



Students 2 Science Biotechnology Day

May 2017 Students 2 Science added a new career path in our first ever Biotechnology Day introducing students to essential 21st century high demand jobs including but not limited to: Biochemist, Food Sample Inspector, Agricultural & Food Science Technician, and Biomedical Engineer. Knowledge of biotechnology is critical for all today's students and communities as it relates to our global needs in sustaining life, food, natural resources, and energy. Within the many scientific advances in biotechnology students become increasingly aware of the ethical dilemmas which will challenge them and the future generations to come.

About the Bio-Technology Day

High School students work in teams on one detailed experiment including content related to health, disease control, alternative energies, and food sustainability. Students prepare materials, utilize basic and sophisticated instrumentation to perform testing, collect data, document results, graph/organize the data, interpret results, present and discuss findings with the larger group at the end of the day.

Experiments

- 1) What is the link between the foods we eat and diabetes?: A look at hidden sugars in foods and detection of Insulin by ELISA.
 - Three groups of students will test various carbohydrate containing foods, in the presence of Amylase enzyme, to assess the amount of sugar in each.
 - A fourth group of students will be the clinicians and analyze blood and urine samples to determine if the patients have Type 1 or Type 2 diabetes.
 - Technique and instrumentation used: ELISA (Enzyme-Linked Immunosorbent Assay), Centrifuge, and Ultraviolet-Visible Spectroscopy.

- 2) Vaccines and Immune Response: Simple immunoassays are conducted to detect and quantify antibody production.
 - Students will assess whether vaccines are successfully inducing an immune response using the Ouchterlony procedure.
 - Students will use ELISA to determine the amount of antibody produced by each vaccine.
 - Students will use a variation of the Ouchterlony technique to identify the amount of antibody protection.
 - Technique and instrumentation used: ELISA (Enzyme-Linked Immunosorbent Assay), Ouchterlony technique, and Polymerase Chain Reaction.

- 3) Biofuels: The Formation of Ethanol by the Yeast Fermentation of Corn Syrup: A study of the fermentation conditions for corn syrup that contains glucose and other complex carbohydrates and yeast.
 - Students will assess the level of water collected and temperature of the fermentation every 15 minutes and graph the results and record them in Excel.
 - Students will use gas chromatography to assess the amount of ethanol in their samples against control samples.
 - Technique and instrumentation used: J-Kem temperature controller, Thermocouple, Gas Chromatography, and distillation apparatus.

- 4) Fish Forgery: Is that really Wild Coho Salmon you're eating?
 - Students will examine muscle proteins in the fish samples by electrophoresis to determine whether it's salmon or not salmon.
 - Students will use High Performance Liquid Chromatography to separate out antibiotics from other components to measure the amount of antibiotic present.
 - Students will use Ultra Violet Visible Spectroscopy to measure the presence and amount of astaxanthin dye in fish extracts to determine whether the salmon samples are farmed or wild.
 - Technique and Instrumentation used: Ultraviolet-Visible Spectroscopy, High Performance Liquid Chromatography, and SDS-PAGE Electrophoresis.

Laboratory Skills

Preparation of samples for analysis

- Pipette technique - auto pipette, transfer pipette
- Dilution and mixing samples
- Bathing samples in varying temperatures
- Centrifuging samples
- Transferring samples
- Collecting timed samples
- Creation of Agarose plates
- Preparation of Agarose plates
 - o Cutting wells in Agarose plates and loading the wells
 - o Incubation of plates
- Boiling solutions on a hot plate and using a magnetic stirrer
- Using J-Kem temperature controller
- Using a thermocouple

Testing Samples

- Immunoprecipitation using double diffusion in a gel matrix
- Ultraviolet-Visible Spectroscopy
- Liquid Chromatography Mass Spectrometry
- Gas Chromatography
- Polymerase Chain Reaction
- SDS-PAGE Electrophoresis
- Fermentation
- High performance liquid chromatography
- Using ELISA to quantify the amount of antibody produced by each vaccine
- Using quantitative radial immunodiffusion to detect levels of antibodies
- Yeast fermentation of Corn Syrup

Assessing Results

- Recording results for multiple samples
- Plot glucose results and compare glucose standard sample
- Entering results in Excel spreadsheet
- Using geometry to measure the diameter of precipitin rings
- Mathematical calculations such as addition, subtraction, squared
- Plotting and assessing data on a graph (x-axis and y-axis)

Soft Skills

- Working in a team – cooperation, teamwork, leadership, and collaboration.
- Assessing the results – critical thinking, problem solving, data interpretation and analysis
- Adaptability, flexibility, resilience, and perseverance.
- Research skills and practices
- Data analysis and interrogative questioning.
- Public speaking and presentation.

Students 2 Science, Inc. is a 501(c)(3) model program in New Jersey that bridges the needs of the public and private sectors. Our mission is to inspire, motivate, and educate elementary, middle and high school students to pursue careers in science, technology, engineering and math (STEM subjects).

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