

## Bioprospecting:

### Exploring the Tension between Traditional Knowledge and Western Science

#### Introduction

This lesson is meant to be taught at the end of a unit on Imperialism to serve as an example of modern day imperialism. Students will work in groups and explore the issues surrounding bioprospecting. The culmination of this lesson will be to prepare a ten minute video in which the students take on the persona of either a pharmaceutical representative or an elder with traditional knowledge. They will argue their point of view and the class will decide whose argument is most persuasive.

#### Learning Outcomes

The students will understand bioprospecting and the controversy surrounding it by completing internet research, and they will demonstrate their understanding of the material by creating and performing a skit.

#### Curriculum Alignment

**WH.1:** Apply the four interconnected dimensions of historical thinking to the Essential Standards for World History in order to understand the creation and development of societies/civilizations/nations over time.

- WH.1.2.4 - Use Historical Comprehension to: *Analyze visual, literary and musical sources*
- WH.1.3.2 - Use Historical Analysis and Interpretation to: *Consider multiple perspectives of various peoples in the past*

**WH.8:** Analyze global interdependence and shifts in power in terms of political, economic, social and environmental changes and conflicts since the last half of the twentieth century.

- WH.8.1 (second one listed on the Essential Standards) – *Analyze scientific, technological and medical innovations of postwar decades in terms of their impact on systems of production, global trade and standards of living (e.g., satellites, computers, social network, information highway).*

#### Classroom Time Required

180 minutes

#### Teacher Preparation

The teacher should be familiar with the issue of bioprospecting. It would be a very good idea to read the articles listed on the Student Instructions sheet before assigning them to the students.

The best source to visit is [www.gibex.org](http://www.gibex.org), which does an excellent job of giving an overview of these issues. The most helpful information can be found by reading the articles on the “About” tab; they are concise and very informative.

### Materials Needed

Copies of the following documents will need to be made for the students: Graphic Organizer – Bioprospecting, Observations – Bioprospecting, Student Instructions – Bioprospecting, and Guided Practice – Bioprospecting.

### Technology Resources

Students will need computers with internet access. Furthermore, the teacher will need to make sure that each group has access to some type of video recording device. Finally, the teacher will need a projector to display the PowerPoint and the student videos.

### Pre-Activities

Since this lesson is designed as the culminating lesson for the unit plan, the previous two lessons (*The “Haves” and “Have-Nots”* and *Nobody Expects the Imperialism Inquisition!*) are the pre-activities for this lesson.

### Activities

Exploration:

1. Show the students the Bioprospecting – An Introduction PowerPoint, but do not give them any information about bioprospecting.
2. Follow the instructions laid out on the Instructions slide of the PowerPoint.
3. After the wrap-up, discuss the ideas the students have written. Feel free to explore any interesting ideas that come up in more detail.

Model System:

1. Explain to students the purpose of the PowerPoint was to introduce them to bioprospecting; explain what this is to the students. Please refer to the Critical Vocabulary section of the lesson plan for a definition of bioprospecting.
2. During the activity, students will explore the controversy surrounding this issue.

[At this point the students need to understand that many pharmaceuticals are often the result of research done on plants found in the developing world which have been used as traditional medicines for many generations. Knowledge of the bioactive properties of these plants is often gained from traditional healers; however, profits from the sale of these pharmaceuticals in the developed world are often not shared with the developing countries where the plants are found.]

3. Divide the students into groups of 3 or 4 and hand out the Student Instructions – Bioprospecting sheet to each group as well as the Observations – Bioprospecting sheet and the Graphic Organizer - Bioprospecting.
4. Give students the remainder of the class period to read and complete all worksheets. Remind them they should be prepared to discuss at the beginning of tomorrow's class.

#### Wrap-up:

1. As a group, go over the questions on the Observations sheet in order to gauge student understanding of the material.
2. Have a class discussion on the positives and negatives of bioprospecting. Please see the Assessment section of the lesson plan for further details.
3. Students should understand what biodiversity is, and how knowledge of the bioactive properties of plants can be used to treat human illness. Furthermore, students should be able to describe what is meant by traditional systems of knowledge and have a basic understanding of the controversy surrounding the issue of biopiracy and the exploitation of traditional knowledge by Western pharmaceutical companies. A definition of biopiracy can be found in the Critical Vocabulary section of the lesson plan.

[As an alternative to having the students make a video, or perhaps as a supplement if time permits, the teacher may choose to have a class debate on the positives and negatives of bioprospecting. You could divide the class in half; one half is arguing the positive side while the other half is arguing the negative side. Furthermore, instead of having the students make a video, have them make a skit using the same guidelines for the video. If the teacher chooses this option, it may be necessary to change the grading rubric which can be done easily at <http://rubistar.4teachers.org/>.]

#### Guided Practice

At the conclusion of the discussion, give the students the Guided Practice – Bioprospecting sheet and have them complete it. Go over the answers as a class.

#### Assessment

The culmination of this lesson is a ten minute video given by each group. The instructions, along with the grading rubric, can be found on the second page of the Student Instructions – Bioprospecting sheet. Furthermore, the discussion in lesson Wrap-up offers the teacher an opportunity to perform an informal formative assessment; the teacher should ask probing questions to determine student understanding. Possible questions include:

1. What is biodiversity? Why is it important for humans to protect biodiversity?
2. What is bioprospecting? What are its positives and negatives?
3. What is traditional ecological knowledge?

4. What is biopiracy? Is there a difference between bioprospecting and biopiracy?
5. What is a patent? Should it be possible for a company to patent the bioactive properties of plants? Why or why not?

### Modifications

For a smaller class, I might modify this lesson and have the students deliver a speech to the class instead of making a video. Instead of having all the students give a speech on the controversy surrounding bioprospecting, allow them to choose a topic they would like to research. As a requirement, I would tell the students they must deliver a balanced speech which discusses all sides of the issue fairly.

### Alternative Assessments

Instead of having the students create a video, another worthwhile assignment would be to have the students compose a letter to the U.S. Patent Office or perhaps a congressperson regarding issues surrounding bioprospecting. As was the case with the video assignment, the teacher could assign different viewpoints to the students. For instance, one half of the class takes on the viewpoint of a pharmaceutical company, and the other half of the class takes on the viewpoint of natives with traditional knowledge.

### Supplemental Information

I would suggest spending some time on the Gibex website ([www.gibex.org](http://www.gibex.org)). Its mission served as the inspiration for this lesson which would not have been possible without the work of Dr. Mary Ann Lila and Dr. Ilya Raskin. A possible extension to this lesson, if time permits, would be to have the students research other possible examples of modern day imperialism, such as the rising impact of globalization and the power of multinational corporations.

Synopsis of websites used by the students in this lesson:

<http://www.globalexchange.org/countries/americas/mexico/biopiracy.pdf>: According to its website, Global Exchange is, “an international human rights organization dedicated to promoting social, economic and environmental justice around the world.” This is a report on the threat biopiracy poses to indigenous Mexican cultures.

<http://web.williams.edu/go/native/rosyperiwinkle.htm>: This is an excerpt from Michael F. Brown’s book *Who Owns Native Culture?* It discusses the case of the rosy periwinkle. Native to Madagascar, its bioactive properties were used by Eli Lilly to create the drug *Vincristine*, which is an anti-cancer medication.

<http://www.forbes.com/2000/05/29/feat.html>: This article from *Forbes* magazine gives a good overview of bioprospecting and the controversy surrounding it.

<http://www.nature.nps.gov/benefitssharing/whatis.cfm>: This article comes from the National Parks Service. It provides a basic introduction to bioprospecting and gives a case study of the benefits of searching for bioactive properties in plant.

<http://www.scidev.net/en/agriculture-and-environment/bioprospecting/policy-briefs/bioprospecting-legitimate-research-or-biopiracy--1.html>: This article, entitled *Bioprospecting: legitimate research or "biopiracy"?* comes from the Science and Development Network website.

<http://hawaii.gov/lrb/rpts06/bioconfs.html>: The title of this article is Bioprospecting – Fact Sheet. It gives a brief definition of bioprospecting and discusses its effects on Native Hawaiians.

<http://www.gibex.org/index.php?subj=40>: This link discusses the “Reversing the Flow” concept of GIBEX (Global Institute for Bioexploration), which was created by my Kenan Fellows mentor, Dr. Mary Ann Lila, and Dr. Ilya Raskin of Rutgers University.

<http://www.cbd.int/convention/about.shtml>: This is a link to the website for the Convention of Biological Diversity. It has many links students can explore to find information on biodiversity and its importance to human well-being.

### Critical Vocabulary

Biodiversity: “diversity among and within plant and animal species in an environment.” – [www.dictionary.com](http://www.dictionary.com)

Biopiracy: “the commercial exploitation or monopolization of biological or genetic material, as medicinal plant extracts, usually without compensating the indigenous peoples or countries from which the material or relevant knowledge is obtained.” – [www.dictionary.com](http://www.dictionary.com)

Bioprospecting: “searching for plant or animal species for use as a source of commercially exploitable products, such as medicinal drugs.” – [www.dictionary.com](http://www.dictionary.com)

Patent: “the exclusive right granted by a government to an inventor to manufacture, use, or sell an invention for a certain number of years.” – [www.dictionary.com](http://www.dictionary.com)

Traditional knowledge: “knowledge gained through tradition or anecdote; ‘early peoples passed on plant and animal lore through legend’” – [www.dictionary.com](http://www.dictionary.com)

### Websites

There is a list of helpful websites for the students on the Student Instructions – Bioprospecting sheet. Furthermore, a much more thorough discussion of traditional knowledge can be found at: [http://www.nativescience.org/html/traditional\\_knowledge.html](http://www.nativescience.org/html/traditional_knowledge.html)

I used <http://rubistar.4teachers.org/> to create the grading rubric for the video.

### Comments

My externship with the Kenan Fellows changed me in many ways. As a Social Studies teacher I was exposed to many concepts and new ideas that I never could have discovered on my own. I relished the experience of being a scientist: doing field work, making observations, participating in training other teachers how to use Screens-to-Nature, and collecting plant species with an Alaska Native elder. At the heart of this lesson is my personal philosophy that teachers need to find as many opportunities as possible to teach lessons across the disciplines; I have attempted to do this by bridging concepts one might study in a biology class and a world history class. Furthermore, I think it is important for teachers to make history relevant to students by giving them examples of how events in history impact the world in which they live. Certainly, we are still living in a world affected by the Age of Imperialism, and I have attempted to give students an example of how imperialism is still occurring today through an examination of bioprospecting.

### Author Info

Mr. Walter teaches Social Studies at Gray Stone Day School, a college preparatory charter school in Misenheimer, North Carolina. Mr. Walter received his Bachelor of Arts in History from UNC – Chapel Hill in 1999 and completed his MAT in Secondary Social Studies Education in 2004, which he also received from UNC – Chapel Hill. During his externship with the Kenan Fellowship, Mr. Walter worked in the research laboratory of Dr. Mary Ann Lila, who is the Director of the Plants for Human Health Institute located on the North Carolina Research Campus in Kannapolis, North Carolina. In this role, Dr. Lila leads a team of researchers who examine the medicinal qualities of plants such as blueberries and currants. At the center of Dr. Lila's work is a respect for the traditional ecological knowledge one typically finds in the developing world. Furthermore, Western pharmaceutical companies are becoming ever more aware of the medicinal benefits of traditional knowledge and are developing new medicines based on this knowledge. However, the financial benefits of these new pharmaceuticals are rarely seen in the home countries. As a result of this paradigm, Dr. Lila has developed the "Reversing the Flow" concept, which attempts to keep all intellectual property rights and any possible financial benefits derived from traditional knowledge in the home country. At the heart of this concept are the Screens-to-Nature biosassays. These assays are field-deployable, inexpensive, and easy to use. Through her work with the Global Institute for Bioexploration and the Plants for Human Health Institute, Dr. Lila is truly effecting much needed change in the world.