

Proteomics: An Introduction to Advanced Biochemistry

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Abstract: Typical: high school students through genetics and DNA without biotechnology. Atypical

Proteomics is the study of protein structure and function, of all proteins within an organism.

Typically a High School Science Teacher would not undertake the seemingly herculean task of conducting protein extraction labs in class as they take a substantial amount of precious time. Moreover, the typical educator would

Mass Spectroscopy in High School, what?

Rationale:

Module 1: Dengue Fever

Pre-assessment on emerging pathogens and dengue fever.

Activity 1: Giant microbes UF equipment locker activity for a warm-up?

Activity 2: Students will begin work on an emerging pathogen crossword puzzle during a brief (10-15 minute) lecture, vocabulary would include bacteria, virus, pathogen, vector, host, parasite etc.

Activity 3: Students will conduct research and complete an Emerging Pathogen Research Chart and an attached emerging pathogen crossword puzzle. Provided the following emerging pathogens, dengue fever, cholera, e. coli, salmonella, citrus greening, lyme disease, ebola students will incorporate a picture, transmission, symptoms, and an interesting fact.

Assessment(s): Students will be graded on the above worksheets

Activity 4: Students will participate in a jigsaw activity where they are assigned a role, community member, mayor, police officer, judge, entomologist, virologist, and doctor. Students will then break into groups where all the community members sift through newspaper clippings and doctors sift through case files etc. Working in these small groups as specialists they will be charged the task of identifying characteristics, symptoms, transmission and ways to prevent the spread of disease. After meeting in small groups, students will break and move into assigned groups A-D that will be comprised of one member from each respective role and students will need to share the information they learned in at their "conference" with their fellow citizens. Students will make a poster to present their findings and course of action in fighting Dengue Fever.

Assessment: Poster.

Post Assessment: At the end of Module 1 students will complete a post test on emerging pathogens and dengue fever.

Module 2: Viral Quest Curriculum

Previous Content: basic structure and function of the four major biological macromolecules, basic structure and function of DNA

Activity: Implementation of Viral Quest, a two week curriculum developed to integrate biotechnology skills and techniques into a High School biology class. Daily lesson plans incorporate biotech equipment and labs in the classroom setting.

Assessment: Pre and post tests to monitor knowledge gains in biotechnology, DNA replication, transcription, translation and DNA as the universal code.

Follow-up: suggestions?

Module 3: Introduction to Proteomics

Previous Content: basic structure and function of proteins (enzymes?).

Activity(s): Biology

Protein Extraction from different life stages of mosquitoes (simulation), I will do this for them.
Protein Separation and Staining by gel electrophoresis.

Activity(s): Chemistry

Protein digestion

Basics Mass Spectroscopy (ions, mass, charge, ratios, time of flight etc.)

Protein Identification by peptide mass fingerprinting (PMF)? If I have major problems with this module it will be here...I'm going to need a lot of help on this part. UF visit? Dr. Chen? Jennifer?

Assessment: Biology students will put together a presentation to introduce aspiring chemists to the world of proteomics. Topics to cover would include a brief description of what proteomics is as well as possible implications. Students will then explain one of the various assigned biotech techniques including but not limited to DNA extraction, PCR, and gel electrophoresis.

Chemistry: After digesting the protein and being exposed to the realm of mass spectroscopy/PMF students would present the topic, procedures and results to the biology classes. They would need to highlight the implications of this new technology and the possibility of future biomedical research/a faster diagnosis time.

Needed: follow-up activity to tie in mosquito proteins to Dengue Fever for Biology kids, with a possible lead into Genetics?

Module 4: Introduction to Genetics

Previous Content: Basic structure and function of DNA, and the processes of DNA replication, transcription, and translation. Students should also be able to explain why DNA is considered the universal code for all life.

Activity: Students will begin a book study in a small group of their peers (3-5 students) reading one of the following stories Uglies, Pretties, Andromeda Strain, House of the Scorpion, or My Sister's Keeper. Students will be allowed to choose the book they will read for the book study with a maximum of 5 students in a group. Approximately 10-15 minutes will be taken every day for students to read their

book with their group in class. Obviously the main goal of this project is to promote literacy, but also introduce students to ethics, focusing on a wealth of issues ranging from cloning to genetic engineering.

Assessment: Students will complete a “summary sheet” of their choice borrowed from Readicide by _____. Formative assessments will be incorporated throughout the 3-4 week unit mainly through Q&A response and class discussion.

UF Materials/Equipment Locker:

Giant microbes

Micropipetting activity

Mosquitoes?

PCR

Gel electrophoresis

Mass spectroscopy

Budget:

Mosquito breeders???

References:

Dr. Sue Chen’s presentation on proteomics

Dr. Polfer’s presentation on mass spectroscopy

CPET staff jigsaw activity

CPET staff giant microbe activity

Janice David’s action proposal