

## **PROTEOMES**

### **Because genomes are so last decade**

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#### **Abstract:**

I propose generating interest in biotechnology and proteomics using information from presentations, online resources, and the “Dot Blot” lab technique demonstrated during the ICORE 2013 workshop. The lesson execution will take place during the Biochemistry unit of biology I curriculum for low and high-level students. Students will be introduced to the complex and vital roles of proteins through videos, web quest, reading, lecture, and discussion of recent research and develop a deeper understanding by constructing models of protein monomers, performing the ELISA “Dot Blot” test, and disseminating what they learn through the production of a school commercial.

#### **Rationale:**

Proteomics will revolutionize medicine and bioinformatics and possibly present new venues for energy conservation and nanotechnology. Within their lifetime, students may see the development of cures and treatments for inherited and infectious diseases. At the heart of this progress are vital biological macromolecules, proteins, and the reason for this proposal.

By approaching the daunting subject of biochemistry with a focus on biotechnology, the intimidation and resistance usually associated with abstract learning will hopefully be substituted with curiosity and excitement. While videos, articles, and lecture will introduce students to the broad spectrum of protein function in real life scenarios, the ELISA simulation will provide a more concrete investigation of proteins on the molecular level. As an inquisition lab, the “Dot Blot” will combine guided discovery and hands-on experience to generate more learning and understanding than a demonstration. In addition, the design of an ELISA simulation for a protein present in all living organisms provides a common ground between the students and the organisms they will study. This will allow the students to be more comfortable or confident when they learn how they are different. The “Dot Blot” lab makes the connection even more immediate as they see physical evidence of the antigen-antibody reaction.

#### **Timeline Overview:**

Three/four 100-minute class periods

This lesson will be delivered the last 6-8 days (block scheduling) of the biological macromolecules unit. The focus on proteins will conclude the 15 days allotted for this unit.

#### **Student Outcomes:**

The students will be able to...

- Identify proteins as a biological macromolecule
- Explain the difference between an amino acid and a nucleic acid
- Identify enzymes and antibodies as types of proteins

- Explain many vital roles of proteins in the structure, homeostasis, signaling, immunity, and pathogenicity of living organisms, as well as their role in biotechnological testing
- Understand the importance of lab procedure and precision in obtaining scientific data

#### Standards:

- ✚ SC.912.N.1.1 The Practice of Science
- ✚ SC.912.L.15.52 Immune System
- ✚ SC.912.L.15.1 Classification, Heredity, and Evolution
- ✚ SC.912.L.16.10 Biotechnology
- ✚ SC.912.L.18.1 Biological Macromolecules

#### Lessons:

- Intro to Proteins- video embedded Prezi
  - Video: Ryan's Story –cystic fibrosis – **membrane channel protein CFTR**
  - Video: Ulcers and Amputations due to Diabetic Complications (youtube) – **hormone insulin**
  - Video: Excerpts from movie The Painted Veil – **V. cholera toxin**
  - Articles and activity sheets: [Cystic fibrosis](#), [Investigating Poisoning](#), [Circadian Rhythms](#), [Vibrio Cholera](#), [Plant Responses](#)
- Protein structure- Modeling
  - Activity- Building Amino Acids – in groups students build the 20 amino acids and answer questions
  - Activity- web quest – introduce ATPase and uniprot – How many amino acids comprise this protein? In what organisms is it present?
- Antibody-Antigen Response and ELISA
  - Dot-Blot lab
- Proteomics Presentation and post lab follow-up inquiry

#### Data Collection Techniques:

- Pretest/Posttest
- Amino Acid Models
- Lab Reports
- Commercial (time and technology permitting)

#### Connections to ICORE Summer Institute:

- Vibrio Cholera presentations- Dr. Judith Johnson, Thomas A Weppelman, Ph.D
  - Link in prezi presentation
- ELISA presentations- Ms. Linda Green
  - Link in prezi presentation
- Bioinformatics –Gordon Burleigh
  - Post lab inquiry
- Proteomics and Mass Spectrometry presentations and lab investigations- Dr. Sixue Chen, Dr. Nick Polfer, Jonathan Benskin
  - Link in prezi presentation
- Dot Blot lab Houda Darwiche
- Best practice- Jon Breedlove's chemical reaction demo (carbohydrates and lipids)

### Improvement on Traditional Teaching Techniques:

I taught this unit before with PowerPoint lectures, worksheets, paper cut-out modeling and one lab on the properties of water. Students were lost or became frustrated. Even though I drilled the fact that hormones and enzymes were proteins for weeks, very few learned it. The unit taught in this manner caused many students to give up and feel helpless.

This revised teaching technique uses writing answers to questions only as a supplement. The initial learning will take place using visuals and real life connections, modeling, and performing an experiment. Students will be engaged because they are having fun and won't resist the learning.

### Budget and Budget Justification

Item	Cost	Vendor
6 – Chauvet 6” Handheld Blacklight	\$6.99/each	Blacklight.com
1 – Opticz UV Blacklight Reactive Blue Invisible Ink – 8 oz.	\$14.99	Blacklight.com

These items are essential because each lab group in a class period will have a blacklight to test for the ELISA reaction which is simulated with the invisible UV paint.

### Literature Cited

Thiellement, H., Bahrman, N., Damerval, C., Plomion, C., Rossignol, M., Santoni, V., ... & Zivy, M. (1999). Proteomics for genetic and physiological studies in plants. *Electrophoresis*, 20(10), 2013-2026.

Mohamadi, M. R., Mahmoudian, L., Kaji, N., Tokeshi, M., Chuman, H., & Baba, Y. (2006). Nanotechnology for genomics & proteomics. *Nano Today*, 1(1), 38-45.

<http://stem.org.uk/rx9sa> - Ryan's Story - cystic fibrosis

<http://youtu.be/ViC3-vvTiqQ> - Ulcers and Amputations due to Diabetic Complications