The Sci-Fi Microbe: Reinforcing Understanding of Microbial Structures and their Significance Through a Creative Writing Exercise †

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INTRODUCTION

By blending storytelling with topics in biology, a fun activity can be created for students to strengthen their scientific knowledge (1-3). The “Sci-Fi Microbe” writing assignment lets students create an altered version of a known microorganism, and write a story describing an unusual observation that leads the characters discovery of their new microorganism.

The Sci-Fi Microbe exercise is appropriate for any microbiology course where the instructor has previously reviewed structures, metabolism, and growth conditions of microorganisms. Since students are responsible for developing and writing their own stories, the activity allows for the instructor to assess students’ understanding in an exercise where they are required to articulate the connection of the microbe to its environment – thereby discouraging simple memorization of facts.

An example of a Sci-Fi Microbe description:

Instead of the bacterium having a normal peptidoglycan layer within the cell wall, he found a strange middle membrane which contained (previously unidentified) proteins. He explained that these proteins have the ability to absorb skin pigment and reflect it back, which was ultimately the new discovery. This explains how the tattoo appears to be missing.

PROCEDURE

A. Introduction of assignment and brainstorming

1. To get students inspired about the idea of fusing their classroom information into a creative story, present the class with story lines from science fiction books and movies, such as the novel *The Andromeda Strain* by Michael Crichton or the movie *Flu Bird Horror* (2008). Many film and literary works describe microorganisms as being pathogens. Therefore, incorporation on how a change in microorganisms leads to positive results will help diversify the types of stories presented.

2. After the introduction, ask students how the virus, bacteria, or microbial eukaryotes mentioned in the books or movies are different from what they have learned in microbiology. One key question to ask the students: *Based on our knowledge about microbial structures, what should be added, removed, or changed in order for this story to proceed?* Although there is no one right answer, the discussion will lead students to reflect on how their story can develop, based on the examples presented.
3. Students are assigned groups of 3–4 students and they begin to brainstorm a story and its main character, the Sci-Fi Microbe, using a brainstorming worksheet (see Brainstorming Sheet - supplementary material). It is important to notify the students during the brainstorming session that their story can be in the form of a news story (television or news article), short story, interview, or series of journal entries (see Journal Entry Format example – supplementary material) – providing them with options on how to present their assignment.
4. To keep the students focused on how the microorganism is linked to their story, they are presented the following questions:
 - a. *Which microorganism are you going to change?* (Students select a known microorganism to change in their story; therefore, they must familiarize themselves with its structure, growth, and nutritional conditions, and its role and significance in health, ecology, agriculture, etc.)
 - b. *Which part(s) of the microorganism do you plan to alter?* (Students select one structure to change about the microorganism. For example, the Sci-Fi Microbe can have altered cell wall components, the production of novel protein(s), or external structures to improve resistance. Students may alter more than one structure if it can be supported by the storyline. Too much alteration can lead to a confusing story.)
 - c. *Where was the microorganism discovered?* (This question challenges the student to reflect on how metabolism, nutrition, temperature, and other conditions must be present to support the microorganism.)
 - d. *What unusual observations led to the microorganism’s discovery and how are the characters involved?* (The students answer this question to explore how the change made to the microbe will influence the story, including the initial discovery. This question also allows students to develop the role of the characters in the story.)

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† Supplemental material available at <http://jmbe.asm.org>

- e. *What techniques were performed to confirm the presence of the Sci-Fi Microbe in the story?* (In the story, the student must explain the techniques used to characterize the microbe. Laboratory techniques covered during the course, such as Gram stain or metabolic tests, can be incorporated into the story. Techniques that are too complex to mention in the story can be omitted.)
- f. *How can we use the microbe (or research generated from it) to make it useful to everyday people (cure for Alzheimer's disease, new cosmetic product, etc.)?* (Students end their story with explaining how their discovery will lead to a new product.)

B. Review of student drafts and instructor feedback

Groups are given seven to ten days to develop their first draft. Reviewing a draft of the story is an important aspect of the learning process because students receive feedback on how they have answered the questions addressed during the brainstorming session and the instructor can assess the students' understanding through their individual stories. Instructors will review drafts for errors that demonstrate a disconnect between the Sci-Fi Microbe and the story. Based on the number of assignments, review of drafts can be completed via email, in-person reviews with group members, or a mix of both.

An additional review of second drafts occurs within five to seven days following, based on suggestions from the first draft. Review of a second draft provides the instructor with additional feedback on students' assurance that they have addressed the instructor's feedback, increased the quality of their draft, and have a positive group dynamics during the development of the story. Most poor group dynamics result in second drafts having little or no improvement compared to the first draft submission. To encourage quality drafts, a rubric can be designed to award points based on the quality of the writing drafts and final assignment submitted (see Rubric for Grading – supplementary material). Instructors may also include a peer review of second drafts for additional feedback.

C. Final submission and presentation of story

After review of the second drafts, the final submission is to be completed in a further five to seven days. Therefore, the entire assignment takes approximately one month to complete. In lecture, students present a summary of their writing assignment, where they can use props such as pill bottles, creams, and clothing to show the benefits of final products produced from their discovery.

Tips

Student writing assignments may be limited as a result of the amount of course information covered prior to the

start of the assignment. For example, if only prokaryotic structure and function is covered, a large number of student drafts may have the Sci-Fi Microbe as a prokaryote. Introducing the assignment after prokaryotes, virus, and microbial eukaryotes are addressed in lecture will increase the variety of assignments.

During the introduction and brainstorming stages, the instructor can review two examples, one excellent and another needing improvement, guiding the students through how the story (i) address the questions presented, and (ii) connects the activities of the Sci-Fi Microbe to the story (see Needs Improvement and Excellent student examples – supplementary material).

Movie Clip: Bird Flu Horror (2008) – Approximately 26 minutes into the movie, two characters explain the difference between the avian flu and the new 'mutant' strain. This clip is a great example of how a student can create a Sci-Fi Microbe from a known microorganism.

Based on the amount of time students have available, it is highly recommended that instructors provide at least 15 minutes of in-class time for students to work on the assignment.

SUPPLEMENTARY MATERIALS

Brainstorming Worksheet
 Assignment Example 1 – 'Journal Entry' Format of Assignment Rubric for Assignment
 Assignment Example 2 – Needs Improvement
 Assignment Example 3 – Excellent

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2. The Sci-Fi Microbe Discovered at General Hospital: Using Creative Writing as a Teaching Tool in a Microbiology Course, May 2010, ASMCUE Poster Presentation.

REFERENCES

1. Killingbeck, K. 2006. Field botany and creative writing: Where the science of writing meets the writing of science. *J. Coll. Sci. Teaching* **35**:26–28.
2. Kirkland, W.L. 1997. Teaching biology through creative writing. *J. Coll. Sci. Teaching* **26**:277–279.
3. Osbourn A. 2006 The poetry of science. *Nat. Rev. Microbio.* **4**:77–80.