

Activity 6: Chimeric Botulinum Toxin Therapeutics

Teaching Notes

This is an open-ended activity appropriate for advanced level biology majors. The exercise focuses on protein engineering, drug development, and clinical trials. Since students are asked to choose the focus of their drug development research proposals they should complete the background textbook readings either before or during this activity.

Activity 6 at a Glance

Class size	Any size class (20-300) Advanced level biology majors
Instructor Preparation	One-two hours (excluding grading) Read Assignments Also read Chimeric BoNT Therapeutics section in the Botulinum Toxin Background
Useful Media	<p>PBS. (2001) “Nova: Bioterror Companion Website.” The website also has short video clips and tutorials for vaccine development and interviews with journalists and scientists. http://www.pbs.org/wgbh/nova/bioterror/. http://www.pbs.org/wgbh/nova/bioterror/vaccines.html# http://www.pbs.org/wgbh/nova/bioterror/biowarriors.html.</p> <p>DiscoverySchool.com. (1997) “Botulinum Toxin” from the <u>Understanding Bacteria</u> video. [VHS] 51 min. A two-minute clip reviews the trajectory of toxin use, from bioweapon to medicinal miracle. http://teacherstore.discovery.com.</p> <p>Schindler L, Kerrigan D, Kelly J. Science Behind the News: Understanding the Immune System. This site has a graphics slide show of immune response and vaccine development. http://newscenter.cancer.gov/sciencebehind/immune/immune01.htm</p>
Student time	In class: 8-10 hours Out of Class: None required

Background Reading

The following textbook selections are interchangeable:

Molecular Biology of the Cell **Fourth Edition**

Alberts, et al. (2002). Garland Science. New York.

- “Manipulating proteins, RNA, and DNA.” p.478-494 and 508-524.

Essential Cell Biology **Second Edition**

Alberts, et al. (2004). Garland Science. New York.

- “Intracellular compartments and transport” p. 497-531. (Interactive

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- “Intracellular vesicular traffic.” p. 711-766.
 - “The Adaptive Immune System.” p. 1363-1384.
 - “Cell Communication: Signaling via Enzyme-Linked Cell-Surface Receptors.” p. 871-892.
 - “Cancer.” p. 1313-1362
 - “Pathogens, Infection, and Innate Immunity.” p. 1423-1463.
- 15.8). The most relevant sections are the sections on clathrin mediated endocytosis (p. 512-516) and receptor mediated endocytosis (p. 525-526). Note that the text does not clearly define SNAREs. V-SNAREs include VAMP/synaptobrevin and syntaxin, while T-SNAREs include SNAP-25 and its homologues. For more detailed reading see MBOC.
- “Protein structure and function.”p. 117-167 (Interactive 4.1, 4.2, 4.11). The most relevant sections include the sections on antibody production and function. (p. 144-146)
 - “Membrane structure.” p. 365-388 (Interactive 11.2).
 - “Membrane transport: Ion channels and signaling in nerve cells.” p. 411-425. (Interactive 12.8)
 - Cell communications: General principles: p. 533-543.
 - Manipulating genes and cells. p. 329-364 (Interactive 10.1)
 - "Cell-Cycle Control and Cell Death: Overview of cell cycle." p. 612-615
 - "Cell-Cycle Control and Cell Death: Programmed cell death." p. 625-634.
 - “Tissues and Cancer: Extracellular matrix and connective tissue.” p. 706.
 - “Tissues and Cancer: Cancer.” p. 726-738.

Recommended

- Rensberger B. (1996) “In Self-Defense” and “Revolution.” *Life Itself*. New York: Oxford University Press (p. 213-246).

Implementation

1. Direct students to the **Assignment** and allow them 10 minutes to review it and ask for clarification.
2. Have students complete the assigned reading and review the websites over the course of one week.
3. Each student plays the role of a scientist in a biotech company and addresses the questions in the **Assignment** and uses these answers to develop a research proposal

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for a new botulinum toxin therapeutic. **Resource Six: Self Assessment of Writing** may also be distributed to assist students.

4. Have students exchange proposals with a peer and play the role of a scientific advisory board member and critique a peer's proposal using **Resource Five: Peer Assessment of Writing**.
5. Students submit a portfolio of work that includes the first version, the peer-review and the revised version of the research proposal for a grade.

Assessment

Students submit a portfolio of work that includes the first draft of the research proposal, the peer-review, and the revised draft of the research proposal for a grade. Attention should be given to language, clarity, style, organization, originality, feasibility, and creativity.