

PASSAIC ACADEMY FOR SCIENCE AND ENGINEERING



BIOTECHNOLOGY LEARNING UPDATE

In December, students in the Organic and Biochemistry class (year 3) completed their most exciting multi-procedure lab. They synthesized aspirin (acetylsalicylic acid) from two reactants. During this laboratory students used techniques to isolate (vacuum filtration), recrystallize, purify, and confirm the identity (melting point analysis). We are currently making our way through the Chirality unit. Here students learned about stereoisomers and learned to visualize two-dimensional chemical structures in 3D. The majority of this unit was devoted to model labs where students could test their predictions on paper and constructed molecules to determine if mirror images were engntiomers or superimposable.

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BIOTECHNOLOGY LEARNING UPDATE

Our pathway is continuing to go to Students 2 Science for more fun field trips! We participated in the Middle School Day. We have brought students in grades 6-9 and they had a great time learning about vacuums and the way blood is drawn, being disease detectives, learning about identifying pharmaceutical drugs, and circuitry via electroplating and making a "pickel" (penny and nickel combination).







BIOTECHNOLOGY CONTINUED

As part of the biotechnology pathway, in Genetic Engineering, we engaged in various activities this quarter. One of our ongoing projects was GBE. During this quarter, we collaborated with the biotechnology students to create a proposal for the Growing Beyond Earth organization. This proposal aimed to research a specific area where we could change the experiment so that we can have different results. Our proposal was about how changing the light intensity can affect the growth of the plant, sage. One of the handson activities we undertook was a gramstaining lab. In this lab, we stained bacteria such as E. coli to determine their gram status. The gram staining procedure is an important tool used by microbiologists to classify bacteria based on their cell wall structure. In this experiment, we used bacteria like e.coli along with bacteria we made with our hands



After staining the bacteria we put them under a microscope and classified them as either positive or negative according to their color. Another activity we engaged in was the creation of paper CRISPR models. CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is a gene-editing tool that has revolutionized the field of genetic engineering. We created paper models to help us understand the different parts and functions of this technology, including the guide RNA, the Cas9 protein, and the PAM sequence. In collaboration with Kean University, we ran through a lab where we attempted to transform bacteria into being resistant to antibodies. During this experiment, we had to use various tools and equipment such as micropipettes and a thermocycler. We used programs, DNA Subway and the NCBI Virus Database to study how the COVID-19 virus mutated over time. This helped us understand how genetic mutations appear over time and how the virus's genetic sequence differs depending on the location.

Also, it showed how similar the different variants of SARS-COV are. This information can be used to develop more effective vaccines. Finally, we learned about ELISA (Enzyme-Linked Immunosorbent Assay) and participated in three protocol lab procedures where we tracked down the original host of the bacteria, found out which of us had the antigen, and which of us had antibodies for that antigen.

During our experiment, we had to learn how to use an I Mark Absorbance/ microplate reader so we can analyze the actual color of



P BIOTECHNOLOGY Q2 PULSE

MAKING SOLUTIONS: WE CREATED SOLUTIONS WITH SPECIFIC CONCENTRATIONS. UTILIZING THE FORMULA TO CALCULATE THE PERCENTAGE TO BE ADDED INTO THE STOCK. WHICH WAS THEN USED IN THE SERIAL DILUTIONS. WE MADE A STOCK SOLUTION THAT WOULD THEN BE DILUTED INTO LESS CONCENTRATED SOLUTIONS

SERIAL DILUTION: SERIAL DILUTION IS A PROCEDURE IN WHICH THE CONCENTRATION OF AN ORGANISM, IN THIS CASE A LIQUID, IS GRADUALLY LOWERED BY SERIAL MIXING WITH SET AMOUNTS OF LIQUID DILUENT (A SUBSTANCE USED TO DILUTE SOMETHING.). TO PROMOTE LOGARITHMIC REDUCTION OF THE SAMPLE ORGANISM, THE AMOUNT OF THE DILUENT IS USUALLY A MULTIPLE OF 10.





spectrophotometer

THIS TOOL WAS USED AND IT WAS COMBINED WITH THE SERIAL DILUTION AND MAKING SOLUTIONS. IT FOLLOWED A PROCESS WHERE THE SOLUTIONS WAS FIRST CREATED IN WHICH THEN IT WOULD BE DILUTED AND THEN PLACED INTO CUVETS, WHICH ARE CLEAR TUBES IN WHICH THEY'RE PLACED INSIDE THE SPECTROPHOTOMETER IN WHICH IT OBSERVES THE ABSORBANCE OF THE SOLUTIONS. THE MACHINE READS THE ABSORBANCE AND THEN IT ALSO ALLOWS YOU TO ADJUST THE WAVELENGTH.

This month we had guest speakers talk to our students. These guest speakers are college students at Rutgers who are in the Biotechnology Club called Designer Genes. They spoke about their interest in biotechnology, career goals, life as a college student, and answered questions that our students had.



COMPUTER SCIENCE LEARNING UPDATE

In **AP Computer Science Principals**, students

have been working on the AP Create Performance Task. In this project, students design and implement a program that might solve problems, enable innovation, explore personal interests, or express creativity. Students submit this project to College Board, and is graded as part of their AP Exam grade. Popular projects included Rock-Paper-Scissors, a Dice game, a Pick-a-Number game, and a calculator.

BIOMEDICAL SCIENCE LEARNING UPDATE

In **Medical Interventions,** students have been learning about the immune system and genetic disorders. Students used lab techniques such as DNA extraction and purification, PCR, restriction digest, and gel electrophoresis to model the process of genetic testing by analyzing their own genotype and phenotype for a gene. In HOSA, students learned how to suture wounds.



In **Human Anatomy and Physiology DE** (Human Body Systems) we take a detailed look into the systems and functions of the human body. Students are exposed to each system of the body with great detail and depth. So far this year, we have covered the integumentary, skeletal, muscular, nervous systems! Students have progressed a long way during the year! Here are some pictures of some activities during class. Like identifying the bones of our body or dissecting a brain:







BIOMEDICAL SCIENCE LEARNING UPDATE

In the **Biomedical innovation class**, we worked on identifying different environmental exposures found in Passaic, analyzed different water from sites in Passaic, and Used PCR to test for coliforms and other contaminants, students also worked on creating a dose-response curve by studying different contaminants and how they affect germination and growth of common plants found in NJ. We ended up creating an environmental health community profile for Passaic identifying potential sources for contamination for air, water, health, and industry.



AEROSPACE ENGINEERING LEARNING UPDATE

In Aerospace Engineering, students have been learning about Earth's atmosphere. The atmosphere on Earth is a dynamic system that is always in flux. We analyzed a common reference as a way to relate flight tests. wind tunnel tests, and general airplane design and performance. This reference, called The Standard Atmosphere, uses mean values of pressure, temperature, and density properties as functions of altitude. Students have also been learning how to program in Python. Using CodeHS, students have been learning python commands, functions, and control structures by drawing shapes on their screen and solving puzzles with Turtle Graphics. With this acquired information, students will be ready to learn how to program an Arduino in our next project.



Figure 3.4 Temperature distribution in the standard atmosphere.

Engineering students are engaged in a paramount activity. They are using high level commands such as Chamfer, Hole, Circle, etc. from Inventor 2023 to sketch and design the piece of train to be assembled using mate techniques.



AEROSPACE ENGINEERING LEARNING UPDATE





DATA SCIENCE LEARNING UPDATE

Students in **IDS** are deep into how to analyze data and find hidden connections. Using data from a recent federal survey, students looked for correlations between teen depression and other factors such as sleep, vaping/smoking, video games, and amount of homework. One group even conducted a small study amongst 30 peers! Students created posters and presented to the class. IDS students have also broken into 4 groups to work on projects for the DataJam competition in April. As we close this quarter students have received approvals on their proposal and are moving forward with data analysis. In December, Data and CS pathway students participated in a Hour of Code Activity in a partnership with CodeHS.org. A small group also go to tour Google's NYC headquarters! They heard about all the different types of careers at Google, what its like to be a person of color at Google, and how and when they can prepare to become Googlers themselves!







Q2 2023 EDITION

AEROSPACE ENGINEERING CONTINUED

During Q2, students in the **Principles of Engineering** course learned about circuits, energy, and thermodynamics. They used breadboards to build series, parallel, and combined circuits. Then, they used circuits and power sources to power a machine using an electric motor. They were able to calculate the efficiency and mechanical advantage of the machine.



In guarter 2, students in the **Unmanned** Aircraft Systems course covered airport operations, where we learned about the parts of the airport, runway nomenclature, and how pilots communicate with Air Traffic Controllers, using specific vocabulary to avoid miscommunication. We also learned about crew resource management and professionalism in the drone industry. These topics build the soft-skills that our students need to be successful as a part of large organization. Finally, we covered aeronautical decision-making, where we learned about the decision-making models that can help us make safe flying decisions. Specifically, we analyzed Captain Sully's landing on the Hudson river that saved hundreds of lives.







THANK YOU FOR READING!

