNTS ON VENUS FLYTRAP PLANTS AND SEEDS WHEN USED AS FERTILIZER**

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

The growth and development of a plant is based upon the nutrients, sunlight and water it receives. The more nutrients, sunlight and water it gets, the larger it will grow, to an extent. When too many nutrients, too much sunlight or water is absorbed, the plants growth stunts, and it under – develops; so what happens when a hearty plant, like a Venus flytrap, is loaded up with nutrients? Would the plants survive at all, and if so, thrive or become stunted? In order to test this, nine Venus Flytrap (*Dionaea muscipula*) plants, were separated into different soil types: nutrient poor, average, and fertilized. Each of these plants, along with 20 seeds of the same variety, were kept in a terrarium, put under a lamp to simulate sunlight for 12 – 14 hours, and sprayed with distilled water 3 – 4 times per week; this spanned from mid – November until mid – March. Color was visually judged and recorded. They showed that, in a properly fertilized soil, plants will grow and thrive, and pass the regular nutrition and poor nutrition plants in both size and color.

## **BOTANY (CONTINUED):**

### **206. WHAT IS THE BEST MEDIUM FOR REGENERATING AFRICAN VIOLET ROOTS?**

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

The African Violet, *Saintpaulia ionantha*, is native to Tanzania, Africa, and is found in rainforest environments with high moisture and varying amounts of shade. They typically thrive in rocky crevices, areas with beds of moss, and on any type of wet surface. Due to their sturdy and adaptable nature, they are common houseplants that can survive among many types of changing conditions. In order to test the adaptability of African Violets, twelve violets will have all of their roots removed and measured according to mass. Three violets will then be placed in each of the following mediums: water, long fibered sphagnum moss, African Violet soil, and regular potting soil. The plants' root masses will then be removed and massed again after an eight week period. All of the mediums provided for substantial regeneration, some of the violets had even exceeded their original root masses. However, one medium had a significantly higher growth rate and final average mass than the others.

### **207. THE EFFECT OF TEMPERATURE OF THE GROWTH OF SOYBEAN PLANTS**

Kevin Rochette, Block 1 Chemistry Class, Marine Academy of Technology and Environmental Sciences (MATES),  
Advisor: Dr. Wnek, Mr. Werner

Farming has always been a cornerstone of our country, and is always trying to be improved in countless ways. Take for example irrigation, which just made watering plants a much simpler task. This project focuses on how temperature affects the growth of soy bean plants. Soy beans are very important since they provide a complete protein as a vegetable. If we can find the best ways to grow this very important vegetable, it would continue to improve our agriculture. Soybeans were grown in three separate environments, represented by a greenhouse with a lamp, one without a lamp, and one with nothing. The plants were grown for thirty days in each of these environments and heights were measured. After the allotted time, the greenhouse with a lamp, the hottest environment, grew the tallest plants. This would help society since it demonstrates the best environment to grow one of the most important vegetables, the soy bean.

### **208. EFFECTS OF OCEAN FLOODING ON ENGLISH IVY**

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

Many coastal regions face chances of ocean and bay flooding that can have the potential to destroy its local habitats. The length of these floods may have different effects on the environment, and even reduce the possibility for plant life to recuperate from the flood. When flooding occurs in an area filled with plant life, the organisms can face submersion in high salinities of water for many hours. Viewing each organism when submerged for different time periods had different effects. Some plants were unable to recuperate, while others had fully recuperated in under a week. The time it had taken each plant to recuperate depended on the amount of oxygen it was able to receive. The longer it had been submerged, the less oxygen it received, therefore delaying or even depleting its chance to recover. When English Ivy had faced flooding for ten hours or more, its chances of recovery was exhausted.



## **EARTH SCIENCE AND ATMOSPHERIC SCIENCE:**

### **301. MASS OF PARTICLES IN RAINWATER**

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

Water that cycles through the water cycle is made up of not only water, but also other small particles. This experiment was performed in order to determine the mass of such particles which were collected from samples of rainwater. The purpose of the experiment was to determine the mass of particles in collected samples of rainwater. This was to be done by determining the masses of filter papers before and after being used to filter suspended particles from the water. The differences in masses would be used to calculate the masses of the filtered particles. The results showed that there were indeed particles in the water which existed in small quantities, and the solids contributed very little weight to the total mass of the rainwater. Also, the conductivity of the rainwater samples tended to vary with the results and only increased with the masses of the collected particles in some cases. In conclusion, the original hypothesis was supported by this experiment. Rainwater does contain a low supply of solid particles that are tiny compared to the volume of the water they are in. In addition, suspended particles do exist in the clouds and even throughout the water cycle.

### **302. THE AFTERMATH OF HURRICANE SANDY IN NORTHERN OCEAN COUNTY**

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

Empirical data surrounding the event Hurricane Sandy was gathered and analyzed to determine the resultant changes, which have occurred in the Northern Ocean County environment. Initial focus was on the effectiveness of the barrier island dune protection system. With little exception, the magnitude and force of the storm event devastated all zones studied. Massive volumetric losses were discovered in both the beachfront and dune system. Scarping, over wash and breaching occurred throughout the studied area. This, along with a sustained storm surge seems to have led to volumetric changes in the Barnegat Bay. Sand and additional storm debris left in the estuary system, has altered tide levels. Examination of daily tide maximums in the Barnegat Bay post-storm indicate a new “normal” to which the Northern Ocean County communities will be forced to adapt to. Flood events in this zone may be expected to occur with greater frequency and effect. Whereas past flooding was often the result of massive storms it will not take the same amount of surge to create similar damage in the future.

### **303. CAN SALTMARSH CORDGRASS EFFECTIVELY REMOVE SALT FROM ITS SOIL?**

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

Salt Marsh Cordgrass (*Spartina alterniflora*) has the unique ability to absorb and excrete excess salt from its soil and environment through pores in the plant's leaves. Cordgrass has been able to survive with this set of adaptations in nature successfully, as they can tolerate a great amount of salt as the tides flow in and out. When introduced into an environment with a set salinity, would the grass successfully be able to remove salt and lower the salinity of the soil and water? To come up with an answer to this question, four individual *Spartina alterniflora* were placed in pots with plain potting soil and 0.4 gallons of water with a salinity of 18ppt. The pots were monitored over a course of three weeks and data was recorded every two days. Recorded salinities were quite shocking, as the data did not show a decrease in salinity at all. Results showed a greater concentration of salt in the water than was originally present. This high concentration was likely due to the lack of tides, which play a key role in moving in water of different salinities in nature. The cordgrass did not prove to be successful in removing salt from soil, due to a lack of natural occurrences necessary to the life of the plant.

## **EARTH SCIENCE AND ATMOSPHERIC SCIENCE (CONTINUED):**

### **304. EFFECTIVENESS OF DRAINAGE BASINS USING INFILTRATION RATES**

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

When rainfall or storms occur, management of excess water is vital, especially for areas more prone to flooding. To prevent flooding and mitigate this inclement event, there are several defenses that are commonly practiced and even are often required by local municipalities. One of the utilized techniques is the creation of Detention basins whose sole purpose is to hold water and surface runoff, in a convenient, yet out of the way and unobtrusive location until the water is drained naturally. When the basins are not maintained properly, or exposed to an excess of human activity, compaction is likely to increase, and as such, because infiltration is directly related to compaction, infiltration rates will suffer. This leads to the question of how effective are the Detention basins in a coastal area of New Jersey? In the interest of answering this question, infiltration rates were collected from a number of local Detention basins and it was found the average basin was moderately effective.

### **305. COLD AS SNOW: HOW DOES COLD WEATHER AFFECT NITRATES IN SOIL?**

Samantha Mehnert, Block 4 Science Class, Marine Academy of Technology and Environmental Science (MATRES)  
Advisors: Mr. Dave Werner and Dr. John Wnek

Nitrogen mineralization is the process by which organic nitrogen is converted to inorganic forms, ready for plants to thrive off of, and a key component in the speed at which mineralization occurs is weather. But how much does cold, wet weather affect the nitrogen levels in soil? During this study, soil was collected from three locations in Tuckerton, NJ, and put into twelve pots, nine of which stayed outside and three which were kept in similar temperatures but were not exposed to precipitation. Throughout the winter, there were slight changes in the nitrogen levels, and eventually a pattern was discovered. In warmer weather, nitrogen levels typically stayed the same or dropped, while in colder weather, nitrogen levels would increase in both the controlled pots and the pots that were exposed to various forms of precipitation. By comparing the weather to the collected nitrogen levels, it can be concluded that during the winter, nitrogen levels increase due to cold weather. The soil composition did not affect their overall nitrogen levels.

### **306. COASTAL EFFECTS OF HURRICANCE SANDY IN NORTH BEACH, HAVEN BEACH, BEACH HAVEN, SURF CITY, AND HARVEY CEDARS**

Olufemi Palmer, Block 3 Science, Marine Academy of Technology and Environmental Science (MATES).  
Advisor: Dr. John Wnek

Hurricane Sandy left an unprecedented mark on properties along coastal New Jersey. Ocean County was hard-hit with loss of beaches and major shifting of dunes. In this study I profiled the beaches in Haven Beach, Surf City, North Beach, Harvey Cedars, and Beach Haven after Hurricane Sandy. I then used profiles that took place before and after Hurricane Sandy to find out the changes in gradient between the beaches before and after the hurricane. I found that the gradients of the beaches decreased. Then, I noted which beaches had the most damage, and realized that there was a relationship between the gradient of the beach and the amount of damage sustained from the hurricane. Finally I compared the beaches with artificial dunes (Surf City and Harvey Cedars) to the beaches with natural dunes (Beach Haven, Haven Beach, and North Beach) to see if the investment of artificial dunes pays off, and found out the natural dunes are nearly as effective as artificial dunes.

## **EARTH SCIENCE AND ATMOSPHERIC SCIENCE (CONTINUED):**

### **307. BACTERIAL CONTENT OF SOIL WITH DIFFERENT KINDS OF COMPOST**

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

The total number of bacterial in soil will increase and decrease as compost in it decays. Different types of bacteria will die when a certain stage is completed and new bacteria will grow inside the soil. The stages of decomposition of compost also affect the temperature of the compost, and the type of bacteria in the soil will depend on the stage of the decomposition. Will putting compost in potting soil cause the total number of bacteria to increase continuously? Does a compost of egg shells make the count increase more than a compost of orange peels? To test these questions, I put orange peels in one bucket of potting soil and egg shells in a different bucket. Over a period of about one month, from the beginning of January to the beginning of February, I measured and recorded the total bacterial count of a sample of about 15 mL. I put the data into graphs and compared them to the daily temperature. I found that the bacterial counts would increase and then decrease; however, it was not a continuous pattern like I had predicted. This led me to the conclusion that certain bacteria die off after certain stages in the decomposition of compost and that after certain stages of decomposition, more bacteria die off than are replaced.

### **308. FERTILIZERS: ARE THEY WORTH IT?**

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

This project has been conducted to reach the answer of whether it is worth the money to buy store bought fertilizer for grass, or if the same results will be obtained using homemade fertilizer or no fertilizer at all. It has been hypothesized that the homemade fertilizer will work just as well as the store bought fertilizer and the grass with no fertilizer will not germinate at all. In this experiment, the bottom third of nine two-liter soda bottles were filled with store bought top soil. The same amount of grass seed was then planted in each and each planter was watered the same amount and received the same amount of sun light for two weeks. In the end, the homemade fertilizer grew the best, followed by the store bought and then no fertilizer. This conclusion can be reached by the fact that the homemade one contained a variety of nutrients and substances, whereas the store bought one had a limited amount and the three other planters with no fertilizer had no nutrients at all. These results can help provide others with the answers they need to reach such a picture perfect lawn while saving money at the same time.

## **ENVIRONMENTAL SCIENCE:**

### **401. SPECIES OF TREES MOST LIKELY TO FALL DURING A STORM**

Sean Begane, Block 4 Science Class, Marine Academy of Environmental Science (MATES). Advisors: Mr. David Werner and Dr. John Wnek

It is not uncommon for trees to fall, especially if they are found in wetter, looser soil. There are also many different kinds of trees in New Jersey. During storms, many trees will fall, sometimes causing a large amount of damage. The point of this study was to find what species of tree fall the most during a storm. To complete this study, sixty different fallen trees were found in three different locations in Ocean County, Double Trouble State Park, Winding River Park, and Cattus Island State Park. These trees were identified by their bark, leaves, and other factors, and the species of these trees were recorded. The data from each site was then combined, analyzed, and compared to the percentage of each species out of the total number of trees in New Jersey. It concluded that the majority were Northern Red Oaks, or fell into the more broad category of Red Oaks, even though there was a higher percentage of other species.

## **ENVIRONMENTAL SCIENCE (CONTINUED):**

### **402. DO PLASTIC WATER BOTTLES DEGRADE WHEN REUSED?**

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

Many people reuse plastic water bottles in an effort to save money and help the environment. But they don't know what happens to the polyethylene terephthalate, PET, the bottles are made from when they keep using them over and over. This experiment investigates whether plastic water bottles degrade when reused under conditions that replicate the conditions bottles would be in if they were in the freezer or a hot car. It also looks at what happens to different brands such as Dasani and Poland Springs under these conditions. All the bottles were weighed before the experiment and then again after it. Seven Dasani and seven Poland Springs water bottles were heated at 49 degrees Celsius, seven of each brand were frozen to 0 degrees Celsius and seven of each were kept at room temperature as a control group. At the end of the experiment, most of the Dasani bottles were recorded as having no change in mass except for the heated ones and the control group of the Poland Springs bottles had the most change on average. If the experiment was done over a longer period of time with more water bottles and less variables, such as the bottles being wet when they were weighed, more accurate data could have been gathered.

### **403. THE EFFECTS OF SALTWATER, BRACKISH WATER, AND FRESHWATER ON OAK**

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

Oak wood has been used for centuries in many ways and for many reasons, such as building houses. Oak has been claimed to be one of the strongest of common wood, but living beach front or bay front could be causing damage in this wood, threatening the integrity of your house. Oak homes exposed to excessive amount of salt water, brackish water, and even fresh water may be weakening. To test this, I experimented with salt water, brackish water, and fresh water with oak. The oak was soaked in these three types of water for one week, then three weeks, then five weeks. For each type of water and each week, three trials were conducted. It was found that after a week, even three weeks, no major changes in strength were noticed. It was only after five weeks that the effects of the water began to be noticeable. The wood weakened considerably from the brackish and salt water, most likely because of the NaCl found in them and not the fresh water.

### **404. THE EFFECTS OF COPPER SULFATE ON SEA LETTUCE (*Ulva lactuca*)**

Jarod Michael, Block 3 Science Class, Marine Academy of Technology and Environmental Science (MATES).  
Advisors: Mrs. Kelsey and Dr. Wnek

In order to determine the effects of heavy metal pollution due to the after effects of Hurricane Sandy the heavy metal copper sulfate was administered to sea lettuce (*ulva lactuca*). The sea lettuce that received the copper sulfate was collected from the Barnegat Bay estuary in Bricktown, New Jersey near the inland coast. Copper sulfate was then added periodically to determine the effects of acute heavy metal poisoning on photosynthetic organisms in a saltwater habitat. The introduction of copper sulfate was not initially lethal to the algae but they had shown signs of change in color because of the heavy metals being absorbed and over time the algae died off.

## **ENVIRONMENTAL SCIENCE (CONTINUED):**

### **405. ECO-FRIENDLY CLEANING PRODUCTS VS. CHEMICALLY BASED CLEANING PRODUCTS: WHICH IS MORE EFFECTIVE?**

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

Recently, there has been an emphasis on the use of “eco-friendly” cleaning products, therefore, it is necessary to determine if these products are just as effective at killing bacteria colonies as products that are not labeled “eco-friendly”. Seventh Generation, a cleaning product company that considers its products “eco-friendly”, was compared to Lysol, a cleaning product company that does not consider its products “eco-friendly”, to determine which brand of products was more effective at killing bacteria colonies in three categories (multi-purpose cleaner, wipes, and bathroom cleaner). The numbers of bacteria colonies were counted both before and after they were sprayed with one of the cleaning products to determine the percentage of bacteria each product killed. It was determined that Lysol products killed a larger percentage of bacteria than the Seventh Generation products. This can be explained based on the fact that Lysol products contain ingredients that are more effective at killing bacteria than Seventh Generation products. Therefore, the results of this experiment suggest that Lysol products are more efficient at killing bacteria.

### **406. WHICH NATURAL MATERIAL BEST FILTERS STORM/ RUNOFF WATER?**

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

Pollution from runoff water is a continuous burden on Barnegat Bay. Fertilizers and soils are constantly washed down the storm water drains of the Barnegat Bay Watershed, releasing pollutants into Barnegat Bay. In order to determine a way to stop these pollutants from entering our bay, I attempted to determine which natural materials would be best to use in a filter in order to minimize the amount of pollutants entering the bay. In order to determine which filter material was best for the job; I used a turbidimeter to measure the clarity of the water after passing through different materials. The tested materials used were carbon, sand, gravel, and seaweed. After running three different water samples through each of the filters, I was able to determine that carbon was the best filter to use because it was the only filter to benefit the water in terms of turbidity. Sand made the water much more turbid than the unfiltered water. The seaweed and the gravel had very little effect on the water samples and were therefore counted as expendable.

### **407. SOIL VS. HYDROPONICS**

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

Hydroponics is the usage of a plant growing material that is not soil. It has been proven that soil is not necessary for plant growth, but rather the nutrients that the soil retains. This research was conducted to test whether soil or hydroponics plant growth would prove to be more effective. The Kentucky Pole Bean was used as the test plant during the research. The data was collected over the course of three months. “Perlite” is the mineral rich material that was used as substitute to soil. A total of sixteen pole plants were grown, eight for each growth material. The significance in this project not only lies in the results, but the conclusions that may be created afterwards. The use of “artificial soil” may prove to be more convenient or effective as opposed to ordinary growing soil. Although the project itself is naturally subjected to human error, the results are arbitrary. As the final result of the experiment, it was proven that ordinary gardening soil produced more efficient results with a faster growth time and healthier plant condition.

## **ENVIRONMENTAL SCIENCE (CONTINUED):**

### **408. THE EFFECTS OF SALINITY ON INVASIVE VERSUS NATIVE SPECIES**

Danielle Tsougarakis, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES), Advisors: Mr. Werner, Dr. Wnek

When plants are exposed to increased levels of salinity, their growth can be adversely affected. This is because when salt accumulates near the roots of the plant it damages the ability of the plant's roots to efficiently extract water from the surrounding soil. The plant then expends an increased portion of its energy on withdrawing water when it would normally use this energy for growth and development. So what exactly would happen if there was a rise in sea level, increasing the salinity levels that plants are exposed to? This experiment was designed to test these effects on the growth of an invasive species and typical lawn grass coexisting together. For eight weeks, two containers of grass were exposed to dandelion seeds, an invasive weed. One container was watered with tap water while the other was given water having a salinity of 0.5 ppt. After 6 weeks, the salinity was raised to 1.0 ppt. By the end of the experiment there was no statistical difference in the growth rates between the two containers which lead to the conclusion that very low increased salinity levels do not have an effect on the growth of invasive species coexisting with grass.

## **HUMAN HEALTH AND BEHAVIORAL SCIENCE:**

### **501. CORRELATION BETWEEN HEART RATE AND AGE AFTER RUNNING A SPECIFIED DISTANCE AT A CONTROLLED PACE**

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

Running is a sport that many people take part in to stay in shape. When a person runs, their heart rate normally gets faster than their resting heart rate. But does age have an effect on this change in heart rate? Will someone older in age have a higher or lower heart rate while running than someone of a younger age? This study was conducted to answer these questions. To compare age and heart rate, nine subjects ran one mile and then had their heart rates calculated. Each subject ran the mile at the same pace. The results suggest that there is a correlation between age and heart rate. Those of younger age generally have a higher heart rate than those of older age. The results can benefit people in that while exercising they can test their heart rate and make sure it is in the average heart rate zone for their age.

### **502. A TWIST ON SALT**

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

From coarse salt to Celtic sea salt to even smoked sea salt, there are many different types of salt. Basically all salt can be used while cooking foods and/or it can be used after the food is cooked to give the item a little more flavor. However, since there are so many different types of salts, can people actually taste a difference between two types of salt? To find the answer, sea salt and kosher salt were placed on small samples of pretzels that were baked. Fifty people were then asked to taste two pretzels: one with sea salt and the other with kosher salt. Questions were asked like, "Did you prefer the first pretzel or the second one better and why?" or "Was there not a difference between the tastes of the salt on the pretzels?" In the end of the experiment, it was concluded that most people can taste a difference between the two salts.

## **HUMAN HEALTH AND BEHAVIORAL SCIENCE (CONTINUED):**

### **503. SHORT TERM MEMORY: MALES VS. FEMALES**

Devin Dragon, Block 3 Science, Marine Academy of Technology and Environmental Science (MATES). Advisors: Dr. John Wnek and Mr. Dave Werner

The part of the central nervous system (CNS) that controls memory is the temporal lobe. It is responsible for processing information and deciding whether to discard it or keep it. This experiment was designed to test how much short-term memory the temporal lobe can hold and who can hold more: young males or females. The experiment found that there was no significant difference between males remembered on average 4.6 words per every 10 and females about 4 words per every 10. Therefore it was shown that there was not a significant difference between the two. However, the average corresponds to Miller's Law that states that an average person can remember 4 - 9 items in a sitting. Hence, this experiment was conducted to determine whether males or females have better short-term memory and how much short-term memory can young males and females hold.

### **504. WHICH PAIN RELIEVER HAS A FASTER DISSOLUTION TIME: BRAND OR GENERIC**

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

There are two different types of drugs out in the world, brand name drugs and generic drugs. The generic drugs are always cheaper than their brand name counterparts. But does this price difference make a difference in the quality of the drug or the chemical properties of the drug? The way the tablets were tested was by their dissolution time this simulates the digestion into the blood stream of the drug through the stomach. In some cases there was a difference and in other cases the difference was negligible within human error. This led to the conclusion of that in some cases brand and generic make a difference but further testing would be needed to prove this statement.

### **505. THE PSYCHOLOGICAL EFFECT OF VIOLENT VIDEO GAMES ON MALES AND FEMALES**

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

The brain is a sensitive and vital part of the human body. It has the strong capability to grasp and remember anything that is passed through it. However, science has shown that violence has always been a stronghold for the brain rather than good. Violent video games are parts of everyday life in teenagers. Does this have anything to do with increasing juvenile imprisonments? To find this out, five male and five female teenagers were asked to participate in an experiment. They were asked to take a particular test before beginning to base them on their level of violence. Then, they were asked to play Call of Duty 2 for six weeks. After six weeks, they took the test again, to see their level. The data suggests that six weeks of continuous play at 2 hours a day can have a change in violence levels, and that males are inclined to be more violent than females. This leads to many conclusions, such as males overall, are more violent than females.

### **506. HOW DO ARTERIES AFFECT THE HEART?**

Jazmine Prana, Block 3 Science Class, Marine Academy of Technology and Environment Science (MATES), Advisors: Mr. Dave Werner, Dr. Wnek

The heart is a major organ in the body that pumps blood and makes arteries and capillaries carry blood to and from the heart. Since this organ is such a vital aspect to life, I decided to experiment with arteries to see if it would affect the heart. Cholesterol is a leading cause for plaque growth in arteries, so I decided to figure out why it was so bad. My experiment was conducted to discover how wider arteries are healthier for the body and allow blood to travel faster than with small arteries. I compared 0.95 cm width tubing to 0.64 cm width tubing to see which had a faster flow rate. When comparing the two tubes, the 0.95 cm width tubing had an easier and faster flow rate.

## **HUMAN HEALTH AND BEHAVIORAL SCIENCE (CONTINUED):**

### **507. THE EFFECTIVENESS OF PROFESSIONAL WHITENING PRODUCTS COMPARED TO THEIR COMMERCIAL COUNTERPARTS**

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

Tooth whitening is a subject that has been approached by many people in many different forms. Some have tried using professional whitening pastes, while others have tried using whitening strips. Throughout the use of all the different methods, people have asked how effective the treatment is. A study was conducted testing this question, comparing the percent change between shades for each whitening technique. A control group was also used to eliminate any possibility of false data, as well as to supply a baseline for the comparison of the whitened teeth to show how the whiteners compare to no treatment whatsoever. It was concluded that the professional whitening product, NiteWhite, was the most effective in terms of percent shade change.

### **508. IS WARMING DOWN REALLY NECESSARY?**

Marissa Wagner, Block 1 Science Class, Marine Academy of Technology and Environmental Science (Mates),  
Advisors: Dr. John Wnek and Mr. Jason Kelsey

The warm down period of exercise is surprisingly understudied and is not proven to be beneficial. Research shows that if a swimmer warms down after a period of anaerobic exercise, then the heart rate will be slower than if the swimmer did not warm down. This was tested by having a group of swimmers sprint 200 yards of freestyle one day and warm down for 1 ½ minutes, and the following day having the same group repeat the exercise and rest for 1 ½ minutes. Heart rates were taken before the sprint for the rest rate, or control, and after the 1 ½ minutes of warm down or rest. The results showed that the difference from the rested heart rate to after the exercise without warm down was significantly lower than with warm down. The results from the experiment do not support the idea that warming down is not beneficial because it only looks at heart rate. A final conclusion can only be made if other studies were conducted on lactic acid levels and surveys from athletes the day after a workout.

## **PHYSICAL SCIENCE AND ENGINEERING:**

### **601. DOES THE MAGNETISM OF AN OBJECT ALTER THE WAY IT WILL SWING IN A PENDULUM?**

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

A pendulum is an object that has been standard throughout many centuries. It is a construction made of a weight suspended in the case by simple twine from a pivot. Magnetism is a relatively well known force, and it is known that the north pole of planet earth will attract the north side of a magnet, as the south attracts the south. But do these two well known things interact? In this study the question was asked, does the magnetism of the weight affect how it will swing? In the study a pendulum was built and as a constant a nonmetallic weight was swung. The swinging of this weight was natural, as shown by Foucault's experiment. Multiple weights were used, an oxygenated metal, a non-oxygenated metal, and even an actual magnet. The results of each swing, all done with a constant swing start height and a constant direction, were the same to the original constant. This means that the magnetism of the weight does not matter, and the experiment has shown that the Coriolis Effect, the force created by the rotation of the earth, is much more powerful than that of the Earth's magnetic field.



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

### **602. ELECTRICITY: HARNESSING IT IN A POTENTIALLY NEW WAY**

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

In the never-ending quest to improve our current sources of power, people are always searching for ways to make more efficient and, as of late, cleaner sources of energy. From this impetus this experiment here was devised in order to explore a new route in the creation of clean electrical energy by the use of the use of magnets. Three different experiments were carried out to this end, a fan with magnets hot glued to its blades, a paper disk with magnets glued down it and sent through a makeshift rail-gun and a half motor. The first and the third experiments were demonstrated to be successes while the second was a failure. With these experiments, a possible and considerable alternative to creating power in an alternative was created.

### **603. THE EFFECTS OF PHOTODEGRADATION ON THE COLOR OF WOOD**

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

Photodegradation is the decomposition of a compound by radiant energy. In this case, it has to do with the decomposition of the chemical bonds in paint. To observe how photodegradation affects the color of wood, the wood would be painted three different colors (red, blue, yellow). To observe the best environment, the wood was placed underneath a shade cloth, a tarp (for darkness) and directly under the sun, to see where the color faded the most. The results show that the wood under direct light faded more than the wood underneath the tarp. The best environment was underneath an opaque covering to sustain the color of the wood longer than being in direct sunlight.

### **604. ELECTROMAGNETIC RADIATION EMITTED BY MOBILE PHONES**

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

All cell phones emit a form of electromagnetic radiation called radiofrequency (RF) radiation during a call. When a cell phone is pressed to a caller's ear, some radiofrequency radiation penetrates the skull and enters the body. The EPA and the FCC consider a dangerous amount of cell phone radiation to be  $5\text{mW}/\text{cm}^2$ , and all new phones must be held up to these standards. The tests used to measure cell phone radiation are only conducted on brand-new phones, but what about used phones? Do used phones give off radiation amounts that surpass national safety standards? To test this, a Gen-EI Digital Microwave Oven Leakage Meter measured the radiation from 9 different mobile phones from two different distances—contact and 1cm. The phones were weighed, and the radiation emitted by each phone during call mode was recorded. The data showed that phone weight and brand did not affect radiation levels; however, it was found that certain phones had radiation amounts that were unsafe for exposure. This indicates that cell phone radiation increases with phone usage, due to the fact that all phones sold in the US initially have safe radiation levels.

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

### **605. THE EFFECTS OF A BULKHEAD ON THE ENVIRONMENT**

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

Shoreline areas along the coastal regions sometimes have structures, called bulkhead, that form a wall to define property. The overall use of bulkheads is sometimes estimated at 42% along Barnegat Bay. Studies indicate that bulkheads do not prevent erosion as they were intended, but they cause more erosion and change habitat along the shoreline. The objective of this study was to determine if a bulkhead affects the environment of a body of water. The study was conducted by using a seine net to collect samples of macro, free-swimming organisms around and near a bulkhead, then on the same beach in the open water. Four trials were conducted to determine any differences in capture numbers. The seines were done at different times of the day and on varying tidal cycles to ensure randomness. The results indicated that the structure causes a reduction in the number of captures since there was a greater number of fish caught in the open water area. These results supported my hypothesis that bulkheads reduce the number of species within that area. The results are significant since it allows us to now that it is better for the environment if there is no bulkhead.

### **606. A MICROBIAL FUEL CELL'S EFFICIENCY AND COST COMPARED TO A SOLAR PANEL**

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

Mediator-less microbial fuel cells produce electricity because electrochemically active bacteria produce electrons through digestion of organic material and carry it to the electrode in the fuel cell. This type of microbial fuel cell is much safer because the mediators are mostly toxic. Solar panels are also very popular ways of clean energy production. Can a mediator-less microbial fuel cell be as efficient as a solar panel? How do the costs of the microbial fuel cell and solar panel compare? A mediator-less microbial fuel cell was built and run for 30 days and a solar panel was set up in an area with an average amount of sunlight. During those 30 days, Direct Current (DC) Voltage output readings were taken with a digital multimeter, and the solar panel was read in the same way, at the same times of the day. The solar panel produced a significantly larger amount of energy, but the microbial fuel cell produced electricity at a constant rate. A microbial fuel cell can produce energy during the day and during the night, while a solar panel is only efficient while the sun is out.

### **607. CORROSION OF METALS: SALT VS FRESH WATER**

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

When metals are exposed to environmental conditions, changes in their chemical makeup can gradually take place, rendering them destroyed. This process is called corroding. Different metals undergo varying types of corrosion, dependant on both the conditions the substance is subjected to, and the makeup of the metal itself. What metals corrode the fastest? Which corrode the slowest? How would the effects of salt water versus fresh water play a role? What metals would be most beneficial to use on an architectural structure that would be exposed to fresh or salt water? To find these answers, six different types of common metals were tested over a ten week period. Each had a sample that was subjected to both salt water (approx. 29 PPT) and distilled fresh water. Progress was documented once the experiment was roughly half way completed, every other week. Once the ten week period was concluded, the corrosion was cleaned off the samples, and damage was observed. The data showed an increase in the damage received to the salt water samples versus their fresh water counterparts. However, in both sets, low alloy steel was shown to undergo the greatest corrosion, while stainless steel was the most corrosion resistant. In locations along the coast and other water bodies, the result of flooding can impact the type of metal fastener used, which could impact the fastener's overall effectiveness.

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

### **608. WATER SAMPLE COLLECTION IN HAZARDOUS ENVIRONMENTS**

Andrew Seney, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES).  
Advisor: Mr. David Warner

Scientists of many fields collect data from bodies of water by collecting a sample. Many water bodies are overgrown with vegetation, or are located in an overall hazardous environment that present risks of injury for field scientists. To help remove this risk, a robot was designed to travel through potentially hazardous environments and collect a water sample, and other information at the water's edge. The design was created based on several engineering principles, and the performance of technological components in wet or treacherous environments. In addition, a proof of concept prototype was constructed to help demonstrate the basic operation of the water collection system that is present on the design. This construction took place at the Marine Academy of Technology and Environmental Science robotics club. The construction of the prototype and the designing of the full model are documented in an engineering log journal.

## **TOXICOLOGY:**

### **701. THE USE OF SHRIMP AS A BIOLOGICAL INDICATOR OF COPPER**

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

Most shrimp are extremely sensitive to copper. Shore shrimp have been recorded to die at levels of copper over 0.40ppm. The suggested highest level of copper in water for humans is 1.3ppm. So would shrimp make good biological indicators of copper? To test this, 25 shrimp were collected from their natural habitat along with water. Copper was added to this water each week. Each week copper levels were also tested using a colorimeter. These copper levels were compared to the number of living and dead shrimp. The shrimp were found to have remained at a constant 24 living shrimp as the copper levels rose. The shrimp seemed to have built a tolerance to the copper in the water, which led to the conclusion that shrimp would not make a good biological indicator of copper.

### **702. EFFECTS OF OCEAN ACIDIFICATION ON MORTALITY IN BLUE MUSSELS (*Mytilus edulis*)**

Nick Hughes, Block 1 Science Class, Marine Academy of Technology and Environmental Science (MATES):  
Advisors: Mr. Kelsey and Dr. Wnek

Ocean acidification is a growing concern as it is a cause of greater rates of mortality of species since many marine organisms have narrow pH tolerance ranges. Bivalves (i.e., blue mussels, scallops, clams) have shells made of calcium carbonate that may not form well as a result of changes in pH. And, changes in types of runoff that affect pH feed into water bodies that may change pH values overall. To test the effects of pH changes on organisms, blue mussels (*Mytilus edulis*) were used as part of an experiment. The effects of changes in pH on *Mytilus edulis* were investigated by utilizing three tanks with different pH levels (control: 7.8, 7, and 6.2). After approximately two months of treatments with specific pH levels, the overall mortality rate of the mussels was very high. Out of forty-five total mussels, only a few survived. In the most acidic tank, the mortality rate was one hundred percent, with the control tank having the lowest mortality rate. The results of this experiment suggest that an increase in acidity (decrease in pH) increases the mortality rate in *Mytilus edulis*. Applying this information to ocean acidification clearly supports the hypothesis that mortality in marine life is in fact caused by changes in pH.

## **TOXICOLOGY (CONTINUED):**

### **703. DOES pH AFFECT THE INDESTRUCTIBLE WATER BEAR?**

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

It was already determined that tardigrades were durable animals: they survived space, extreme temperatures, and numerous other things. The levels of pH that tardigrades can survive in were understudied. The study was completed by gathering tardigrades and separating them into different pH groups. There were five in total with two tardigrades per pH group. Each group was tested in a certain pH level and the data was recorded. The results showed that the tardigrades couldn't survive in 10.10 and 2.30 pH levels for more than two days. Tardigrades did survive in 4.53, 7, and 8.30 pH levels. The significance of the results is that they show that tardigrades can survive in a wider range of pH levels than most animals, but they cannot survive in pH levels that are too acidic or alkaline.

### **704. ANTIFOULING PAINT AND SHRIMP**

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

Anti-fouling paint is a method in order to prevent fouling which is the growth of organisms on items that are submerged or soaked with water. Although anti-fouling paint is useful, it has been linked to many environmental concerns such as the deaths of many marine organisms. As traces of paint peels off by movement of the water, chemicals such as TBT and cuprous oxide are released and can affect organisms physically. In the experiment, the lethality of three copper anti-fouling paints were tested to show how each affected the shrimp. Twenty shrimp were placed in each tank with rocks that were covered with anti-fouling paint. The shrimp were monitored constantly to record any deaths in the tank. Results show that all three paints caused all of the shrimp to die to the amount of cuprous oxide.

### **705. EFFECTS OF STORM RUNOFF ON BARNEGAT BAY LIFE**

Ryan Paul, Block One Science Class, Marine Academy of Technology and Environmental Science (MATES),  
Advisor: Mr. David Werner

Shore shrimp (*Palaemonetes sp.*) are a very abundant shrimp species in the Barnegat Bay. The shrimp are eaten by many creatures in the bay, and serve as the base of the bay's food chain. Storm runoff causes many chemicals to go into the water and change water characteristics. This experiment tests the result of storm runoff with the ease of predating shore shrimp if a large amount of storm runoff was to enter the bay. Some shore shrimp were put into water with red dye. After living in this water for a week, they were then put into a tank with red paper surrounding the walls of half the tank. The shrimp were observed to see what side, red or clear, they went to after a predator was assimilated. The shrimp did not seem to know the difference between the sides. Because of this, it was concluded that if a substantial water change was to happen in the bay, the shrimp will not adapt soon, and the shrimp will be predated easily, causing the base of the food chain to weaken or not exist.

## **TOXICOLOGY (CONTINUED):**

### **706. BIOFOULING DETERRENCE**

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

Biofouling is the attachment of an organism to the surface of a submerged object that has been in contact with water for a period of time. There are variations in attachment organisms depending on the water conditions, amount of salt, amount of sunlight, and also the rate of water flow. To determine the effects of biofouling in Beaver Dam Creek, New Jersey, control and variable materials were submerged in the creek to show how well they deterred biofouling based on percentages of fouling. One of the variables was an air bubbler attached to a piece of fiberglass in order to replicate the >2m/s velocity of water movement that is needed to stop organisms from attaching to the surface. Biofouling abundance on the materials was recorded by taking a picture with a camera phone every week for three months. Water and air temperature, salinity, and pH were also recorded. After the initial data was collected, the surface area of the materials and the biofouling coverage on the materials were measured. The bare copper pipe did not collect any biofouling in the time period and had <0.01% of biofouling; the air bubbler only seemed to *deter* biofouling and did not *completely* stop it with the biofouling percentage of 5.4%. This study shows that an air bubbler does help in limiting the amount of biofouling, which showed a significant improvement over other materials that did not have constant water movement.

### **707. BIOFOULING COMMUNITIES FOUND ON DIFFERENT SUBSTRATES DURING A WINTER SEASON**

Anthony Srnka, Block 4 Chemistry, Marine Academy of Technology and Environmental Science (MATES).  
Advisor: Mr. Werner

Biofouling is the accumulation of living organisms on surfaces in a marine environment. During this experiment, the accumulation of biofouling organisms on the different substrates was observed. To conduct this experiment, an apparatus was constructed with wood, plastic, aluminum, ceramic, and PVC substrates attached to it. It was then deployed off of a floating dock at the Rutgers University Marine Field Station (RUMFS) in Tuckerton, New Jersey. During the course of three months, the device was checked periodically to record observations of the progress of biofouling on the different substrates. When the device was removed from the marine environment, the biofouling on the different substrates was observed. The identified organisms found on the substrates were brown algae, amphipods (*Gammarus mucronatus*), and grass shrimp. The surface area of the substrates and the mass of the biofouling material were calculated to determine which substrate had the most and which substrate had the least biofouling. Observations were also made on different factors that affected the amount of biofouling on each substrate, such as texture, light, and temperature.

### **708. DETERMINING THE MOST NON-FATAL FILTRATION SYSTEM WHILE MAINTAINING SEA JELLIES**

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

Sea jellies have been shown to be very difficult to maintain in tank systems due to their lack of rigidity, counter movement from danger, and difficulty to move/handle. Many different tank setups have been examined or made to overcome this obstacle and three were chosen to test. Two different species were collected: the Beroe comb jelly (*Beroe ovata*) and the leidy comb jelly (*Mnemiopsis leidy*). Many modifications to each tank were carried out to help insure the longevity of the sea jellies. Totes were used to originally house the sea jellies. Totes were not used after tank #2 due to their flexibility. In tank #1 an acrylic sheet was used to help with water flow. In tank #2 a spray bar with a tote and a tank were used to decrease suction and remove the filter from the main tote. In tank #3 a bucket was used to contain the sea jellies and the spray bar introduced water from the second tank to the first tank. It was shown from this experiment that the health and length of survival for tank setup #3 was the longest and most successful. While more sea jellies were used in the last trial because no more *B. ovata* could be caught, the health and appearance of *M. leidy* seemed to show that this setup was the most effective.

## **ZOOLOGY:**

### **801. DO CHICKENS HAVE A PREFERENCE ON THE COLOR OF FOOD THEY EAT?**

Lauren Harper, Block 4 Science class, Marine Academy of Technology and Environmental Sciences (MATES),  
Advisors: Mr. Jason Kelsey and Dr. John Wnek

Chickens have been found to have better eyesight than humans as a result of tetra-chromatic vision, while humans only have tri-chromatic vision. This is because chickens can see a fourth spectrum of light. Humans can only see the “visible colors” which are red, blue, and green; chickens can perceive violet light waves as well as red, blue, and green. Seeing a new spectrum of light does not add a color to their eyesight, but instead, it changes every other color. The color that we see is different from the color a chicken sees when adding the violet spectrum of light. Does the different color spectrum affect the way chickens choose their food or perceive their prey? Do they have a preference on the “visible color”, we see, of their food? Does this new spectrum of light change the color so much that they are not attracted to it? To answer all of these questions, a y-maze was used in conjunction with different colored-food to test chicken feeding preferences. The results of this study suggest that the chickens were more attracted to the red coloration, while they were least attracted to the blue color. This study could lead to more effective use of feed so that chickens on farms could eat more effectively thus producing more eggs and offspring, and become more muscle and meat dense.

### **802. ALGAE GROWTH AND REGROWTH ON GASTROPOD SHELLS**

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Hermit crabs and marine slugs are believed to have a co-relationship with algae in order to hide from their prey. What happens when algae is removed? Will it regrow? More importantly, is what people are putting into our ecosystems affecting this growth, and therefore leaving them unprotected? Ten marine slugs and hermit crabs’ shells were used for the experimentation. They were divided into four groups, each group undergoing different experimental procedures. As a result, algae growth and regrowth was observed on particular areas of the shell. Knowing that hermit crabs and marine slugs use algae to camouflage themselves, people should take precautions so as to not affect this process. If runoff and excess nutrients are causing eutrophication and cause changes in algae types, this may have a negative effect on these organisms. Therefore, determining algae health on hermit crab shells may be an indicator of the health of a water body.

### **803. THE BEHAVIORAL REACTIONS OF SHORE AND SAND SHRIMP DUE TO PREDATORY FISH SOUNDS**

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Shore shrimp (*Palaemonetes sp.*) are small decapods found in the eelgrass beds, oyster beds, and generally anywhere in salt marshes. Sand shrimp (*Crangon septemspinosa*) are different in appearance to shore shrimp, and prefer to live in sandy flats of the salt marshes. Both however are excellent swimmers with well-developed sensory organs, and play a large role in estuarine ecosystems. As detritus and phytoplankton feeders, they serve as an important food source for a large variety of bay organisms. Arthropods such as shrimp possess chordotonal organs that can sense vibration in water, which are thought to be associated with sound. Sound produced by predator animals can be transmitted through the substrate in which these crustaceans live, and be detected by chordotonal organs. Just how well developed are these sensory organs? Is it possible sounds from sources such as predatory fish can trigger a behavioral change in shore and sand shrimp? To test this, 37 shore shrimp and three sand shrimp were kept in a test tank where the sound recordings of three predatory fish of the Barnegat Bay were played underwater. The reactions of the shrimp were then observed for any behavioral changes such as increased activity or attraction to the sounds. The observations suggested that there were a variety of behavioral changes corresponding with the sounds, as well as certain sounds receiving more reactions, and the two different species of shrimp responding differently.

## **ZOOLOGY (CONTINUED):**

### **804. CHARACTERISTICS OF FLOUNDERS ON DIFFERENT COLORED SUBSTRATES**

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Flounders are a species of bottom dwelling fish. Blending in with their surroundings is key to their survival. Depending on the color substrate, flounders camouflage their body coloration to hide from predators. But how drastic can these changes be? To test this, different colored substrates were used to examine the amount of color change on a Summer Flounder (*Paralichthys dentatus*) and a Winter Flounder (*Pleuronectes americanus*). Pictures were then taken, and ratios of red, green, and blue were found to compare the differentiation of each flounder's ability to camouflage. Neither of the flounders was able to fully adapt to the colored substrates. The summer Flounder's ability to camouflage was better than the Winter Flounder. However, a bottom made up of regular sand was the area that both flounders favored and both were able to camouflage the closest to the background colors.

### **805. THE GRASS ISN'T ALWAYS GREENER**

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Earthworms are said to improve growth on plants but do they really? Grass was used for testing this myth. Earthworms are a natural fertilizer and their excretions help give plants nutrients. The earthworms need decomposing matter to make these excretions. Earthworms were kept for a few weeks prior to the experiment in a container in their own soil, leaves and bread (providing an organic food source). The soil amended by earthworms was used as an experimental treatment to grow grass. A container full of backyard soil was also set up to serve as a comparative measure. Both experimental containers were given the same amount of seed and water. Over the course of forty-six days the soil was observed. My expected outcome of earthworm treated soil being more conducive for grass growth was not supported as there was an unexpected result. My data suggest that the backyard soil was more beneficial than the earthworm soil for the growth of grass. The grass was taller and more dense in this container, as the earthworm grass didn't grow as much. The difference in growth may be a result of the soil types found in the southern New Jersey area, which is dominated by sand particles, which may not fully support earthworm nutrient soil fixation.

### **806. OBSERVING THE PREDATORY SENSES OF THE CHOCOLATE CHIP SEA STAR (*PROTOREASTER NODOSUS*)**

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Sea stars are marine invertebrates found all over the globe. Apart from their use as decoration, sea stars are important bioturbators for almost all marine environments. Because it is difficult to monitor sea stars in their natural habitats, a natural predatory encounter was simulated with the *Protoreaster nodosus* species. By placing three sea stars in a closed environment it was easy to observe their choice of harmed prey, that was easier to digest, or prey that remained alive. After seventeen observations it was clear that the sea stars chose the vulnerable prey for the majority of the trials. With this information it was concluded that this selection also occurs in the wild, therefore, inferring that sea stars do have predatory senses that allow them to detect vulnerable prey.

## **ZOOLOGY (CONTINUED):**

### **807. DO SHORE SHRIMP PREFER TO REST ON CERTAIN OBJECTS?**

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When most animals are not moving, they are usually resting. But do they prefer to rest on a particular object or do they prefer to settle on the bottom of their environment? A tank was set up with a brackish water environment with gravel on the bottom and a variety of objects in it to test this with shore shrimp (*Palaemonetes vulgaris*). Observations were made to see if the shrimp would have a preference on which object they rested on or if they preferred to rest on the bottom gravel. It was found that, on average, most of the shrimp could be found resting on the gravel. This could be because either it was similar to the shrimp's natural environment or because it was the largest area for the shrimp to rest. There seemed to be no preference among the variety of other objects placed in the tank.

### **808. COMPARISON OF GROWTH RATES OF THE RED BEARD SPONGE, *MICROCIONA PROLIFERA*, IN DIFFERENT WATER TEMPERATURES**

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When attacked and broken by other animals, or perhaps other conditions, sponges have the ability to regenerate lost parts. Sponges can be found in waters all around the world in all sorts of climates. It is not determined what climate(s) sponges thrive and grow the best in. Do broken pieces of sponges regenerate at a faster rate in water at room temperature, or water at a temperature of about 10°F higher? Samples of red-beard sponge, *Microciona prolifera*, were collected and stored in tanks. Three pieces of the sponges were kept in a tank kept at room temperature, and three were kept in a tank that was heated. The volume of each individual sponge was measured every Monday, Wednesday and Friday for a couple of weeks. The results show that both sets of sponges had similar increases and decreases, but the set of control (room temperature) sponges had slightly more of an overall increase.