

Activity 3: Communications in the Stem Cell Research Community

Teaching Notes

This activity is an intermediate to advanced level activity. Like Activity 2, this activity aims to illustrate how scientific knowledge is constructed through primary and secondary scientific literature, conferences, meetings, technical comments, and journal club meetings. Both assignments in Activity 3 are more rigorous and open-ended than that of Activity 2. The exercises focus on embryonic and adult stem cell plasticity and provide general guidance for reading scientific literature. Students are expected to have familiarity with experimental methods and interpretation of data and figures. These assignments are particularly well suited for an advanced biology course or a science writing course.

Assignment 1 mimics the activities associated with journal club meetings in which each participant is expected to present the specifics of a particular study and provide critical analysis of the work. During such meetings, participants are able to keep up with a fast moving field by sharing the responsibility of literature research and discussion. This assignment asks students to read a set of articles, address a set of questions, and present their findings to the class via an oral presentation. Depending on the student background and the number of articles assigned, time for implementation will vary, but oral presentations will require at least three to four class sessions. The students can work individually or in groups for this assignment. Instructors should give students advance notice of this assignment so that they can allocate the appropriate amount of time to complete this assignment.

Assignment 2 asks students to compose an up-to date review article based on a series of articles. A few weeks should be allocated to allow sufficient time for reading textbook chapters, review articles and one or more research articles, as well as time for writing the review article.

Assignment 1: Journal Club Presentations

Assignment 1 at a Glance

Class	Small or intermediate classes (20-50) Intermediate to advanced biology majors
Instructor Preparation	Four to six hours (excluding grading) Read Assignment 1 , assigned articles, and Activity 3: Answers . Also read Stem Cell Research Background
Useful Media	Please see the References for a list of media with annotation that includes colorful imagery, interactive web site and animations.

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Student time	Ten to twelve hours outside of class, depending on how much work is assigned. Allow students at least two weeks to complete the assignment.
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Background Reading

Since the focus here is on experimental methods and approaches, having students complete the relevant textbooks 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.

- **Chapter 4:** “DNA and Chromosomes.” p. 191-234
- **Chapter 7:** “Control of Gene Expression.” This chapter is very detailed. These sections are particularly useful:
 - *An Overview of Gene Control.* p. 375-379.
 - *How Genetic Switches Work* p. 398-408.
 - *The Molecular Genetic Mechanisms That Create Specialized Cell Types.* p 415-435.
- **Chapter 8:** “Manipulating proteins, RNA, and DNA.” p. 476-500, 504-525 and 532-546.
- **Chapter 9:** “Visualizing cells.” p. 547-580.
- **Chapter 17:** “The Cell Cycle and Programmed Cell Death.” p. 983-1026.
- **Chapter 20:** “Germ Cells and Fertilization.” p. 112-1156.
- **Chapter 21:** “Development of Multicellular Organisms” Note that this chapter is very long and is divided in sections that review specific organisms. These sections are particularly useful:
 - *Universal Mechanisms of Animal Development.* p.1157-1170.

Essential Cell Biology **Second Edition**

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

- **Chapter 4:** “Protein Structure and Function.” p. 160-165.
- **Chapter 5:** “DNA and Chromosomes.” p. 169-194.
- **Chapter 8:** “Control of Gene Expression.” p. 267-292.
- **Chapter 10:** “Manipulating Genes and Cells. p. 321-364.
- **Chapter 16:** “Cell Communication.” p. 533-571.
- **Chapter 18:** “Cell-Cycle Control and Cell Death“ p. 611-636.
- **Chapter 19:** “Cell Division” p. 637-657-658.
- **Chapter 20:** “Genetics, Meiosis, and the Molecular Basis of Heredity.” p. 659-696.
- **Chapter 21:** “Tissues and Cancer.” p. 717-726.

Biology Today

Third edition

Minkoff and Baker (2004). Garland Science. New York.

- **Chapter 1:** “Biology: Science and Ethics.”p. 1-32.
- **Chapter 4:** “Genetic Engineering and Genomics.” p. 95-122.
- **Chapter 9:** “The Population

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- *The Mouse* p. 1223-1227.
- **Chapter 22:** “Histology: The Lives and Deaths of Cells in Tissues.” Note that this chapter is very long. These sections are particularly useful:
 - *Epidermis and Its Renewal by Stem Cells.* p.1259-1267.
 - *Renewal By Multipotent Stem Cells: Blood Cell Formation.* p.1283-1296.
 - *Stem Cell Engineering .*p. 1308-1311.
- Experience” section *Human Reproductive Biology Helps Us to Understand Fertility and Infertility.* P. 296-317.
- **Chapter 12:** “Stem Cells, Cell Division, and Cancer.” p. 413-432. Note that this very short chapter touches on transcription, translation, gene expression, and cell signaling, but for a more comprehensive overview please see the following chapters:
 - **Chapter 2:** “Genes Chromosomes and DNA” p. 33-62
 - **Chapter 3:** “Human Genetics.” P. 63-94.

Recommended Reading:

Rensberger, B. (1998) Chapter 6: “One Cell Becomes Two,” Chapter 7: “Two Cells Become One,” and Chapter 8: “Constructing a Person,” as seen in *Life Itself: Exploring the Realm of the Living Cell.* Oxford University Press, New York, NY: 117-188.

Implementation

1. Choose articles to be assigned.
 - A set of review articles appears at the start of the assignment and you may choose to assign all or only some of these.
 - Though instructors may appreciate the articles listed under the historical and seminal section, most students feel that these articles are not as important as those in other categories. If these articles are assigned, it is very helpful to spend some time explaining their purpose in the context of this activity. Some of the most fundamental questions posed in the earlier studies are the same ones being asked in more contemporary articles, illustrating the pace of scientific discovery. Alternatively, instructors may choose to assign the following article which summarizes all of the work: Solter, D. (2006). "From teratocarcinomas to embryonic stem cells and beyond: A history of embryonic stem cell research." *Nature Reviews Genetics* 7(4): 319-327. <http://dx.doi.org/10.1038/nrg1829>.
 - The last set of articles under the heading **Embryonic stem cells lines without embryo destruction** require a fair amount of genetics and molecular biology background.
 - The Martin, Mezey et al., and Weimann et al. papers are published by labs headed up by women.
 - Please note that the last set of references in the reading list under the heading “Characterization of Stem Cells” includes a series of articles published between 2002-

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2003 and includes a set of technical comments or critiques by Fortunel et al. and Eviskov et al. and that these communications are representative of the peer review aspect of science.

- Students need to be aware of this assignment well in advance, and it is preferable that article assignments and dates for presentations be distributed during the beginning of course.
 - The **Answers** for this activity summarize the findings of each paper and provide commentary in terms of teaching and learning with respect to difficulty, important points, and methods, and it might be useful for instructors to review this before choosing articles.
2. Direct students to **Assignment 1** and **Resource Seven: Worksheet for Reading Primary Literature** and inform of them of their specific reading assignment.
 3. Outside of class, over the course of a few weeks, have students complete the assigned textbook readings and articles. During these weeks, it might be useful for instructors to present material on scientific techniques, basic embryology, and contemporary views on stem cell biology. During this time, student should also be reading their particular article or set of articles.
 4. You may choose to check in with students and review answers to the questions posed in the **Assignment**. In preparation for this discussion and the subsequent presentations, it might be useful to review the summaries of the articles in the **Answers** of this activity.
 5. Have students present a 10-minute oral PowerPoint presentation and address questions from the class for 5-10 minutes. Be sure to allocate enough class sessions for presentations. If students do not have experience presenting scientific material the presentations may move more slowly and contingency plans should include “catch up” days.
 6. Grade students on the quality of the oral presentation and report (if assigned). A rubric which can serve as a guide for grading appears in the **Core Materials** section.

Alternative

- You may ask students to provide a written report of their oral presentation.
- You may ask each group or individual student to indicate which presentation did the best job in educating the class and why. Having students contribute their own assessment of the symposium is an important reflective educational activity and will be very illuminating to you as well.
- 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 review article about stem cell research based on their answers to the assignment questions.

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Assessment

- Grade students' oral presentations and reports for **Assignment 1**.
- 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' review articles. Attention should be given to language, clarity, style, organization, originality, and creativity. Consider grading review article final draft together with 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.

Assignment 2: Writing a Review Article

Assignment 2 at a Glance

Class	Small or intermediate classes (20-50) Advanced biology majors
Instructor Preparation	Four to six hours (excluding grading) Read Assignment 2 , assigned articles, and Activity 3: Answers . Also read Stem Cell Research Background
Useful Media	Please see the References document for colorful imagery, interactive web site and animations.
Student time	The assignment could be considered a semester length project or half-semester project. The duration of the assignment depends on how much work is assigned. Allow students at least two weeks and up to ten weeks to complete the assignment.

Background and Recommended Reading

See the selections listed above for Assignment 1.

Implementation

1. Choose articles to be assigned and direct students to **Assignment 2** and **Resource Seven: Worksheet for Reading Primary Literature**. Since the field is vast, instructors may decide to have students focus their review on only one category of articles. If all articles are assigned, the review article should be a semester-length project. There are three important things to note in assigning articles:

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- Though instructors may appreciate the articles listed under historical and seminal, most students feel that these articles are not as important as those in other categories. If these historical articles are assigned, it is very useful to spend some time explaining their purpose in the context of this activity. Some of the most fundamental questions posed in the earlier studies are the same ones being asked in more contemporary articles, illustrating the pace of scientific discovery. Alternatively, instructors may choose to assign the following article which summarizes all of the work: Solter, D. (2006). "From teratocarcinomas to embryonic stem cells and beyond: A history of embryonic stem cell research." *Nature Reviews Genetics* 7(4): 319-327. <http://dx.doi.org/10.1038/nrg1829>.
 - The last set of articles under the heading **Embryonic stem cells lines without embryo destruction** require a fair amount of genetics and molecular biology background.
 - Students need to be aware of this assignment well in advance,
2. Outside of class, over the course of a few weeks, have students complete the assigned textbook readings and articles. During these weeks, it might be useful for instructors to present material on scientific techniques, basic embryology, and contemporary views on stem cell biology.
 3. Instructors may choose to check in with students and review answers to the questions posed in the **assignment**.
 4. Grade students on the quality of their review article, paying close attention to flow, organization, and clarity. A rubric which can serve as a guide for grading appears in the **Core Materials** section.

Alternative

- To mimic a graduate level seminar course, you may choose to tackle one category of articles every two weeks and assign two students each week to lead the discussion of the papers. There are eight categories, leaving one week for a wrap up. You could also ask students to bring in more current articles during this course.
- You could have students exchange papers with a peer, conduct peer review and revise their papers accordingly.
- You could ask students to answer the questions in this assignment using shorter essays instead of the full length review article.

Assessment

- Grade student papers including the first and second drafts and the feedback they receive from peer critiques. You may also choose to grade students on the quality of their peer critiques of other students. This sort of portfolio assessment emphasizes the process as well as the product.

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- You may also choose to have students answer the questions posed in this assignment and grade those as well.