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## Integrating Biology and Literature

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### Abstract

Scientific literacy is a challenge for many high school students. In light of this difficulty, we created a course combining biology and literature to offer to incoming high school freshmen. This paper presents some of the ideas and strategies that we have used over the last six years, as well as some of the challenges that we have faced. These ideas can be adapted for use in a stand-alone classroom, or they can be used for cooperative projects between two different classrooms.

### Keywords

Teaching, Pedagogy, Science, Biology, Literacy, Reading, Project Based Learning, PBL, Group Work

### INTRODUCTION

The idea for this class was originally driven by the decision of our high school to have some classes participate in the New Tech national model for learning. Among other emphases, this model encourages joint classes as a way to help students broaden their experiences and make connections between different subject areas. When we joined the New Tech network, some of the more common combinations were math and science classes or English and social studies classes. Ours was the first (as far as we know) to pair biology with literature. This combination may seem odd at first glance, but it feels very natural in practice. Introductory science classes require proficiency in both reading and writing, and science topics offer plenty of ideas for research papers and reading assignments.

In the years that we have taught this class, our students have scored well above the overall school average on the Indiana tests for both biology and English, showing positive results from these methods.

Why incorporate biology and literature?

There were several factors that led us to try this out. First was the high failure rate in both subjects for freshmen in our high school. If we were able to truly integrate the subjects, then a double-length class would give the students more time working with each subject.

A related concern was the struggle that many of our students have with reading comprehension, particularly with scientific texts. Combining with a literature class would bring the expertise of the language arts teacher into the science classroom, resulting in more effective use of reading strategies. Additionally, knowledge of the common use of important word roots in scientific terminology is important in building vocabulary, and the high frequency of these terms in science offers a natural opportunity to learn and practice them.

Although many students are interested in science for its own sake, some students are not so enthusiastic. Having a literature connection enables students to explore and consider social issues. One example is our DNA project. Students still learn about the structure and function of DNA, but they do this in the context of writing a persuasive essay about some type of genetic engineering. Students who may not care much about the structure of DNA may care a great deal about genetically modified food. These sorts of connections can increase student interest and motivation.

### READING STRATEGIES

There are many reading strategies out there. The specific one you use is probably not as important as your willingness to stick with it. Usually it takes us two or three times with a particular reading strategy before students have enough familiarity to use it well, so do not give up if it does not go well the first time. Here are some of our favorites:

- “Say Something”: Divide in groups of two. One student reads a section of text. At the end of the section, the other student says something about the text. Then the reader has a chance to respond. The students switch roles for the next section and continue to the end of the article.
- “Agree / Disagree / Wonder”: Students read an article, then write down something that they agree with, something they disagree with, and a question that they have. They then discuss these in groups of three or four. This works well for issues

on which students have a variety of opinions.

- “Reading by Colors”: Divide into groups of three to five students. Read individually through a section of text, highlighting in yellow any unfamiliar words. Share the list with the group, and define all of the vocabulary as a group, looking them up if needed. Read individually through the same section, highlighting in green any connection that you have to the text. Share with the team. Finally, the group should write a one-sentence summary of the section. This is good for informational texts. (We use an abbreviated version with our 9<sup>th</sup> graders.)

As previously stated, these are just a few of many possible strategies. Use one of these or develop another that you like better. The main thing is to do it and stick with it. We usually do each strategy two to three times to learn it, then we can mix them up and choose whichever strategy seems best suited for our texts.

### SAMPLE PROJECTS

At the heart of our instructional philosophy is our commitment to project based learning (PBL). Projects allow us to truly incorporate the two disciplines of literature and biology. In each project, our goal is for the students to create an end product that uses the knowledge and skills from both areas. As we help students to gain the abilities they need to complete the project, we may focus on English at some points and biology at others, but the goal of completing the project provides the focal point to tie everything together.

**Salad Dressing Project:** This is not necessarily an easy project from the teacher perspective, but the students love it. Each year, it is at or near the top of the students’ list of favorite projects, and it is one of the projects that they almost always talk about. The connections to biology and literature are less obvious than in some other projects, so a short explanation is given with each of the content pieces.

In the project, students (two per group) create a properly emulsified salad dressing and a promotional brochure to go with it. The biology content includes: organic molecules (related to nutritional information); polar and non-polar molecules, types of bonds (particularly hydrogen bonding); familiarity with metric system (Students are asked to put recipe measurements in grams or milliliters, as well as cups and teaspoons.); and the scientific method (Students study

existing recipes, then try out different combinations and amounts of ingredients to try to come up with a tasty dressing.). The literature content includes: basic research (Students research existing dressings to get ideas.); descriptive writing (The brochure includes a detailed description of their dressing, including flavor, smell, texture, and appearance.); biographical writing (Each student writes a short “about the chef” section for the brochure.); layout and presentation (Students have to make an attractive layout with headings, images, and text.); and process writing (Brochures include the recipe and instructions for mixing.).

**Designer Babies Project:** This project grew out of two desires. One was a general desire to help students learn about areas of biology that will be relevant to their lives even if they do not pursue science as a field. Because genetic engineering and testing are becoming increasingly common, this seemed like an important topic to tackle with our students. The second desire was to find a novel that could introduce our students to the idea of point of view, and Jodi Picoult’s novel, *My Sister’s Keeper*, fit perfectly. It tells the story of a family whose youngest daughter was genetically selected to be a tissue donor for her older sibling. Each chapter gives the perspective of a specific character in the story, and we assign each student to read a specific character’s chapters. Students are then placed into different groups. One group is made up of students who read the same character. The students discuss their readings to ensure understanding. The second group consists of one student representing each character of the story. This group provides each student and opportunity to share what happened in his section, and the whole group can put together the story. This story also provides a perfect introduction to the benefits and risks that are inherent in many applications of genetic engineering and testing. After we read and discuss the novel, students are asked to topics and write about them.

The project goal is for students to write persuasive essays about some topic related to genetic engineering or genetic testing. The biology content includes DNA structure and function, protein synthesis, and basic knowledge of some methods of genetic engineering. The literature content includes research and citation methods, writing mechanics and organization, and novel reading (*My Sister’s Keeper* provides an introduction to some of the ethical issues involved in genetic engineering and testing.).

**MRSA Project:** This project also serves a dual purpose. First, it is another way to help students gain important real-world knowledge. In this project, students learn about the characteristics of MRSA and how it has become increasingly common over the past 15 years. We then look at the increase in antibiotic resistance among other types of bacteria and talk about factors that contribute to this problem. Second, this project serves as a perfect introduction to the topic of evolution because it is an example of a population changing over time in regard to selective pressure. The idea for the project product came after we had a MRSA “scare” at our school where several students came to school with masks and gloves after hearing that another student had been diagnosed with MRSA.

The project goal is for groups of three students to create a brochure and public service announcement for the school nurses, who may use the materials to educate the community in case of a MRSA scare at school. The biology content includes: characteristics of bacteria; antibiotics (basic understanding of how they work and how bacteria can resist them); mutations and variations in a population; selective pressure and survival of the fittest; introduction to evolution; and lab work with plating, incubation, and viewing results from bacteria exposed to different levels of antibiotics. The literature content includes research and citation, scientific writing, use of graphs or charts to communicate information (in brochure), and script writing (for public service announcement).

These specific projects may not work for every classroom. They are just some ideas that have worked for us. The main thing is to try to find projects that require students to not only learn the material, but to put their knowledge to use in different contexts. A good project will have a great deal of scaffolding, including article reading, labs, research, lectures, and opportunities for student creativity.

### CONCLUSION

Since the beginning our experiment with Bio-Lit, we have had the opportunity to share our ideas and experiences at several conferences and workshops. At this point, there are more than 45 Bio-Lit classes around the country. One of the most rewarding parts of this has been to hear from other teachers as they have either customized some of our projects for their use or have come up with their own ideas. In fact, some of our current projects have incorporated feedback

from other classrooms so that it is hard to keep track of which ideas were originally ours and which came from other teachers.

Although a stand-alone science class may not have the time to fully incorporate a literature component, there are still ways to use some of these ideas. Students could write a paper with fewer research or citation requirements. They could use some of the reading strategies for certain articles or book texts. Even better, there could be a short-term cooperative project between two separate classrooms. Although this might be difficult to manage, our experience has shown that the results of such an integration can have very positive results, both for student achievement and for connections to real-world issues and topics.

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