Most Wanted Poster

Directions: You are an ethnobotanist for a start-up pharmaceutical company about to journey to the rainforest, the coral reef, and other natural sources of medicine in the world. Your mission is to catalog 1 plant and animal species that may be useful to medical research. Research on the Internet and review books and magazine articles to discover medicinal plants from that area.

Part I. Research one (1) of the following species. Genus and species names are in italics.

Animals

Pit Viper- *Bothrops jararaca*
Marine sponge- *Cryptotethya crypta*
Sea snail- *Conus magus*
Southeastern pygmy rattlesnake
Coho salmon
Israeli yellow scorpion
Ursus maritimus
Mediterranean tunicate-*Aplidium albicans*
Okinawan sponge- *Agelas mauritianus*
Gila monster-*Heloderma suspectum*
Leech-*Haementeria officinalis*)

Plants

Papaver somniferum-Poppy
Salix alba vulgaris-White Willow Tree
Melilotus species-Spoiled sweet clover
Catharanthus roseus-Rosy Periwinkle
Madagascar periwinkle
Pacific yew
Taxus brevifolia
Camptotheca acuminate
Atropa belladonna
Callistemon citrinus
Galanthus nivalis
Artemisia annua
Chonodendron tomentosum
Cinchona trees
Pilocarpups jaborandi

back of this sheet.

Include in your report:

- a sketch or photo of each plant or animal
- a description of the plant or animal
- growing habits
- geographical distribution-include an image of a map
- notes about its potential medicinal benefits (backed up by references from other sources)
- threats to the preservation/conservation of the animal/plant species you chose.

Part II. Traditional Medicines

- Create a visual presentation, e.g., displays or a video, about the history of traditional medicine of one indigenous population anywhere in the world.
- Include examples of some of their plant or animal derived medicines and their uses. Mark a world map to show where these people live.
- Are any of your examples derived from endangered animal or plant species that are being overexploited/harvested.
- Include why you think there is a need to preserve the indigenous knowledge for future generations

Part III. Presentations

- You will share the information on your species with the class in a power point presentation (3-5 minutes). When planning your presentation, keep in mind all of the concepts we have studied that relate to the topic and try to tie them in.

POLAR BEARS

Polar Bears (*Ursus maritimus*) are threatened by habitat destruction, human encroachment, and exposure to persistent organic pollutants (they are at the top of the marine food chain and tend to concentrate these toxic chemicals in their tissues). But the greatest threat to them is from the melting of sea ice due to global warming, because large areas of open water make it possible for seals, Polar Bears' main food source, to elude capture when surfacing for air.

Many have responded with anguish to predictions that these magnificent creatures, Earth's largest land carnivores, will become extinct in the wild within this century, but few are aware of their value to human medicine.

Unlike all other mammals, Polar Bears and other hibernating bears do not lose bone mass despite periods of 7 months or more of immobility. We lose more than 1/3 of our bone when we are immobile for that long. If we knew how the bears accomplished this, we could perhaps synthesize new, more effective medicines to treat osteoporosis, a disease that causes 750,000 deaths each year worldwide and costs the global economy about 130 billion U.S. dollars.

Polar Bears don't urinate during the several months of hibernation and yet don't become ill. If we cannot rid our bodies of urinary wastes for several days, we die. If we understood how hibernating bears did this, we might be able to develop better treatments for kidney failure, that each year, in the U.S. alone, kills more than 87,000 people and costs the U.S. economy more than $35 billion. More than 1 million people around the world with kidney failure are now kept alive by renal dialysis, a number that is expected to double in the next decade.

Polar Bears become massively obese prior to entering their dens and yet do not develop Type II diabetes, as we humans tend to do when we become obese. More than 20 million people in the U.S. today have obesity-related Type II diabetes, some 7% of the population, and a quarter of a million people die from this disease each year. It is also increasing rapidly in many other countries, with some 250 million people affected worldwide.

If we lose Polar Bears in the wild, we may lose with them the secrets they hold for our being able to treat, and possibly even prevent, osteoporosis, kidney failure, and obesity-related Type II diabetes, three human diseases that kill millions each year and cause enormous human suffering.

▲ **FIGURE 7.** Mother and cub Polar Bears on ice floes separated by large areas of open water. (© 2002 Tracey Dixon)

CONE SNAILS

Cone snails are a large group of predatory molluscs that live mostly in tropical coral reefs. Such reefs, which have been called the "rainforests of the seas" because they are home to vast biodiversity, are among the most endangered ecosystems on Earth, largely because of greenhouse gas emissions that ultimately warm the oceans (as ocean temperatures rise, corals loose their symbiotic algae and "bleach," making them vulnerable to infectious diseases), and that make oceans more acidic (corals have calcium carbonate backbones that dissolve in acid). Scientists predict that coral reefs could be lost entirely by the end of this century, taking with them the organisms that live in the reefs.

Cone snails defend themselves and paralyze their prey—worms, small fish, and other molluscs—by firing a poison-coated harpoon at them.

There are thought to be approximately 700 cone snail species, and as each species is believed to make as many as 200 distinct toxic compounds, there may be 140,000 different cone snail poisons in all. The toxins are small proteins called peptides, and they bind to receptors on the surface of cells, receptors common to all animal cells including our own, that govern how cells work, and in turn, how the organs these cells comprise function.

Because of the enormous number of cone snail peptides, and because they seem to target, with great potency and selectivity, almost every receptor we know about on our own cells, there has been great interest in these peptides as sources for new medicines.

Only 6 species and about 100 of the peptides have been studied in any detail, and already several important new compounds have been found. One is a pain-killer called ziconotide (marketed as Prialt™), an identical copy of a cone snail peptide. Opiates like morphine have been our most effective pain-killers, but they often don't work well in cases of severe chronic pain because patients develop tolerance to them. Tolerance is the state where one has to keep giving more medication to achieve the same effect. Ziconotide is 1,000 times more potent than morphine, but it doesn't cause addiction or tolerance. Its discovery may someday end the suffering of millions of people worldwide in severe chronic pain who cannot be treated by opiates.

Other cone snail peptides are in clinical trials for protecting nerve cells from dying when blood flow is reduced, such as during strokes or open-heart surgery, and for protecting heart cells during heart attacks. Some scientists believe that cone snails contain more leads to important medications for people than any other group of organisms in Nature.

▲ **FIGURE 10.** Cone snail (*Conus striatus*) harpooning fish. (© Baldomero M. Olivera)

Name _____ Lab Number _____

Biodiversity Lab

When scientists speak of the variety of organisms (and their genes) in an ecosystem, they refer to its biodiversity. A biologically diverse ecosystem, such as an old growth forest or tropical rainforest, is healthy, complex and stable. Nature tends to increase diversity through the process of succession.

In this activity, you will use math to calculate the diversity index of a habitat. The closer the diversity index is to 1, the more diverse and healthy the habitat is.

Procedure:

1. Each team will be given a container containing "animals" that live in the area. Each different object/different color represents a different species. The container represents the habitat.
2. Count the number of different species, the number of each species, and the total number of organisms in the container. Place information in Data Table 1.
3. Calculate diversity index by dividing the number of different species by the total number of organisms. Record in Table 1.
4. Repeat for the other 5 ecosystems (containers).
5. When all data is gathered, obtain Biome Diversity Index Table from teacher. Use the information to determine which biome each container represented. Enter the information in Table 2.

Questions:

1. What does biological diversity mean?

2. Which biome is the most diverse?

3. Which biome is least diverse?

4. There are so many species on earth, why will it matter if we lose a few?

5. Describe two threats to biodiversity.

Table 1:

Container Number	Number of Different Species	Number of Each Species	Total Organisms	Diversity Index
1				
2				
3				
4				
5				
6				

Table 2:

Container Number	Biome Name
1	
2	
3	
4	
5	
6	

Biome Diversity Index Table

Biome	Diversity Index
Coniferous Forests (Taiga)	0.5
Deserts	0.333
Lawn/Wheat Fields	0.019
Tropical Rainforest	0.75
Temperate Deciduous Forest	0.52
Grasslands	0.348

Biome Diversity Index Table

Biome	Diversity Index
Coniferous Forests (Taiga)	0.5
Deserts	0.333
Lawn/Wheat Fields	0.019
Tropical Rainforest	0.75
Temperate Deciduous Forest	0.52
Grasslands	0.348

Name_____ Lab #____

Some Like it Hot- Testing Spices for Antibiotic Properties

Background

Humans have added spices to their foods for centuries. Hieroglyphs in the Great Pyramid at Giza, built around 2500 BC, show workers eating garlic and onions for strength. Around 400 BC Hippocrates, the Greek physician, listed more than 400 medicines made with spices and herbs, about half of which we still use today. In the American southwest, chile pepper seeds have been found in Anasazi ruins, which date to around 1200 AD.

When you have a bacteria infection, such as strep throat, your doctor gives you antibiotics to kill the infection. In 1928, Alexander Fleming discovered that molds make chemicals that stop bacteria from growing. These chemicals became our first antibiotics. (He won a Nobel Prize for this discovery!)

Think about early human beings. They could not drive to the pharmacy for medicine. They used what they had- in many cases, plants. Spices are parts of plants and some evolutionary biologists think that we eat spices because they protect us from infections. In this lab you are going to investigate whether common spices are capable of killing bacteria.

How to Set up Your Experiment:

1. Decide what spice or spices you are going to test. Think about what controls you will need for your experiment.

2. Design your experiment

3. Pick up Petri dishes, spices, and a marker.
Label your plate with the name of your group and your spice.

4. It is time to add bacteria to your plate. If you are using your fingers, dip your finger into water and rub it around the space in your plate.

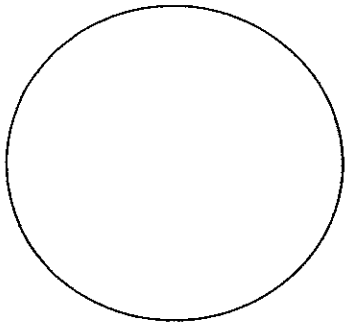
5. Let the dishes sit for a few minutes, then turn them upside down and give them to your teacher. The plates will be incubated to allow the bacteria to grow.

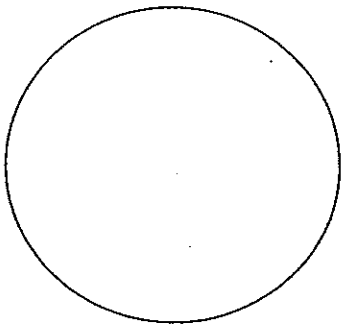
Title:
Hypothesis:
Independent Variable:
Dependent Variable:
<u>Controlled Variables</u> 1. 2. 3. 4. 5.
<u>Control Group</u>
<u>Materials</u> Agar 2 petri dishes spices incubator

Experimental Design

1.

Experimental Plates





Vocabulary:

Agar

Agar is a carbohydrate obtained from the cell walls of red algae or seaweed. The word agar comes from the Malay word agar-agar (meaning jelly).. Its chief use is as a culture medium for bacteria.

Going Further

Now that you have finished your experiment, research your spice and answer the questions below.

1. Where is your spice found(Country)?

2. What are some of the characteristics/descriptions of your spice?

2. How is your spice obtained?

3. Describe three medicinal uses of your spice?

   a. _____
   _____
   _____
   _____

   b. _____
   _____
   _____
   _____

   c. _____
   _____
   _____
   _____

4. What are some general safety precautions/side effects of your spice?