

Activity 1: Botulinum Toxin Use and Abuse

Teaching Notes

The assignments in this activity are different versions of the same introductory project. Teachers are encouraged to choose between the assignments or to combine them as they think might work best for their own classes. This activity can be used in introductory as well as advanced level courses for either biology majors or non-majors. The level of discussion and the complexity of questions will vary depending on academic background and interest. **Assignment One** is an individual reflection assignment and does not necessarily use class time, though there are options for in-class discussion. **Assignment Two** involves small group work and class discussion during one class session.

Assignment 1 at a Glance

Class	Any size, see modifications as needed. All levels, but discussion varying with scientific background
Instructor Preparation	About 30 minutes to one hour. Read Assignment 1
Useful Media	“Botox injections for wrinkle removal.” As part of the <i>Five Nights to a Better You</i> series produced by the WB11 News at 10. Aired on May 16, 2001. 1 minute in length. DiscoverySchool.com. (1997) “Botulinum Toxin” from the <i>Understanding Bacteria</i> video. [VHS] 51 min. A two-minute clip reviews the trajectory of toxin use, from bioweapon to medicinal miracle. Students see the personalities of two scientists, Schantz and Johnson, as they prepare a batch of botulinum toxin. http://teacherstore.discovery.com
Student time	Out of class: about 20-30 minutes In class: none required

Implementation

1. Show the two short video clips at the start of class.
2. Direct students to “**Botulinum toxin: Lethal weapon or magic bullet?**” by **Katayoun Chamany**, found in the **Core Materials** section. This summary mentions a variety of current and future applications of botulinum toxin, but it few details.
3. Have students read the essay and reflect on the questions in **Assignment 1** on their own. Encourage students to form a personal set of questions that, if answered, would provide a deeper understanding of the molecular mechanisms and societal implications of this toxin.

Alternatives

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1. The class could be divided into small groups to arrive at a consensus on answers to the questions. This, in turn, could be shared with the class.
2. Given the broad expanse of time covered in the essay, students could conduct literature research and construct a timeline of botulinum toxin use and abuse. Students could share these with the class via powerpoint, poster, or transparency.

Assessment

Since this activity is designed to stimulate interest and discussion, there is no formal assessment. However, there are options for assessment

- Students could submit one-page summaries of their answers to the questions found in **Assignment 1**. The summaries could be based on individual work, collective responses from the small groups, or both.
- If students construct a timeline of botulism discoveries and applications, these could be graded or reviewed as well. These could be shared with the class via powerpoint presentations or posters, in which different groups of students would be responsible for covering a particular period of time. A comprehensive **Time Line** is available in the **Core Materials** area.

Assignment 2 At A Glance

Class	Any size, see modifications as needed. All levels, but discussion varying with scientific background
Instructor Preparation	About two hours. Read the Botulinum Toxin Background, Assignment 2 . Assign students to small groups and assign one article per group.
Useful Media	“Botox injections for wrinkle removal.” As part of the <i>Five Nights to a Better You</i> series produced by the WB11 News at 10. Aired on May 16, 2001. 1 minute in length 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. Students see the personalities of two scientists, Schantz and Johnson, as they prepare a batch of botulinum toxin. http://teacherstore.discovery.com
Student time	Out of class: 45 minutes to one hour In class: One 50 minute period or longer

Implementation

Day 1: 10 minutes

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1. Show the two short video clips at the start of class and direct students to **Assignment 2**.
2. Break the class into small groups, and assign each group a unique news story that provides a key component to synthesizing a more complete understanding of the toxin and its applications.
 - The Kuczynski and Avery articles are very similar so one could be dropped (the Kuczynski article mentions some specific side effects of cosmetic use).
 - The Sotos article is actually a letter in response to the Arnon article. It is only one page in length but contains some interesting information and could be combined with the Arnon reading.
 - The Black article covers nanotechnology and DNA detection techniques and is a bit advanced for non-majors. The Beardsley article covers some nanotechnology, is not as scientific, and also mentions that the U.S. has not ratified the Biological Chemical Weapons Convention Treaty because of potential loss to the commercial sector of biotech.
3. Have students complete the readings outside of class and individually answer these questions for discussion:
 - What did you learn from reading this article?
 - What questions are left unclear or ambiguous in this article?
 - What additional questions do you have about this neurotoxin?

Day 2: 50 minutes

4. In this class session, convene each small group for fifteen minutes to form a consensus on answers for the questions for discussion.
5. For the remainder of the session, have the groups share their answers with the rest of the class. Each group will hold the answers to another group's questions. This discussion might last thirty to forty-five minutes.
6. Take some time, perhaps in the last five minutes of class, to jot down unanswered questions that can be researched in future class sessions.

Alternatives:

1. Large classes may experience difficulty conducting small group work and discussion during class time. For these classes, students can conduct their discussion on-line via Classwire or an email group, freeing up time during the class session for sharing the outcomes or consensus of those on-line discussions. If, however, the reading and discussion take place during the class session, shortening the news stories to one page will free up more time for small group work and class discussion.
2. Given the broad expanse of time covered in these news stories, students could conduct literature research and construct a timeline of botulinum toxin use and abuse. Students could share these with the class via powerpoint, poster, or transparency.

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Assessment:

Since this activity is designed to stimulate interest and discussion, no formal assessment is necessary. However, options for assessment might include the following:

- Students could submit one-page summaries of their answers to the questions found in **Assignment 2**. The summaries could be based on individual work, collective responses from the small groups, or both.
- Since small group work is involved, assessment could be conducted by the students using **Resource Two: Group Work Self Assessment** and **Resource Three: Group Work Peer-assessment**, found in the resources section of the Core Materials page.
- If students construct a timeline of botulism discoveries and applications, these could be graded or reviewed as well. These could be shared with the class via PowerPoint presentations or posters, in which different groups of students would be responsible for covering a particular period of time. A comprehensive **Time Line** is available in the **Core Materials** area.