

Activity 3: Identification of Botulinum Toxin Receptors

Teaching Notes

This activity is an intermediate to advanced level activity and is more open-ended than Activity 2. The exercises focus on receptor-mediated endocytosis mechanisms and provide general guidance for reading primary literature. Students are expected to have familiarity with experimental methods and interpretation of data and figures. This assignment is particularly well suited for an advanced level biology course or a science writing course.

Activity 3 at a Glance

Class	Small or intermediate classes (20-100) Intermediate to advanced biology majors
Instructor Preparation	Four hours (excluding grading) Read Assignment 1 , assigned articles, and Activity 3: Answers . Also read BoNT host cell receptors: Controversial beginnings section in the Botulinum Toxin Background .
Student time	Ten to twelve hours outside of class, depending on how much work is assigned. Allow students two weeks to complete the assignment

Background Reading

Since the focus here is on experimental methods and approaches, having students complete the relevant textbook readings either before or during this activity is strongly recommended. The following textbook selections are interchangeable:

Molecular Biology of the Cell Fourth Edition

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

- “Proteins” p.129-188.
- “Membrane Structure” p.583-614.
- “Membrane Transport” p. 645-650
- “Manipulating proteins, RNA, and DNA.” p.478-494 and 508-524.
- “Intracellular vesicular traffic.” p.711-766.
- “Visualizing cells.” p.547-580.

Essential Cell Biology Second Edition

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

- Intracellular compartments and transport p. 497-531. (Interactive 15.8)
- The most relevant sections are the sections on clathrin mediated endocytosis, p. 512-516, and receptor mediated endocytosis, p. 525-526.
- “Protein structure and function” p.117-167 (Interactive 4.1, 4.2, 4.11). The most relevant sections include the panels depicting experimental methods (p. 160-165)
- “Membrane structure.” p. 365-388 (Interactive 11.2).
- “Membrane transport: Ion channels and signaling in nerve cells.” p. 411-425.

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(Interactive 12.8)

- Cell communications: General principles: p. 533-543.
- Manipulating genes and cells p. 323-364.

Implementation

1. For the basic version of this Activity, direct students to **Assignment 1** and **Resource Seven: Worksheet for Reading Primary Literature**.
2. Outside of class, over the course of a week or two, have students complete the assigned textbook readings and articles and answer the questions posed in the **Assignment 1**.
3. Have students submit answers to the questions for grading.

Alternatives

- For students with advanced scientific knowledge and writing proficiency, **Assignment 2** may be administered. This assignment extends **Assignment 1** by asking students to write a “News and Views” review article about the identity of the BoNT receptor based on their answers to the assignment questions.
- Direct students to **Assignment 2**, **Resource Seven: Worksheet for Reading Primary Literature**, and **Resource Six: Self-assessment of Writing** and **Resource Eight: Grading Rubrics**.
- Outside of class, have students first read the assigned articles and answer the questions posed in **Assignment 2**. Instruct them next build upon their answers by synthesizing them into a review article on the identity of the BoNT receptor.
- Students might exchange their review articles with other students for peer feedback. **Resource Five: Peer-Assessment of Writing** will help to simulate the peer-review process.
- Have students revise their articles.
- In addition to the final draft, instructors might collect the first draft and the peer-review comments for evaluation.
- Students might also be evaluated on the quality of their peer critiques.

Assessment

- Grade students’ answers to the questions posed in **Assignment 1** using **Answer Key** (available to instructors only).
- If using **Assignment 2**, consider assessing student learning by reviewing answers to the questions on **Resource Six: Self-assessment of Writing**.
- For the more advanced elements of **Assignment 2**, grade students’ “News and Views” reports. Attention should be given to language, clarity, style, organization, originality, and creativity. See **Resource Eight: Grading Rubrics**.
- Consider grading student “News and Views” final draft reports together with their first draft reviews and the feedback they received from peer critiques.
- Consider grading students also on the quality of the peer critiques they provided to their fellow students.