Welcome! In order to get our students more invested and involved in their learning we decided to create inquiry based lessons in our biology classrooms. Below are descriptions of the few we will go over today. Please feel free to download some of the activities at:

**Saving Superman Stem Cell Debate** This activity was based off the case study by Lisa M. Rubin, University at Buffalo. In this activity, students are first shown a you tube video depicting Christopher Reeve as Superman. They then learn of his accident and his support of stem cell research. Students then research stem cells. Armed with their knowledge, they are divided into teams of stakeholders that must present their agenda in a town hall meeting. Finally, students use the information they gather at the meeting to write an opinion paper on stem cell research.

**The Plant Game** This activity was based off of the activity from Cornell University. It is used as an introduction into photosynthesis. Students can see how plants can use the reactants of photosynthesis. It can also be used to demonstrate factors that can affect the rate of photosynthesis.

**Gummy Bear Island and Speciation** In this activity, students learn how the Gummy Neanderthal underwent speciation and became the many colorful species currently on the Isle of Gum. They also watch as nature determines which of these species is now most fit.

**Smelly Balloons** Through a series of demonstrations, students learn about the process of diffusion and factors that affect the rate of diffusion.

**Fruit Loop Adaptations** In this activity, students become blue jays searching for butterflies (fruit loops) to eat. Unfortunately some of the are mimicking poisonous monarchs

**Bear Population Lab** In this activity students pretend they are bears foraging for food. It’s a great way to show carrying capacity and limiting factors.

**Cypridina Hilgendorfii.** (Ordered from Carolina $61.75 for 500mg) This is our beginning activity. It was used to get kids thinking, working together, realizing science is “doing”, and that the right answer is not always obtained on their first try.

**A “Fishy” Unit** This is an integrated unit taught during a summer program. It was inspired by the *Chemistry in the Community* unit on water. It could easily be adapted to an ecology or introduction chapter.

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**Saving Superman Stem Cell Research Town Hall Meeting**

You will be assigned to one of 7 groups. Each group represents a specific stakeholder on the issue of stem cell research and therapeutic use. The group of stakeholders has a particular set of biases that will drive their viewpoint. Use your role to help create a poster board displaying your agenda. The criteria for the poster boards are listed below each stakeholder. Once your poster is complete you will share your information playing the role of whatever stakeholder you were assigned at town meeting. The other groups of stakeholders will be able to ask questions about your presentation. The other groups will also be required to fill out questions about your presentation. At the end of the town hall meeting you will be required to write an opinion essay using the information you learned.

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem Cell Researchers</td>
<td>Pharmacologists</td>
</tr>
<tr>
<td>World View</td>
<td>Senators</td>
</tr>
<tr>
<td>Ethicists from the National Bioethics Advisory Commission (NBAC)</td>
<td>Right to Life Committee Members</td>
</tr>
<tr>
<td>Patients with Autoimmune Diseases/Other Illnesses</td>
<td></td>
</tr>
</tbody>
</table>
The Plant Game – Learning photosynthesis

In this lab, you and your table will try to devise a strategy that will allow your plant to thrive and reproduce (make flowers). A winning strategy will be one that makes a lot of flowers before the first killing frost of autumn strikes!

1. A plant in nature cannot control the weather. Neither can the teams playing this game. To randomly determine each day’s weather, Mother Nature (your teacher) will roll a standard die. Use the Weather Table below to interpret the roll, or “weather report” for the day:

<table>
<thead>
<tr>
<th>Number on Die</th>
<th>WEATHER</th>
<th>PHOTOSYNTHESIS</th>
<th>RAINFALL OR TRANSPIRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chilly, downpour</td>
<td>No photosynthesis</td>
<td>Gain 20mL of water</td>
</tr>
<tr>
<td>2</td>
<td>Cool, light rain</td>
<td>Make 1 Sugar X Number of leaves</td>
<td>Gain 5mL of water</td>
</tr>
<tr>
<td>3</td>
<td>Very humid, overcast</td>
<td>Make 2 Sugar X Number of leaves</td>
<td>Lose 1mL of water X Number of leaves</td>
</tr>
<tr>
<td>4</td>
<td>Warm, partly cloudy</td>
<td>Make 3 Sugar X Number of leaves</td>
<td>Lose 2mL of water X Number of leaves</td>
</tr>
<tr>
<td>5</td>
<td>Humid, sunny</td>
<td>Make 4 Sugar X Number of leaves</td>
<td>Lose 2mL of water X Number of leaves</td>
</tr>
<tr>
<td>6</td>
<td>Sunny very dry, hot</td>
<td>Make 4 Sugar X Number of leaves</td>
<td>Lose 4mL of water X Number of leaves</td>
</tr>
</tbody>
</table>

2. As the days pass, you can save enough sugars(tokens) to “make” leaves, or roots or flowers. Trade in the sugar tokens in exchange for what you want. Here are the “costs” for plant growth:
   a. To make a LEAF, the cost is 7 sugar tokens
   b. To make a longer ROOT, the cost is 7 sugar tokens
   c. To make a FLOWER, the cost is 14 sugar tokens

The Isle of Gum – Learning Speciation and Natural Selection

You are a visitor to the Isle of Gum, a beautiful paradise where you can come to relax and play! The Isle of Gum is also home to many different species of Gummies that were thought to have come from the same ancestor, Gummy neanderthal, whose fossils have been dated to be about 3 million years old. Gummy neanderthal is thought to have gone through speciation due to reproductive isolation. Through natural selection, Gummy neanderthal, evolved into many different species of gummies that have different adaptations in order to exploit the very different habitats that are available on the island.

In this activity, you will make a model of the island with the gummies in their environments. Then you will watch what happens to the gummies as selective pressures cause the populations to change.

PART 1: Identifying the Habitat

In this section, you will be using characteristics of each Gummy species to match it with its specific habitat. Use the description of each Gummy color to help you decide where it lives.

<table>
<thead>
<tr>
<th>Gummy Species</th>
<th>GUMMY CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gummy yellowthal</td>
<td>Webbed feet, claws on toes, breathes with lungs, eats a diet of crustaceans and small fish. Its fur is smooth and sleek</td>
</tr>
<tr>
<td>Gummy orangethal</td>
<td></td>
</tr>
<tr>
<td>Gummy greenthall</td>
<td></td>
</tr>
<tr>
<td>Gummy terathal</td>
<td></td>
</tr>
<tr>
<td>Gummy redeathal</td>
<td></td>
</tr>
</tbody>
</table>

PART 2: Island Design

On the large paper, sketch a picture of the shape, size and habitat areas of your island. Make sure you label your drawing.

PART 3: Obtaining the Original Populations

Place your gummies in the correct habitat areas on your island and record how many you have of each color in the table below.

PART 4: Letting Nature Take its Course

Your gummies are susceptible to unique selection pressures in their individual habitats. They are also vulnerable to selection pressures that may affect the whole island. Follow your instructor’s directions to see what happens to your island that affects the Gummy populations.

PART 5: Analysis
Use the information above to create a graph for each of the gummy species. Use a different color to create a line graph for each species.

**Smelly Balloons** - Learning Diffusion

**Smelly Balloons** - Place extracts into a balloon, blow them up and have the kids determine the smell of the extract. Why do you think the smell gets out when the liquid does not? Think back to our last unit on cells- what cell organelle does the balloon act as and why?

**Air inside the Balloon** - BEFORE you smell these two balloons, do you think the inflated balloon or the deflated balloon will smell stronger? Why?

**One egg, three days** - On day one, place an egg in vinegar and leave it overnight. On day two remove the egg from the vinegar and place it in corn syrup for the second night.

**You’re Hot, then you’re Cold...** - BEFORE we begin this segment, do you think the dye will spread out more quickly in the hot water or the cold water? Why?

**More is Less or Less is More?** - BEFORE we begin, how do you think the amount of dye will affect how quickly it spreads out?

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**Fruit Loop Lab**

You are a blue jay and your main source of nutrition is butterflies. However, the monarch butterfly (top left) not only tastes horrible but also is toxic to your health. A type of butterfly known as the viceroy (bottom left), has an adaptation that allows them to resemble the monarch species to avoid predation by birds even though they are completely safe and tasty to the birds.

Question: What type of adaptation is this? ________

In this activity there are different types of cereal that will represent different species or variations butterflies. Since you will be simulating a blue jay that needs to eat food (butterflies) to survive, you have to figure out which butterflies are safe to prey upon. You will do so by eating them and figuring out which ones are safe.

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**Bear Population Lab** - Population activity adapted from the Project WILD Curriculum

When a black bear’s natural food source gets low, they try to find any food they can get. Today you will become black bears and search for food for survival. The pieces of paper represent various kinds of bear food. Since bears are omnivores, they like a wide assortment of food.

1. Write your name on an envelope. This will represent your “den site” and should be left on the ground (perhaps anchored with a rock) at the starting line on the perimeter of the food area.
2. Line up on the starting line. Leave the envelop between your feet on the ground.

   “You are now black bears. All bears are not alike, just as you and I are not exactly alike. Among you is a young male bear who has not yet found his own territory. Last week he met up with a larger male bear in the big bear’s territory and before he could get away, he was hurt. He has a broken leg. (One student must hunt by hopping on one leg.)

   Another bear is a young female who investigated a porcupine too closely and was blinded by the quills. (One student will be the blind bear. He or she must hunt blind-folded.)

   The third special bear is a mother bear with two fairly small cubs. She must gather twice as much food as the other bears. (One student will be the mother bear.)

3. You must walk into the “forest.” Bears do not run down their food; they gather it. When you find a colored square, pick it up ONE AT A TIME and return it to your “den” before picking up another colored-square.

4. When all the colored squares have been picked up, the food gathering is over. Pick up your den envelopes containing the food they gathered and return to class. Fill out your food collection score sheet.
TIME FOR HUMAN INFLUENCE! If you gathered any food that showed G-50, this was from human garbage.

Bears (participants) who collected three or more garbage cards are told they were killed in defense of life and property (DLP)

**Cypridina Hilgendorfii (Sea Firefly)**

- This was an opening activity where students were given the name *Cypridina hilgendorfii* and told to think aloud as to what it was.
- Next the common name Sea Firefly was given to the students. They had to come up with what they think it was (usually lives in the sea and glows like a firefly)
- Students must work in teams to get the *Cypridina* to glow.

Teaches them
1. Science is fun.
2. It is important to work in teams and listen.
3. It is okay to be wrong the first time – don’t give up

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**A “Fishy” Unit**

This unit has activities pulled from multiple sources. The original idea came from a *Chemistry in the Community* unit about water. It grew from there. It is meant to have students learn multiple concepts while trying to solve a real world problem. The order I do it is below.

1. Students read about a major fish kill happening in the Rogue River behind the school.

   **Wayne News**

   **Fish Kill Triggers Wayne Water Emergency:**

   Severe Water Rationing In Effect

   Timeline of Events:
   
   September 1 – Centropygia raniformis kills the area, 10 inches in 2 days.
   
   September 3 – Power Company releases extra water from the dam to prevent dam failure and flooding.
   
   September 18 – Fish kill discovered.
   
   September 18 – Sanitation closes municipal water plant that draws water from Rogue River, leaving residents of Wayne without water. September 20 – Wayne begins trucking water from nearby Woodland.
   
   September 21 – City Council cancels the annual “Full Fish Tournament” scheduled for October 14.
   
   September 21 – Investigation begins on what caused the fish kill.

2. Student research possible causes for fish kills. They create a hypothesis and design a controlled experiment to test this hypothesis. I purchase feeder fish and they actually run the experiment.

3. Water testing data from the EPA is provided and students graph this data. They then compare the results to normal levels. Once the abnormal level of a substance is identified, students research what can cause this anomaly as well as possible solutions to this problem. They then write all results in a report.

4. We then move on to determine how scientists actually calculate population size. This is done using Goldfish crackers and the equation for population size.

5. Next we determine the role of the fish in the environment by creating food webs and discussing the result to the web when the fish start to die. I throw in invasive species & keystone species here too.

6. Finally we tie in the Tragedy of the Commons. We move a step ahead and speak about overfishing
“Let’s Go Fishing”
The Tragedy of the Commons

In colonial days, there was usually an area of land set aside in each town called a “commons,” upon which all townpeople could graze their livestock. In Ecology, this concept is employed to understand the use of resources that are shared, or held in “common.” In this activity, you will learn what often happens to such commonly held resources.

Procedure:
1. Each one of you represents the head of a hungry family. In order for your family to survive, you must catch enough fish for them to eat. The only food source is a small local public lake, which can hold up to 16 fish.
2. Once a year you will get a chance to fish; and each time you fish you may take 1, 2, 3, or 4 fish from the lake. It is your choice how many fish you take!
   - One fish: Your family starves.
   - Two fish: Your family survives.
   - More than 2 fish: You can sell them for a profit.