Limp Salad
Elizabeth Garren - Biology Senior

MATERIALS:
2 clear beakers
2 pieces of cut celery
Water
Table salt

SETUP:
Dissolve an adequate amount of salt into a beaker half filled with water.

PROCEDURE:
1. Fill one beaker half way with water
2. Fill the second beaker half way with salt water
3. Place one celery piece into the plain water beaker and one in the salt-water beaker
4. Ask students to hypothesis which celery will remain crisp
5. After setting for a while, break each celery piece in half to see if they were correct!

TIPS:
Place the celery in the water cups prior to the beginning of class. This will speed up the process by not having to wait for the osmosis to occur.

EXPLANATION:
This demo displays the process of osmosis and concentration gradients. The celery in the salt water will become limp because the higher concentration of water inside the celery will force the water out.

SAFETY:
Always be careful when working with glass objects.

SOURCE:
www.darylscience.com

Blood Types

Alyssa Baker- Biology Senior

MATERIALS:
4 Styrofoam disks
4 Skewers
Two colors of paper
Tape

SETUP:
Use the colored paper and skewers to create flag that symbolize A and B antigens. The four Styrofoam disks represent red blood cells. Demonstrate A, B, AB and O blood types by sticking the skewer flags into the Styrofoam disks.

PROCEDURE:
1. Stick an A antigen flag onto a ball to create type A blood.
2. Stick a B antigen flag onto a ball to create type B blood.
3. Stick A and B antigen flags onto a ball to create type AB blood.
4. Use not antigen flags for type O blood.

TIPS:
Ask for volunteers to hold the Styrofoam disks and walk through procedure with students. After explaining rationale for type A and B blood types ask students to come up with ideas to create AB and O blood types.

EXPLANATION:
Blood types are determined by the carbohydrate(s)that are associated with red blood cells (erythrocytes). The blood type is determined by the presence of one or both of the antigens A and B.

Anitgen	Blood type
A	B
B	B
A,B	AB
None	O

SAFETY:
No safety concerns

Source:
http://www.researchandteaching.bio.uci.edu/lecture_demo.html

Rubber Egg
Alyssa Baker- Biology Senior

MATERIALS:
1 egg
Vinegar
Plastic cup

PROCEDURE:
1. Hold an egg up for your students and describe the shell of an egg
2. Put the egg in a cup and pour the vinegar over it until it covers the surface of the egg
3. Observe the bubbles created and explain that a chemical reaction is taking place
4. Leave the egg in vinegar for 24 hours.
5. The egg shell is removed and the membrane is exposed.

TIPS:
Be careful when taking the egg out of the vinegar because it is fragile.

EXPLANATION:
An egg shell is made primarily of calcium carbonate. The acid in vinegar breaks apart calcium and carbonate. This can explain how acid rain or ocean acidification affects the lives of creatures who need a shell to survive.

SAFETY:
The vinegar can irritate eyes

Small Intestine Length
Alyssa Baker - Biology Senior

MATERIALS:
Small scarves that measure to 20 ft
- You can also use ribbon or whatever is available at your local secondhand store.

PROCEDURE:
1. Roll up the scarves/ribbon as tight as you can
2. Ask for a student volunteer
3. Tell the class you are going to pull out their small intestine
4. Begin unraveling the scarves/ribbon behind the student's mouth
5. Once unraveled ask the students why they think the small intestine is so long

TIPS:
Unravel the ribbon behind the student's mouth with it open for a funny dramatic effect.

EXPLANATION:
The small intestine averages to be 20 feet in length. The small intestine is responsible for digestion and nutrient absorption.

SAFETY:
No concerns

Sock Chromosomes
Alyssa Baker - Biology Senior

MATERIALS:
Two pairs of different colored socks (longer socks better to see)
4 hair ties
Velcro

SETUP:
Take one sock and wrap a piece of Velcro around the top 1/3 to symbolize a centromere. Repeat this for all four socks.

PROCEDURE:
1. Describe one sock as a chromosome. 2
2. The two different colors represent a chromosome from each parent. (hold up each one)
3. During replication each chromosome gets an exact copy. (Hold up the replicated chromosomes joined at the centromere).

EXPLANATION:
Humans have 23 pairs of chromosomes which is a total of 46 chromosomes per cell. In each pair of chromosomes is a chromosome from mom and a chromosome from dad. These are called homologous chromosomes. During replication all 46 chromosomes are duplicated. Once duplicated, the chromosomes are called sister chromatids.

SAFETY:
No concerns.

SOURCE:
http://www.researchandteaching.bio.uci.edu/lecture_demo.html

Balloon Diffusion
Cassie Waldron-Biology Graduate

MATERIALS:
1 balloon
Imitation lemon extract (or other kinds of extract)

PROCEDURE:
1. Stretch the mouth of the balloon over the opening of the vanilla extract bottle and pour a little into the balloon, it just can be a quick inversion of the bottle.
2. Blow up the balloon and tie it off.
3. Pass the balloon around your classroom and ask your students if they can smell the lemon through the outside of the balloon (they can).
4. Can also have other balloons with other kinds extract

EXPLANATION:
This is a representation of diffusion. Cells use diffusion/osmosis to get various kinds of nutrients through a semipermeable membrane, from an area of high concentration to an area of low concentration. When the balloon is blown up, it causes small gaps in between the rubber molecules of the balloon (like a membrane) that allows the extract molecules (or nutrients in a cell) to fit into the gaps of the rubber molecules. This allows someone to smell the extract scent on the outside of the balloon. If this is used for an osmosis membrane representation, make sure to mention if would need water to be truly osmosis.

Cooking an Egg Without Heat
Cassie Waldron-Biology Graduate

MATERIALS:
4 eggs
60mL of Isopropyl alcohol, 70% soln. (or any rubbing alcohol found in a store)
2 clear jars (250-mL or larger)

SETUP:
1. Crack two eggs into one of the jars
2. Pour 30 mL of isopropyl (rubbing) alcohol solution into the jar (you can add more as long as the alcohol is covering the egg)
3. Set it aside for 24 hours because some of the egg white will begin solidifying and turn white (opaque) as it does when an egg is cooked

PROCEDURE:
1. Crack two eggs into the other jar
2. Pour 30 mL of isopropyl (rubbing) alcohol solution into the jar
3. The egg whites will start to change color
4. Bring out the jar that was set-aside for 24 hours, and that is an example of how "cooked" the egg will get after 24 hours.

TIPS:
Optional: The can be done using two frying pans and compare the alcohol solution to a frying pan with water. The class then can observe the change in appearance after 5 minutes, 10 minutes, 30 minutes, and 24 hours.

EXPLANATION:
When you cook an egg using heat, the egg changes appearance because the proteins within the egg undergo a chemical reaction. Besides heat, there are other ways to change the proteins within an egg. This process is called denaturing. When alcohol comes in contact with the proteins, it mimics the effect of cooking the egg, producing a similar chemical reaction.

SOURCE:
http://www.flinnsci.com/Documents/demoPDFs/Biology/BF10126.pdf

Movement of Water Through Plants – More Fun Than a Barrel of Monkeys!
Brooke Lyons - Biology Post-bac

MATERIALS:
Barrel of Monkeys game (if you cannot find, you could make 'monkeys' out of paper clips)

SETUP:
Have the Barrel of Monkeys game ready. You may want to help yourself out by joining up a few monkeys and putting them on the top of the barrel, or even using little rubber bands to wrap the monkeys together.

PROCEDURE:
While talking about the properties of water, you can pull up the monkeys out of the barrel to demonstrate the concept of capillarity.

TIPS:
None.

EXPLANATION:
The attractive force that holds molecules of water together is called cohesion. Adhesion is the force that holds water molecules to solid substances. Adhesion and cohesion work together in very small tubes to create capillarity, which is the rise of water against the force of gravity. In plants, evaporation combines with capillarity to pull water from roots, through xylem, and out through stomata. This behavior of the water molecules is much like the behavior of the monkeys holding on to each other.

SAFETY:
None.

SOURCE:
Jacque Schmidt, Frontier Academy High School

DNA Extraction

Concepts:

How DNA looks

Materials:

Strawberry
meat tenderizer
detergent
isopropyl alcohol
water, salt, beaker, test tube, cheese cloth, paper clip, Ziploc bag

Procedure

In a plastic bag, add a strawberry and 5mL of water. Add 1g salt, 2g meat tenderizer, and 1mL detergent. Macerate mixture. Once the crushed strawberry solution is ready, strain it through a cheese cloth into a beaker. Transfer this material to a large test tube. Carefully pour the cold isopropyl alcohol down inside the test tube until you have about an inch layer on top (2 separate layers should be visible). Using a paper clip, swirl the alcohol layer so DNA can precipitate from the pink layer into the alcohol layer.

What is happening?

Using the different reagents from above, the DNA is being extracted from the strawberry. First, the meat tenderizer release papain, a protease enzyme that breaks down histone proteins then frees the DNA. The salt helps isolate and precipitate the DNA by shielding the phosphate groups on the backbone of the DNA. The detergent helps break down the cell membrane. The ethanol precipitates the DNA.

Osmosis

Concepts

How does osmosis work?

Materials

2 pieces of lettuce (or 2 pieces of celery)

1 bowl of DI water

1 bowl of salt water

Procedure

At the beginning of the demonstration, ask students if they think leaving the lettuce (or celery) pieces in plain water or salt water will help keep the lettuce more crisp. Set a piece of lettuce in each bowl and wait (possibly till the end of the period.) Go back to the bowls and bend the lettuce from each in your hands. The lettuce from the water bowl will still be crisp; however, the lettuce from the salt bowl will be limp in your hands!

What is happening?

In this experiment, osmosis is taking place through the lettuce. In the bowl with just water, the concentration of water is equal on both sides and therefore no movement is happening. In the bowl with salt, however, the concentration of water is higher inside the lettuce than within the salt water. Therefore, the water moves out of the lettuce, causing it to become limp.

Skittles Taste Test

Materials:

1 Bag of Skittles

Procedure:

Give each student one Skittle (or more of the *same flavor*)

Tell everyone to pinch their nose.

Eat the Skittle.

Ask for observations

After a few seconds, release your nose.

Explanation:

Though at a glance the procedures seem easy, students (and you!) shouldn't be able to actually taste the flavor of the Skittle with your nose pinched. Observations may be about texture, but not much else. Once you release your nose, you should be able to taste the flavor of the Skittle. This is because your tongue can only taste or sense sweet, bitter, salty, sour, and umami. The receptors in your nose are much more complicated, and "fill in the blanks" of what you're tasting. This also explains why when someone is sick and their nose is congested, food can taste very different!

For more information, this article is very helpful, and is more detailed: http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/articles/2012/taste-and-smell/

Tips:

- Make sure students have their noses *completely* sealed. This makes for the most drastic change.
- Lemon flavor tends to have the strongest reaction out of all the flavors.
- I have tried this with other foods such as chocolate, and it works pretty well with that too. Experiment with other foods as well!

Safety: Be wary of any food allergies students may have. You may have to change the food based on that.

Eggs and Osmosis
Karen Allnutt, Biology Major

Materials:
At least 3 eggs
Large bowl
Vinegar
10% Salt water
DI Water
Corn syrup
Beakers large enough to hold egg and some liquid

Procedure:
Part 1: Making a shell-less egg

1. Place the eggs in the large bowl and cover with vinegar. Let these sit for 24-48 hours.

Part 2: Osmosis

1. Fill a beaker half-way with DI water, another with 10% salt water, and another with corn syrup.
2. Carefully use the large spoon to transfer a shell-less egg to each beaker.
3. After 24 hours, what do the eggs look like?

Explanation:
When the eggs are placed in the vinegar, the acid dissolves the hard calcium carbonate shell. However, the membrane of the egg itself will not dissolve and you are left with a shell-less egg. Osmosis is the movement of water through a selectively permeable membrane. The direction of the movement depends on the concentration of the water on either side of the membrane. Because osmosis is a form of passive transport, it does not require energy, the water will move from an area of higher concentration to lower. Because the DI water has a higher concentration of water than the egg inside the membrane, water will move in causing the egg to swell. Both the salt water and corn syrup have lower concentrations of water than the inside of the egg so the water from inside will move out, causing the egg to shrivel.

Tips:
Start off with more than 3 eggs just in case some break during transfer. This does require several days prep so make sure you plan ahead.

Safety:
Be careful not to splash vinegar in your eyes.

Balloons and Viral Replication
Karen Allnutt, Biology Major

Materials:
Large round balloon
About 20 purple colored pieces of paper (about the size of raffle tickets)
About 4 pieces of paper of a different color
Something sharp
Bright stickers
Transparent tape

Procedure:
1. Prep: set aside 1 of the purple papers and put a piece of tape on the back side of it. Put stickers on the remaining purple tickets. Push all of the raffle tickets (except the one with the tape) into the balloon, inflate it and tie it off.
2. Explain to audience that many diseases are caused by viruses. Viruses cannot replicate themselves without a host.
3. The balloon represents a body cell and the single ticket is a virus.
4. In order to replicate, the virus must attach itself to the cell (stick ticket to balloon).
5. The virus then makes the cell make copies of the virus. (Shake the balloon to indicate that more viruses have been made inside).
6. Soon there will be too many copies of the virus inside and the cell will burst (use pin to pop balloon.)
7. Viruses will spread all over the place looking for a new host.
8. Antibodies (stickers) have attached to the virus so that the body will recognize it and fight the virus off. Every once in awhile, the virus doesn't make an exact copy of itself (pink tickets). These blue viruses can still make us sick because they are not recognized by the body as being harmful.

Tips:
Try to be dramatic with the shaking and popping of the balloon so that the viruses fly far.

Safety:
Be careful with the pin so as not to stab yourself.

Vascular Tissues
Stephanie Clark, Biology Major

Materials:
Stalk of celery (with leaves)
wo glasses of water
Food coloring (blue works best)

Procedure:
1. Fill cups full of water
2. To one of the cups add 5 drops of blue food coloring
3. Place one stalk of celery (with leaves) into each of the cups, insuring the leaves are sticking out of the cup
4. Observe the change in color of the stalk immersed in the food coloring as time passes
5. Compare and contrast the food coloring stalk with the plain water stalk

Tips:
You may need to set the experiment aside and allow time to pass before coming back and observing the results

Explanation:
The purpose of this experiment is to demonstrate the movement of water into a plant through the vascular tissue known as the xylem. The color of the celery will change as the celery is allowed to soak up the colored water. Sit back and enjoy your nice green celery stalk turn a shade of blue, all the way up to the leaves!

Safety:
Although food coloring is not dangerous, it could potentially stain skin and clothing. Ensure that it is handled with care.

Mason Jar Semi-permeable membrane
Sam Gleeson, Biology Post-bac

Materials:
Mason Jar
Corresponding lid for the jar
Mesh screen
Coffee beans
Rice
Unshelled nuts
Small rocks or marbles
Water
A bucket to catch water

Procedure:
1. Place the coffee beans, rice and unshelled nuts into the mason jar
2. Put the screen over the mouth of the jar and screw on just the ring of the lid so the opening is completely covered by the mesh.
3. Place rocks or marble on top of the mesh
4. Pour the water through the rocks and mesh and into the jar.
5. Turn over the jar and let the water come back out without losing any of the materials that were inside the jar.

Tips:
- Push the mesh down a little bit so your rocks don't roll off when you pour water through them
- Take the rocks off the top of the jar before turning it over so they don't fly off when you dump the water out

Explanation:
This is a good and very basic model for a semi-permeable membrane. The jar is acting as a cell with organelles inside of it and the mesh is your cell membrane. By having larger objects in your jar and on top of it you can show how water is able to move freely through a cell membrane but large molecules and proteins cannot move from the outside of the cell to the inside, or the other way around freely.

Safety:
The mason jar is glass so be careful that you do not drop it. Also if you are using any kind of nut be aware that you may have a student that is allergic to nuts and it might need to be replaced with a different item.

PB&J Membrane
Sam Gleeson, Biology Post-bac

Materials:
Bread Peanut
Butter
Food Coloring
Butter knife for spreading

Procedure:
1. Spread Peanut butter onto a piece of bread to completely cover one side
2. Place the other slice of bread on top of the peanut buttery side
3. Cut the sandwich in half
4. Drop food coloring near the edge of the bread so it can be visible as it soaks into the top slice

Explanation:
Like a cell membrane the peanut butter sandwich acts as the Lipid bi-layer that has a hydrophilic head, represented by the bread, and hydrophobic tails, represented by the peanut butter. The food coloring spreads out in the bread like a soluble substance would in the hydrophilic heads but is not able to penetrate the lipid part of the bi-layer membrane. Thus it won't cross to the other side (the lower piece of bread stays dry).

Safety:
Some students may be allergic to peanuts in which case you could replace the peanut butter with a nut butter they can tolerate. Also if a student is gluten intolerant, do not let them eat the sandwich. Even though it is not sharp caution should be taken with the knife, as cuts could be a possibility

Impacts of Pollution

Sam Gleeson, Biology Post-Bac

Materials:

Glass gallon Jug
Food coloring
Water

Procedure:

1. Add one or two cups of water to the jug
2. Add a few drops of food coloring.
3. Add water one cup at a time until you can no longer see the food coloring.
4. Drop a few more drops of food coloring directly into the jug

Explanation:

By dropping food coloring into a small amount of water and watching it diffuse it shows how pollution can greatly impact a small area. By adding in more water you can see how the dilution gives the illusion of the pollutant being removed but it is still there. The last step can be used to talk about point source pollution and how when it is coming from a single discreet source, pollution sources can be easy to identify but once it is well mixed into a water supply or downstream in a river finding exactly where the pollution is originating can be difficult.

Safety:

A large glass jug could be very dangerous if it were to fall and break. Make sure to transport it carefully and keep it on a sturdy table or flat ground when doing this demo.

Diaphragm in a Soda bottle
Sam Gleeson

Materials:
2-liter soda bottle
2 large balloons
Tape
Scissors

Procedure:

1. Cut the bottom of the bottle off with the scissors
2. Wrap the edge of the balloon around the opening of the bottle with the balloon inside the bottle
3. Tape the edge of the balloon to the bottle opening so that it is air tight
4. Cut the other balloon so it is flat and stretch it over the cut bottom of the bottle
5. Tape the other balloon so that it is also air tight
6. Move the bottom balloon up and down and watch the balloon inside the bottle inflate and deflate

Explanation:
This structure is designed to simulate how our lungs function. Your lungs do not actively inflate and deflate but rather move air in and out by the action of our diaphragm, which is represented by the balloon on the bottom of the bottle.

Safety:
The bottom of the bottle is plastic but after being cut may have sharp edges. Make sure that the edge won't cut anyone. Students with latex allergies should just watch the demo and not come in contact with the latex balloons.

Dollar bill drop
Heath George Linville, Biology Major

Materials:
1 crisp dollar bill
1 audience volunteer

Procedure:
1. Hold the bill vertically by its long aspect.
2. Ask the volunteer hold 2 fingers at least 3 inches apart.
3. Drop the bill between the fingers without warning and ask the volunteer to catch the bill.
4. Pick up the bill and repeat.

Tips:
Use singles and keep track of the money.

Explanation:
The brain has to detect the event, decide what action is needed and tell the muscles to react. The time the bill takes to pass through a person's fingers is a little bit less than the time it takes for the nervous signal from the brain to the muscles of the body. The task seems easy, but the bill is only caught when the volunteer reads the person dropping the bill to start catching the dollar before it is actually dropped.

Safety:
Perform the demonstration in a clear spot as people tend to follow the bill to make a second attempt at catching it. If there is a table or podium near the volunteer may hit their head while focused on the money.

Seeing what you taste

Heath George Linville, Biology Major

Materials:

Lemon and Strawberry Jell-O
Red food coloring
Small serving cups
Plastic spoons and napkins

Procedure:

1. Make a batch of strawberry Jell-O according to the direction on the box.
2. Make a batch of lemon Jell-O according to the directions on the box, but add enough red food coloring to the hot liquid mix to completely obscure the yellow.
3. Put the Jell-O in different containers to keep track of which is lemon.
4. Allow many volunteers to see the lemon Jell-O before tasting it.
5. Ask the volunteers what flavor they think the Jell-O is.
6. Have the same volunteers try the strawberry Jell-O and guess the flavor.
7. If time permits tell some volunteers there is a third flavor to try. While blind folded serve the lemon Jell-O again to see if any volunteers guess the correct flavor.

Explanation:

What we taste is in part what we have come to expect from a familiar food. This demonstration shows how the brain makes sense of our reality and does not just supply raw data from our senses. When we see red Jell-O we expect a flavor that fits our past experience. This experience can trump the actual taste and smell. Many but not all people will guess the Jell-O is a common red flavor. The more common Jell-O is in the volunteer's diet the less likely the person is to correctly identify the lemon flavor.

Tips:

Make enough Jell-O for everyone and have the volunteers write their first impression of the flavor immediately after eating.

Safety:

Check for dietary restrictions before starting the demonstration. Don't serve a diabetic student a cup of sugar laden Jell-O.

Biodiversity

Lindsey Passantino, Post Bac- Biology

Materials:

Popsicle sticks

Procedure:

1. Take all (around 20 to 40) popsicle sticks and hold them in your hand loosely.
2. Now have a volunteer attempt to remove one of the sticks (probably one near the center) without moving any of the surrounding sticks.

Explanation:

One main idea in biodiversity is that everything is connected. This demo demonstrates to students that you cannot physically remove one stick from the pile without affecting the surrounding sticks. You can compare this to biodiversity because if a species is removed from an ecosystem, then many other species that depend on that species' existence for food, protection, spatial area, etc., will also be affected. It may be helpful for you to use multi-colored Popsicle sticks in order to represent a sample of species diversity.

Safety:

There are no safety considerations for this demonstration.

Natural Selection
Lindsey Passantino, Post Bac- Biology

Materials:
10 different colored 8 x 11" pieces of paper (can be construction paper and 5 pieces have to be red, 2 have to be green, 2 have to be yellow, and 1 has to be brown)
A large roll of nylon rope
Scissors

Procedure:
1. Use the rope to create a large circle with a diameter that is roughly 6 feet across.
2. Have 10 students obtain 1 piece of paper.
3. Instruct each student to create a paper airplane and custom design it in a different way from their peers.
4. Once the paper airplanes have been made, have the students form a circle around the circle you made on the ground (but have them at least 12 feet from the perimeter).
5. Students will then be told to launch their paper airplanes towards the inside of the circle. Make sure that you have the students use different speeds and angles in their throwing technique.
6. After this action, some airplanes will be inside the circle and some will be outside. Some may even be on the perimeter itself.
7. If there are airplanes on the perimeter, the species (or person) will have to play Rock, Paper, Scissors, to see who lives on. This shows competition within a community.
8. Repeat the throwing steps with only the airplanes that made it inside of the circle.
9. Keep doing this until one color is left within the circle.

Explanation:
Natural selection is a biological process that "selects" the fittest species to survive and the less fit to become extinct. This activity shows that each color symbolized a specific "species." Certain species were more numerous than others (red is the dominant species in terms of species number). The 6 ft. circle on the ground represented the threshold for survival in a particular environment. As each student was instructed to throw their airplanes, some students used a slower velocity when throwing their planes while others launched their airplanes at different angles above the horizontal. This diversity of launching techniques is supposed to resemble the different strategies used by different species to survive in their environment. Some airplanes made it into the center of the circle and some did not. The planes (species) that made it "survived" and the ones that did not make it became "extinct." The surviving airplanes were then thrown multiple times in order to "weed-out" the less fit species until only one species dominated. The teacher can then explain what strategies were the best in having their airplanes make it into the circle and what ones did not necessarily work. Other questions related to how a species' number plays a role in surviving a disturbance may also be asked.

Safety:
Ensure that airplanes will not hit anyone in the face.

Components of Blood

Lindsey Passantino, Post Bac- Biology

Materials:

1 clear container at least 2 Liter in size
Red marbles/glass rocks
Buttons (5 different colors)
Small pebbles/rocks
Water
Food coloring

Procedure:

1. Explain the four components of blood.
    a. Red blood cells (red marbles): 44% of blood volume
    b. Plasma (water with food coloring): 55% of blood volume
    c. White blood cells (buttons): 0.5% of blood volume
        i. Neutrophils (green): 62%
        ii. Lymphocytes (purple): 30%
        iii. Monocytes (orange): 5.3%
        iv. Eosinophil (blue): 2.3%
        v. Basophil (white): 0.4%
    d. Platelets (small pebbles): 0.5% of blood volume
2. Measure and combine all four components.
3. Explain to students that plasma is not just made up of water. The food coloring is added in order to show that there are other molecules in the plasma such as organic (fibrinogens, globulins, and albumins) and inorganic solutes (salts, dissolved gases, etc.).
4. Mix the blood!

Explanation:

In this demonstration students will identify the four components of blood and their relative amounts. Explain to students that 55% of our blood volume is plasma, 44% of is red blood cells, 0.5% is white blood cells, and 0.5% is platelets.

Safety:

Watch out for spills.

Bursts of Color
Kayla Schinke, Biology

Materials:

A flat tray (cookie baking tray)
3 colors of food coloring
Whole milk
Liquid dish-soap

Procedure:

1. Carefully pour the milk into the tray so that it just covers the bottom
2. Add about 6-8 drops of different colored food coloring onto the milk in different spots
3. Add about 5 drops of the liquid soap onto the drops of food coloring and watch the show!
4. To clean up, simply pour the colored milk down the drain. (don't drink it!)

Explanation:

The main job of dish-soap it to go after fat and break it down. Usually the fat is on dishes from the food we eat, but fat is also in whole milk. When you drop the liquid soap onto the tray, it tried to break down the fat in the milk. While it was doing that, it caused the colors to scatter and mix creating a very colorful display.

Safety:

The whole milk and dish soap should be used for lab purposes only. The food coloring will dye clothing and skin.

Rubber Chicken Bone
Kayla Schinke, Biology

Materials:
A jar large enough to fit a chicken bone
Vinegar
Two chicken bones (leg or "drumstick")

Procedure:
1. Have a nice chicken dinner and save a bone. Leg bones work best.
2. Rinse off the bone in running water to remove any meat from the bone.
3. Notice how hard the bone is - gently try bending it. Like our bones, chicken bones have a mineral called calcium in them to make them hard,
4. Put the bone into the jar and cover the bone with vinegar. It might be a good idea to put the lid on the jar or cover it - let it sit for 3 days.
5. After 3 days remove the bone. It should feel different. Now can rinse it off and try bending it again.

Explanation:
Vinegar is considered a mild acid, but it is strong enough to dissolve away the calcium in the bone. Once the calcium is dissolved, there is nothing to keep the bone hard - all that is left is the soft bone tissue. Now you know why your mom is always trying to get you to drink milk - the calcium in milk goes to our bones to make our bones stronger. With some effort and you can really get the bone to bend.

Safety:
The vinegar and chicken bones should be used for lab purposes only.

Laser Microscope
Amy Ordaz, Biology Major

Materials:
1 laser
1 plastic dropper/syringe
Pond water
Surface to project image on
Apparatus to suspend beaker (optional)

Procedure:
1. Fill plastic dropper with some of the water collected from a pond
2. Hold dropper pointed down with apparatus or with hand while suspending a single drop from the end of it
3. Orient laser a few inches away (best to stabilize with a level surface)
4. Shine the laser through the suspended droplet
5. Observe the image projected on the wall/screen

Tips:
-The more stable the dropper and the laser are, the easier the image will be able see
-Ensure that water is collected as fresh as possible, so that any microorganisms will still be alive

Explanation:
Water collected from a pond or similar ecosystem will contain a myriad of different microorganisms, from bacteria to protozoans and even invertebrate animals such as rotifers. These organisms are much too small to see with the naked eye. However, the laser can magnify these small creatures when employing the curve of the water as a type of magnifying lens. The concentrated light from the laser is refracted, and what is projected are shadows of the microscopic animals contained in the single drop of water.

Safety:
Laser should not be pointed at anyone's eyes

ATP Energy Jar
Amy Ordaz, Biology Major

Materials:
1 gallon jar
3 Construction paper strips, each with a "P" written on it
Novelty springing snake with the word "energy" attached to it

Procedure:
1. Attach the strips of paper to the jar horizontally, with the 3rd strip attached to the lid of the jar
2. Load the springing energy snake into the jar
3. When the lid is taken off, the snake leaps out of the jar

Explanation:
This demonstration shows how the molecule ATP works. The high energy phosphate bonds will release energy when the third bond is broken (as symbolized by the snake). Conversely, for ADP (diphoshate) to add on a third phosphate again, energy must be used (illustrated by the snake being put back into the jar before the P is secured again.

Safety:
Ensure that the springing snake won't injure anyone's face.

Peanut Butter Jelly Time
Dene Gallagher, Biology Major

Purpose:
The purpose of this lab is to help students visualize the cell membrane and it's amphipathic properties. It will help show a hydrophillic head (bread) and the hydrophobic tails (peanut butter) that phospholipid bilayers have.

Materials:
-2 slices of bread -Peanut butter
-Knife
-Water
-Food coloring

Procedures:
1. Take one piece of bread and spread a thick layer of peanut butter on one side
2. Put another piece of bread on top of the layer of peanut butter -basically you will have a peanut butter sandwhich
3. Color some water with food coloring so that it is visible. A bright color like red, green, or blue that will contrast against the bread will work best.
4. Slowly pour about 30 mL of the colored water on top of the bread and observe whether the colored water has seeped through the peanut butter layer and onto the other piece of the bread.

Tips:
Too much water will oversaturate the bread and and make a mess, use just enough to make your point and be convincing.

Impacts of Pollution

Dene Gallagher, Biology Major

Purpose:

To show the effect of a small amount of pollution on a stream and its surrounding wildlife

Materials:

-1 gallon glass jar
-Measruing cup
-Red food coloring

Procedure:

-Pour ½ a cup of water into the gallon jar
-Add and stir 2 drops of food coloring into the jar
-Add 1 cup of water at a time to the jar until the red color disappears

Explanation:

The food coloring is condensed because there is not a lot of water for it to diffuse in. The molecues are close together making the red more vibrant. As more water is added the food coloring molecules can diffuse and spread farther apart. Eventually they spread out far enough that they are no longer visible because they are so far apart. Relate this to waste that is dumped into a stream; similar concepts apply. The material is dumped and it will flow downstream and it becomes more spread out and mixed with a larger amount of water. Eventually you can't see it anymore, but just like the red food coloring, it doesn't mean that it has disappeared.

ATP Energy Jar
Lauren Christine Burns

MATERIALS:

1. A large jar with a screw top lid, such as a mayonnaise jar or a canning jar
2. 3 strips of paper with the letter "P" written on them
3. A "snake in a jar" type spring-loaded novelty snake with the word "ENERGY" written or attached to it

SETUP:

Take two of the strips of paper with the letter "P" on them and fit them around the jar. Take the third strip and fit it around the lid of the jar. Place the spring-loaded novelty snake inside the jar and screw on the lid.

PROCEDURE:

After teaching the ATP/ADP cycle, show the students the jar with the lid on it. This jar represents a molecule of ATP. Remove the lid and the snake will spring out.

EXPLANATION:

When the lid with the third "P" on it is removed the "ENERGY" snake springs out showing how energy is released when a phosphate is removed. Ask the students what molecule remains and they should say ADP because of the two "P's" on the jar. When ADP is converted to ATP, a phosphate group is required and it takes energy to phosphorylate the ATP. Show how you have to "work" to get the snake back in the jar. Put the lid back on and show how energy is now stored in the molecule.

SAFETY:

Be sure to point the jar away from people when opening it.

Candy Blood

Danielle Thuringer - Biology Post-Bac

MATERIALS:

Candy Red Hots
Corn Syrup
Marshmallows or white jellybeans
Candy sprinkles
Glass or other clear container

PROCEDURE:

Mix the ingredients in a large clear container while explaining the four components of blood and the relative amounts of each.

TIPS:

Optional: Give students spoons and small paper cups and let them sample the candy blood!

EXPLANATION:

- Red blood cells (candy red hots): 44% of blood volume, carry oxygen and carbon dioxide around body. RBC's only live for about 3 months, but are continuously produced in the bone marrow.
- Plasma (corn syrup): 55%, syrups, thick, clear, yellowish liquid that carries dissolved food and wastes.
- White blood cells (white jelly beans or marshmallows): 0.5%, bigger than red blood cells, oddly shaped cells that "eat"• bits of old blood cells and attack germs.
- Platelets: 0.5% -bits of cells and cytoplasm that help clot your blood.

Groundwater Pollution
Danielle Thuringer - Biology Post-Bac

MATERIALS:
Slice of white bread
Food coloring
Water
Pipette

PROCEDURE:
Place a drop of food coloring on the top crust edge of the bread. Use a pipette to add at least 2mL of water to the food coloring. Hold the bread upright (vertically) for a few minutes while the dye soaks down the bread.

TIPS:
Use two different colors to represent two different sources.

EXPLANATION:
The bread represents the earth and the food coloring represents pollution. When it rains, the water carries these pollutants into the ground with it, which in turn pollutes our groundwater. The food coloring spreads out, rather than going straight down, making it difficult to determine the source of the pollutant.

Fresh Water-Apple Analogy
Danielle Thuringer - Biology Post-Bac

MATERIALS:
Apple
Knife

PROCEDURE:
1. Hold the apple in front of you and tell the students that it represents all the water on the earth. Ask them to guess how much they think is salt water. Cut the apple in fourths, three of which are set aside.
2. Take the remaining fourth and cut it in half. Add that to the rest of the pile you have set aside. Tell the students that the large pile is all the water in the world that is salty (97.4%).
3. Ask them if they think the remaining 2.6% of the apple (water) is available for our use. What form of water is not available? Cut the remaining sliver in thirds. Discard 2/3 of it, as it represents the frozen water that cannot be used (polar ice caps and glaciers= 2.0%).
4. Of the remaining sliver take off the peel as it represents some polluted water. The remaining 0.6% is all the useable water on earth! Let students know that includes all rainwater.

Diffusion
Matt Nolen –Biology

MATERIALS:
3 large beakers
Water to put in beakers
Food dye
Hot plate or stove
Large bowl of ice or freezer

SETUP:
Before the demonstration fill the three beakers with water. Place one of them in the freezer or ice to lower the water temperature. Leave one out to stabilize are room temperature and place the 3rd beaker on the hot plate or stove. The water in the beaker on the hot plate does not need to be brought to a boil. It simply needs to be heated to reach a temperature above room temperature.

PROCEDURE:
Place three beakers on a table or desk in order of temperature. Then add food dye to the water and observe the rate of diffusion.

TIPS:
I have found that food dyes are generally darker and easier to observe than iodine or methyl blue. Don't be afraid to add LOTS of dye.

EXPLANATION:
This demo allows students to see something actually diffuse, or move from an area of high concentration to an area of low concentration and become equally dispersed throughout a container. The cold water results in a slower rate of diffusion while the hot water has a very fast rate of diffusion. You may also use this demonstration to show how catalysts function.

SAFETY:
Be careful using the hot plate or stove and then when moving the hot water from the hot plate/stove to the demonstration area. Take proper precautions to protect yourself from burning your hands during transport. Students should be shown which beaker contains the hot water is they are allowed to move in to view the demo close up.

Enzymatic Breakdown by Lactase
Deidra Shutte - Biology Senior

MATERIALS:
Plastic cups
Nonfat milk
Lactaid caplets
Pestle and mortar
Stirrer
Glucose test strips (Diabetic test strips)

PROCEDURE:
1. Pour nonfat milk into plastic cup.
2. Use glucose test strip to determine if glucose is present in milk.
3. Use pestle and mortar to grind one Lactaid caplet.
4. Mix Lactaid into milk with stir bar.
5. Use a new glucose test strip to determine if glucose is now present in milk.

PROCEDURE: (ALTERNATE)
1. Begin with the procedure listed above.
2. Use the same procedure as above for water.
3. Use the same procedure as above for soy milk.

EXPLANATION:
The enzyme lactase, breaks down the disaccharide lactose into two constituent monomers, galactose and glucose. Lactose is present in nonfat milk and has not yet been broken down to galactose or glucose. When a glucose test strip is added to whole milk, the indicator should show neutral, or no glucose present. When the Lactaid caplet is added to the milk, lactase works at breaking down lactose. When a new glucose test strip is used, traces of glucose should be detected by the strip. Doing the same test to water shows there is no glucose present in the Lactaid caplet itself because both glucose test strips show no traces of glucose present in water before or after the caplet is added. Doing the same test to soy milk shows there is no sugar present in the milk. Both test strips will show no traces of glucose present because the Lactaid caplet has no sugar to break down.

SAFETY:
Do not consume anything used in demo.

Ping Pong Lipid Bilayer
Deidra Shutte - Biology Senior

MATERIALS:
Glass Bowl
Ping Pong Balls
Water
Colored Sand (i.e. bath salt)
Colored Pebbles

PROCEDURE:
1. Pour water in a clear, glass bowl.
2. Layer ping pong balls on the surface of the water.
3. Pour colored sand over the ping pong balls. It will "diffuse" through the layer of ping pong balls.
4. Pour colored pebbles over the ping pong balls. They are too big to move past the layer of ping pong balls.

TIPS:
Carefully place the colored pebbles on the ping pong balls. Dropping them on the ping pong balls moves the layer enough, the pebbles sink into the water.

EXPLANATION:
The ping pong balls represent the lipid bilayer of the cell membrane. Colored sand passing through the ping pong balls represents diffusion of small particles into the cell. Colored pebbles represent the larger molecules that are not able to simply diffuse through the cell membrane.

Thermal Grill – Sensory Confusion
Shawn Murphy – Biology Postbac

MATERIALS:
10, 12” pieces of ½” copper pipe
Hot glue gun
12” X 15” piece of wood
Warm water
Cold Water

SETUP:
Each piece of copper pipe in closed off using a hot glue gun to seal the end and make it water tight. Half the tubes are then filled with ice water (0 degrees Celcius) and the other half are filled with warm water (40 degrees Celcius). The water filled pipes are then placed on the piece of wood on an incline, so the water does not drain out. Small pieces of wood can be attached to the bottom of the board and the sides to secure the pipes in place.

PROCEDURE:
When placing your hand on the alternating cold and warm water pipes, there is a feeling that the pipes are red hot and one is inclined to move their hand away quickly.

TIPS:
The water begins to cool down and warm up quickly so this will only be an effective demonstration for a few minutes.

EXPLANATION:
The demonstration shows how contradictory stimulation of cold and warm receptors generates the feeling of burning pain in an individual. A burning sensation is generated by the combination of hot and cold nerve impulses and the inhibition of the cold impulses.

SAFETY:
None.

Soaking Spuds
Sandra Pike – Biology, Post Bac

MATERIALS:
1 small potato cut into several flat pieces
2 containers or bowls
Water
Salt (about 2 tablespoons)

SETUP:
Label one container with "Water" and the other container "Salt Water".

PROCEDURE:
Place half the sliced potatoes in one container and the other half in the second container. Fill both containers with water. Add salt to the container labeled as "Salt Water". Allow the potatoes to soak for 15 minutes before observing and comparing.

EXPLANATION:
This demonstrates osmosis and how water moves from an area of low salt concentration to an area of high salt concentration. The water inside the potatoes that are soaking in the salt water solution will move to the higher concentration of salt which is outside the potatoes. This will cause the potato slice to become less stiff than the potato slice in just water.

This could also be done by the students themselves. The students can cut the potatoes into cubic centimeters and measure the difference in the potatoes that were soaked in salted water and regular water. The salt water potatoes will shrink in size.

Rates of Diffusion
Jill Crookshanks - Biology

MATERIALS:
2 1000ml beakers (or larger)
1 container of food coloring
Cold water from tap
Hot water from tap (or you can use a hot plate to get the water very hot!)

PROCEDURE:
1. Get two 1000 ml beakers (or larger) with the same amount of water in each.
2. Put cold water from the tap in one beaker
3. Put hot water either from the tap or heat up the water on a hot plate in the other beaker
4. Put three drops of food coloring in each beaker

TIPS:
If using a hot plate you might want to heat up the hot plate and get both beakers of water set up before the demonstration.

EXPLANATION:
This demonstration will help clarify the topic of diffusion. Since diffusion describes the spread of particles through random motion from regions of higher concentration to regions of lower concentration. Also, this will show the difference that diffusion will happen more rapidly when in a warmer solution compared to a colder solution. Since water particles in the hot water have been energized by heat, this makes complete diffusion of the food coloring in the hot water much faster than how long complete diffusion takes the food coloring to be in equal concentrations throughout the entire beaker in the cold water.

SAFETY:
If using a hot plate be careful water can start boiling quickly!

Enzyme/Substrate Reactions
Jill Crookshanks - Biology

MATERIALS:
Small cube of liver
A clear container to hold the liver in or a plate
Hydrogen peroxide
Disposable pipette

PROCEDURE:
1. First place a cube of liver on a plate or in a clear container
2. Get a disposable pipette full of hydrogen peroxide
3. Put about 1ml of hydrogen peroxide on the liver and watch it bubble!

TIPS:
It is better to use a clear plastic or glass container to avoid a mess with hydrogen peroxide spilling.

EXPLANATION:
This demonstration will help illustrate some of the properties enzymes and their substrates. The enzyme catalase found in the liver will break down harmful chemicals like hydrogen peroxide into oxygen gas and water (non-harmful). When this reaction occurs, you can see the oxygen bubbles escaping which causes the liver to sort of foam. This enzyme is specific too, if you were to denature the liver in any way (heat, acid, base) then no bubbles should form. You can use this demonstration to show students how the enzyme is working to transform the harmful hydrogen peroxide into nonharmful products of water and oxygen. Then you can elaborate from this demonstration and turn it into a lab. Have the students do the untreated liver and then have them come up with a treatment that they think will make the liver not function by what they know about enzymes.

Lung Demonstration
Marquelle Sanchez

MATERIALS:
Gatorade bottle (32oz or larger)
4 rubber bands
3 balloons
Tube tee nylon 3/8”X 3/8” X 3/8”
Vinyl tubing ½”
Scissors
Drill

METHODS:
(Teacher assembly): Drill a hole at the center of the cap of the Gatorade bottle (1/2” diameter). Cut the bottom of the Gatorade bottle with scissors.

(Student assembly): Cut tubing approximately ½ foot length. Take one rubber band; wrap it around the tubing at the top ¾ of the tubing length from the bottom, to serve as a seal and placeholder for the lungs. At the long end, push the center of the tubing tee in to the vinyl tube. Place balloons on the remaining ends of the tee tube. Tie rubber bands around the balloons to seal them to the tee ends. Put the nylon tubing through the Gatorade bottle with the cap on (try to keep the rubber band under the cap as a sealant when twisting on the cap). Cut the last balloon in half, just above the largest part of the balloon’s diameter. This balloon will go on the bottom of the Gatorade bottle. Once the balloon is on, put the last rubber band on the diaphragm to keep it in place. The lung is now ready to use. To inhale: Pull the balloon on the bottom of the Gatorade out and watch the lung fill with air. To exhale: Push the balloon on the bottom of the Gatorade back in and watch the lung exhale.

This demonstration is a great visualization of the respiratory system; it demonstrates how the diaphragm works and how as we breathe we inhale and exhale air through our lungs. The air fills and empties our lungs by changes in the diaphragm. The can be incorporated into an anatomy class or an introduction to pressure differences.

Nut Osmosis

Cynthia Krull Junior Biology Major

MATERIALS:

Jar of salted nuts (or pretzels), any dry salty food will work

PROCEDURE:

Students love food, and anything revolving food, so why not incorporate food into your demo to spark their interest and attention.

Have students eat a handful of salted nuts. As they are sitting there eating as the question, "What happens after eating salty foods?" Help the students explore the answer that the nuts have a high concentration of salt and a low concentration of water. This causes water to leave the cells of the mouth, making you thirsty. Use a follow up question of "How do you remedy the condition?"

Mouse Muscle Contraction
Cynthia Krull Junior Biology Major

MATERIALS:
Mouse Trap Pen or pencil

PROCEDURE:
Use a mousetrap to show the idea of the all-or-none principle of muscle contraction. It takes a certain amount of force to trip the trap just as it takes a certain stimulus to trigger the muscle. The trap will snap completely, not partially or excessively as does a muscle contraction.

Diffusion Demonstration
Corey Johnson

DESCRIPTION:
This easy demonstration is useful to illustrate how diffusion works. Materials are easy to acquire and students gain concept comprehension.

MATERIALS:
Balloon
Vanilla Extract
Pipette

PROCEDURE:
Place 1-2 drops of vanilla extract into an empty balloon. Blow up the balloon and tie it off like you normally would. Shake the balloon back and forth for a few seconds and then sniff the balloon. Pass the balloon around and have students do the same. For added showmanship, place the vanilla into the balloon without the students seeing it. Then, blow the balloon up and ask a volunteer student to come up and smell the balloon. They are most likely to say that it smells like vanilla. Then prompt the class with "How could this be?" Have them think about why it smells like vanilla and how they could smell something that is inside the balloon.

EXPLANATION:
The balloon itself acts just like a cell wall; it allows certain materials through (vanilla molecules), but also keeps things in (the air).

The Metal inside of you Genevieve Froid Post-Baccalaureate Student

If you sit there and ponder the foods that you eat for a bit, you'll realize that you eat plants and animals just like other fuzzy creatures in the forest. But did it ever occur to you that you eat metal too? You chew through metal every day in your food without even really thinking about it. Even more eye opening is the fact that metal in your diet is required to survive.

MATERIALS:

- Breakfast cereal high in iron
- Bowl with water
- Spoon
- Magnet

PROCEDURE:

1. Take a breakfast cereal that is high in iron and crumble it to powder
2. Mix water with the cereal powder to make a very watery solution
3. Take a magnet and stir the cereal powder mixture around for a while
4. Examine the magnet. You will see particles of iron clinging to the magnet.

Iron is a part of everyone's healthy diet and it's the exact same iron that's used to make metal nails. Oxygen is transported through your body in your blood and iron is required in the blood for the oxygen to cling too. The oxygen piggybacks on the iron and is carried throughout your bodies to all of the individual cells. If you do not consume enough iron, your body will be short on oxygen and you will feel tired. Minerals such as iron are very important to your health.

Strangely enough, having too much iron in your body can lead to a condition called hemochromatosis. Some people even supplement their diet with vitamins and minerals including iron. Taking in too much iron can overload the body with iron and can leave you feeling tired and weak.

Exploring the Properties of Strawberry DNA
Juliana Coalson

PURPOSE:
To determine how the physical properties of strawberry DNA relate to the structure of DNA molecules - what does DNA look like in a test tube and what properties can be observed by the naked eye?

This lesson plan is for the extraction of DNA from strawberries. Strawberries are an exceptional fruit to use for this lesson because each individual student is able to complete the process by themselves and strawberries yield more DNA than any other fruit (i.e. banana, kiwi, etc.). Strawberries are soft and easy to pulverize. Strawberries have large genomes; they are octoploid, which means they have eight of each type of chromosome in each cell. Thus, strawberries are an exceptional fruit to use in DNA extraction labs.

The long, thick fibers of DNA store the information for the functioning of thechemistry of life. DNA is present in every cell of plants and animals. The DNA found in strawberry cells can be extracted using common, everyday materials. We will use an extraction buffer containing salt, to break up protein chains that bind around the nucleic acids, and dish soap to dissolve the lipid (fat) part of the strawberry cell - the phospholipid bilayers of the cell membrane and organelles. This extraction buffer will help provide us access to the DNA inside the cells. DNA is not soluble in ethanol. The colder the ethanol, the less soluble the DNA will be in it. Thus make sure to keep the ethanol in the freezer or on ice.

http://gemsclub.org/yahoo_site_admin/assets/docs/StrawberryDNA...

Materials:
zip-lock (sandwich size) freezer bags
1-2 strawberries - fresh or frozen
10 mil DNA extraction buffer (shampoo, salt and water)
Filtration Apparatus - cheesecloth or gauze, funnel and small beaker
Ice-cold ethanol (90% concentration or higher) in a dropper bottle
Large size test tube
Glass rod for stirring
Safety goggles
Scissors
Micro centrifuge tube (if students want to take home a sample of their DNA)

Characteristics of Life
Shannon Swanson Senior Biology Major

MATERIALS

1. A clear container (glass, bowl, ect.)
2. Mountain Dew (or a very carbonated soda)
3. Raisins

PROCEDURE

1. Fill a glass with Mountain Dew or other carbonated beverage.
2. Add raisins to the glass and observe them “swim” up in down in the glass.
3. Explain how movement is not a characteristic of life.

EXPLANATION

The raisins sink to the bottom of the glass. As the carbon dioxide is released from the soda the bubbles accumulate on the raisins and allow it to float back to the top. The bubbles break at the top and allow the raisins to sink back to the bottom and the process is repeated until there is not enough carbonation left. Although the raisins are able to “swim” in the class of soda, they are not living organisms and can help students to understand how movement does not make something alive.

Chris Schaumberger – Post Graduate – Physics

LUNG DEMONSTRATION

This demonstration is a great visualization of the respiratory system; it demonstrates how the diaphragm works and how as we breathe we inhale and exhale air through our lungs. The air fills and empties our lungs by changes in the diaphragm. This can be incorporated with discussions about our lungs and body. It can also serve as an introduction to pressure differences and a discussion about vacuums.

Materials/ Quantity:

Gatorade 32FL OZ or larger QTY:1
Rubber Band QTY:4
Balloons QTY:3
Tube Tee Nylon 3/8" X 3/8" x 3/8" QTY:1
Vinyl tubing ½" OD 3/8" ID

Resources/tools:

Drill
Scissors

Procedure:

Pre-Lab (Teachers assembly)

1. Drill a hole at the center of the cap of the Gatorade bottle sized to fit ¼" radius ½" diameter.
2. Cut the bottom of the Gatorade bottle with scissors. Make sure that when you cut you keep
   the edge really smooth. (A sharp edge could be a safety hazard!)

Lab Assembly (For the students in class**)**

1. Cut tubing to approximately a ½ foot length.
2. Take one rubber band, wrap it around the tubing at the top ¾ of the tubing length from bottom, to serve as seal tent and placeholder for the lungs.
3. At the long end push the center of the tubing tee in to the vinyl tube, ¼" is sufficient. The remaining tee ends of the tubing tee place balloons over the ends. To keep them in place wrap the rubber bands around the balloon and seal them to the tee end four loops around the balloon will suffice.
4. Put the nylon tubing through the Gatorade bottle without the cap on.
5. Push the cap with the pre-drilled hole though the vinyl tubing and twist the Gatorade cap on the bottle. (Try to keep the rubber band right under the cap as a sealant, note it may improve the demonstration)
6. Cut the last balloon across just above the largest part of the balloon's diameter.
7. Stretch the balloon out, pull it across the bottom diameter of the Gatorade bottle.
8. (This is the most challenging step -it may require two people, one student should hold the Gatorade bottle and the other should stretch the balloon.)
9. Once the balloon is on put the last rubber band on the diaphragm to keep it in place.

Jordan Kaufmann – Senior – Biology Major

BIODIVERSITY

Materials

10 small wooden/plastic sticks

Procedure

Take all 10 sticks and place them randomly on top of each other to make a "mixture" of sticks

Attempt to remove one of the sticks (probably one near the middle or bottom of the pile) without moving any of the surrounding sticks

Explanation

One main idea in biodiversity is that everything is connected. This demo demonstrates that you cannot physically remove one stick from the pile without affecting the surrounding sticks. If a species is removed from an ecosystem, then many other species that depend on that species' existence for food, protection, spatial area, etc. will also be affected. It may help to use multi-colored sticks in order to represent a sample of species diversity.

NATURAL SELECTION

Materials

10 different colored 8 x 11” pieces of paper (can be construction paper and 5 pieces have to be red, 2 have to be green, 2 have to be yellow, 1 has to be brown)
A large roll of twine, string, or tape
Scissors

Procedure

Use the roll of twine, string, or tape to create a large circle with a diameter that is roughly 10 feet across
Have 10 students obtain 1 of the 10 pieces of paper
Instruct each student to create a paper airplane and fashion it in a different way from their peers
Once the paper airplanes have been made, have the students form a circle around the circle you made on the ground (but have them at least 5 feet from the perimeter)
Students will then be told to launch their paper airplanes towards the inside of the circle and have some students use different speeds and angles in their throwing technique
After this action, some airplanes will be inside the circle and some will be outside. Some may even be on the perimeter itself (you can place these airplanes inside the circle).
Repeat the throwing steps with only the airplanes that made it inside the circle
Keep doing it until one color is the only one left inside

Explanation

Natural selection is a biological process that “selects” the fittest species to survive and the less fit to become extinct. This activity shows that each color symbolized a “species.” Certain species were more numerous than others (red is the dominant species in terms of species number). The 10 ft. circle on the ground represented the threshold for survival in a particular environment. As each student was instructed to throw their airplanes, some students used a slower velocity when throwing their planes while others launched their airplanes at different angles above the horizontal. This diversity of launching techniques is supposed to resemble the different strategies used by different species to survive in their environment. Some airplanes made it into the center of the circle and some did not. The planes that made it “survived” and the ones that did not make it became “extinct.” The surviving airplanes were then thrown multiple times in order to “weed-out” the less fit species until only one species dominated. The teacher can then explain what strategies were the best in having their airplanes make it into the circle and what ones did not work. Other questions related to how a species’ number plays a role in surviving a disturbance may also be asked.

Nicole Bobian – Senior – Biology Major

COMPONENTS OF BLOOD

Objective: Students will identify the four components of blood and their relative amounts.

Materials:

- 1 clear container at least 1 Liter in size
- Candy red hots
- Corn syrup
- Small marshmallow or white jelly beans
- Candy sprinkles
- Stir stick

Procedure:

1. Explain the four components of blood.
   -Red blood cells (candy red hots): 44% of blood volume, 1 ½ cups
   -Plasma (corn syrup): 55% of blood volume, 2 cups
   -White blood cells (marshmallows): 0.5% of blood volume, small handful
   -Platelets (candy sprinkles): 0.5% of blood volume, 1 tablespoon
2. Measure and combine all four components and mix the candy "blood"
3. Optional: Dispense "blood" into small cups and pass out one cup to each student with spoons so that the students can eat the candy if they desire.

Jill Legualt – Senior – Biology Major

VANILLA, CHOCOLATE OR COLORS

Objective: To denature the milk solution to see how weak bounds between lipids and proteins break apart and travel all over the plate. This happens because the detergent denatures the bounds and the food coloring allows students to watch the proteins and lipids as they travel across the plate because they are no longer attached and happy. The liquid soap also works to destroy the surface tension of the milk because milk is a lot like water and has surface tension which would allow the food coloring to stay put, but when you denature it, it allows the food coloring to go all over the place helping to cause the color explosions.

Materials: milk (any type available will work)
food coloring
plate
liquid detergent
cotton swabs
elmo (for this demo, in classroom not really necessary)

Procedure:

1. Pour the milk into plate to cover the bottom
2. Add four drops of food coloring, each a different food coloring in the center, but not touching each other
3. Take cotton swab and add a drop of liquid detergent to the tip of one end, place in the center of the food coloring drops in the milk, watch the explosion of color
4. Continue to do this with different cotton swabs and detergent on the end in various places in the plate.

You may also use water in this experiment to see how that reacts to liquid detergent denaturing the water properties. Follow same procedure, just use water instead of milk.

Melissa Haag – Senior – Biology Major

SOLID WATER

Science Concept:
A polymer absorbs a large amount of water by the process called osmosis.

Materials:

two - 400 mL beakers
sodium polyacrylate (This same experiment may be performed by using the stuffing found in the seat of baby diapers as a replacement for the pure chemical)
table salt
water
food coloring
stirring rod

Directions:

1. Measure 300 mL of water in one of the 400 mL beakers.
2. Add a few drops of food coloring to the water.
3. Measure out 5 -7 grams of the sodium polyacrylate and pour into the other 400 mL beaker.
4. Pour the water quickly into the beaker containing the sodium polyacrylate from a height of about 12 inches with a lot of vigorous splashing. This is to ensure good mixing as stirring after the addition of the water does not work properly.
5. Turn the beaker upside down to demonstrate how it has become solid.
6. Measure out about 10 grams of table salt.
7. Pour the salt onto the solid water gel and stir until the mixture becomes a liquid again.
8. Pour the liquid back into the first beaker again to demonstrate that it is a liquid again.

Jacqueline Medford – Senior – Physics and Earth Sciences Major

CLOUD FORMATION

Procedure:

1. Remove the label from your cloud bottle and rinse it thoroughly. Do not use soap and do not dry the inside.
2. Add a small amount of very warm water to your cloud bottle. Replace the cap and shake it up so that water droplets are sticking to the inside of the bottle. Pour out the excess water.
3. Carefully light a match and drop it into the bottle. Shake it up so the match burns out. The smoke adds one of the key ingredients for cloud formation **dust**.
4. Immediately replace the cap and shake it back and forth 2-3 times. You now have the second ingredient **water**.
5. Using both hands, squeeze the center of your cloud bottle as hard as you can. Then, release both hands evenly and very quickly. You are now simulating the third ingredient **temperature and pressure changes**.
6. After several squeezes you should see a cloud that appears when you release your hands. If you don't see a cloud, try placing the bottle near a dark background for contrast.

Tips:

1. **Explanation:**
    - Clouds require key atmospheric ingredients to form.
        - water
        - dust particles
        - temperature or pressure changes
2. **Advanced:** Use a bicycle pump to change the pressure and see even more clouds. Watch Steve Spangler perform the cloud experiment live at a local news channel.
3. **Going further:** Try using other sizes of dust particles. Design an experiment to determine the best size of dust particles to use. You could also test different water temperatures. (These are things I'm still working on)

Materials:

- A clear plastic bottle with a screw on cap
- Matches
- Warm water

MALODOROUS BALLOONS – DIFFUSION THROUGH A MEMBRANE

Materials:

- Balloons, large, latex, various colors
- Flavor extracts, various — coconut, peppermint, vanilla, lemon, etc.
- Beral-type pipette, one for each extract
- String is optional for tying the balloon closed – you may choose to just tie a knot in the balloon

Nothing tricky here, this demonstration is quite simple. You want to deposit about 2 ml of a flavor extract into a balloon. Make sure you insert the pipette well into the inside of the balloon before squeezing the bulb and depositing the extract. If you get the extract on the outside of the balloon the demonstration is somewhat worthless. By using different colored balloons your students can easily reference that specific balloon when they comment about the smell. "The red balloon smelled like maple syrup, and the yellow balloon smelled like peppermint." Pass the balloons around and have students record the odor of each balloon and talk about how the smell gets out of the balloon.

The balloon is a selectively permeable membrane that allows passage of selected molecules. If molecules are small enough they will be able to pass through small holes in the balloon and into the air surrounding us or into the balloon if conditions are appropriate. The flavor extracts contain molecules small enough to diffuse through the balloon membrane and into the room. Eventually these molecules make their way to the olfactory receptors located in the superior part of the nasal cavity and these receptors send signals to the brain. Interestingly enough olfactory sensations are the only sensations that reach the cerebral cortex without first synapsing with the thalamus. Most people can recognize about 10,000 different odors.

Tips and tricks

Use latex verses Mylar balloons. Try blowing up the balloons a few times before you use them, the stretching seems to help the diffusion. You may want to fill one balloon up with nothing but air to act as a control.

THE LYNX AND THE HARE: PREDATOR – PREY – POPULATION GROWTH

(The source for this demo is the website at Flinn Scientific Inc. Publication Number 10109)
http://www.flinnsci.com/Documents/demoPDFs/Biology/BF10109.pdf
I have made minor modifications.

Materials: (for each group)

- Flat surface (about 4 square feet)
- Tape or ribbon (something to mark the area for the study)
- Prey (300 paper squares ~ 1 inch: snowshoe hares)
- Predator (1 cardboard square ~ 3 inch: Lynx)
- Population Data Table
- Graph paper

Procedure

1. Begin the simulation by populating the habitat with three hares—spatially dispersed within the square.
2. Establish a reasonable distance for the Lynx 'tosser' to stand from the square. Toss the cardboard lynx into the square in an effort to capture (i.e., land on any portion of) as many hares as possible. In order to survive and reproduce, the lynx must capture at least three hares when tossed. With the hare population at this stage, lynx survival is virtually impossible. Remove any hares captured and enter the tallies for the first generation.
3. The hare population doubles between generations—multiply *Hares Remaining* by two and enter the resulting number in the "Number of Hares" column for the second generation. Place the required number of hares in the square. If no lynx survived the previous generation another moves into the area. Toss the newly recruited lynx—repeating step 2. Remove any captured hares and enter the new tallies.
4. By generation 5 the lynx should be able to capture three hares when tossed. If successful, the lynx survives until the next generation and also produces offspring—(one per each three hares captured.) Toss the lynx square once for each lynx.
5. As the population builds it is important to separately tally each lynx's kills, removing captured hares after each lynx is tossed. Determine lynx survival and reproduction using individual lynx capture numbers. Remember, lynx produce one offspring for each three hares captured. If a lynx captures seven hares, three lynx enter the next generation—the original lynx and two offspring. Individual lynx capture numbers should be tallied on a separate sheet of paper and only totals entered in the table.
6. Between generations 9 and 11, the populations will probably crash back to, or near, zero. If and when this happens be sure to begin subsequent generations with at least three hares. Carry the simulation through 18–20 generations, by which time the cycle will be well on its way to repeating and the next few generations can be (relatively accurately) predicted.

Generation of Hares	Number of Hares	Number of Lynx	Hares Eaten (total)	Hares Remaining	Lynx Starved	Lynx Surviving	Lynx Offspring
1	3	1					
2							

Discussion

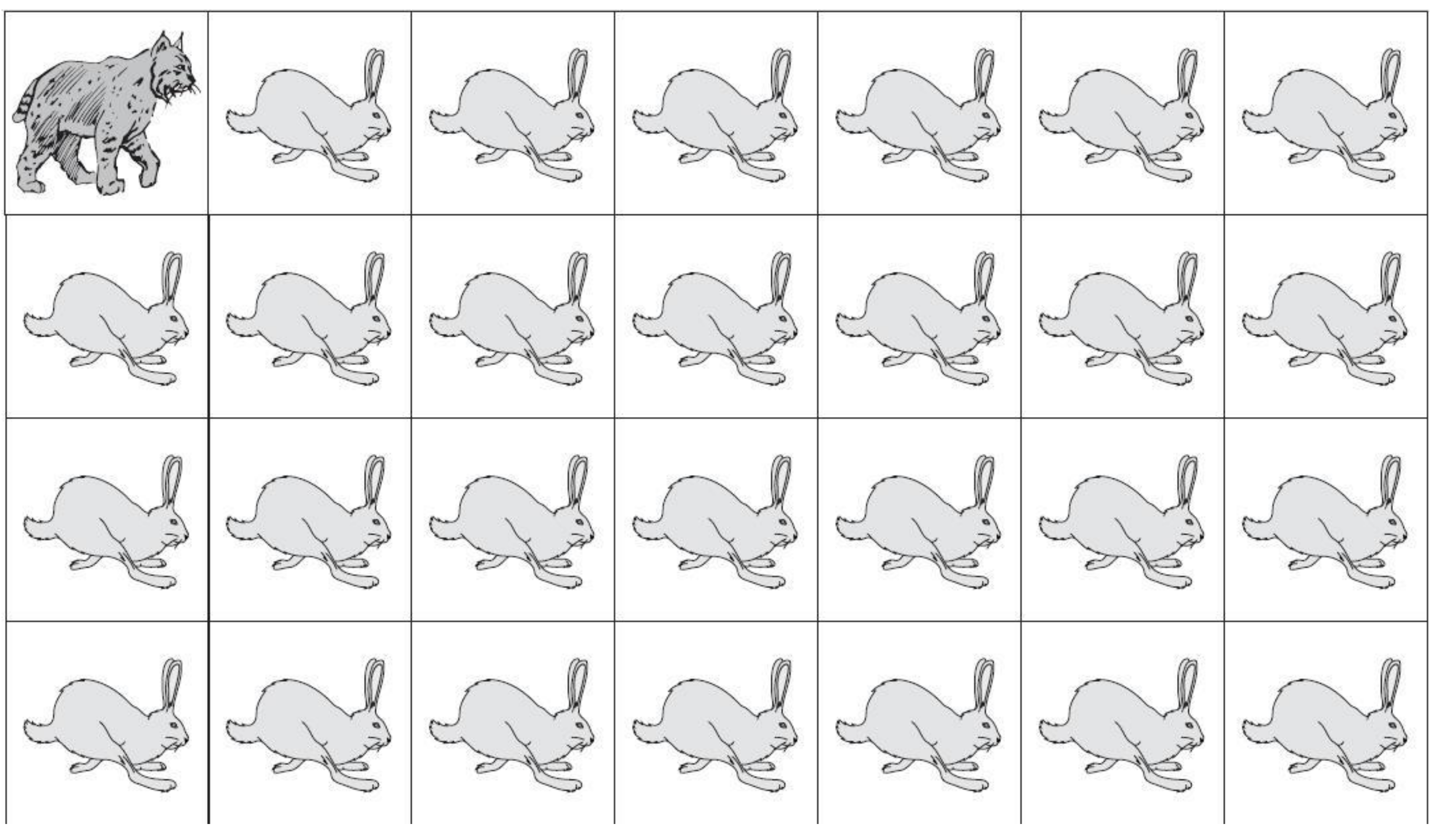
The data is best analyzed graphically. For each animal make a plot of population totals (the first two columns) versus generation number. By plotting the hare population and the lynx population side by side on the same graph, the relationship between the two becomes abundantly clear.

The most evident pattern is the near exponential initial increase in the prey (hare) population followed by a proportional increase in the predator (lynx) population. Students should note the lag time between the two populations. The predator population responds directly to fluctuations in the prey population—recovery follows recovery and crash follows crash.

Students should keep in mind that, as in any simulation (even sophisticated computer models), certain assumptions are made and many variables overlooked. Natural populations are subject to myriad pressures and disturbances such as immigration, emigration, overgrazing, disease, floods, droughts, fires, and extreme cold spells—to name a few. Many of these factors compound each other. Disease spreads more easily as population density increases. Hares intensively competing for food in overpopulated areas will be less able to resist droughts or freezes. The enormous complexity of a relatively simple system is mind-boggling.

If several groups are conducting the simulation, you may wish to introduce other variables. Disease or fire could reduce the hare population at any stage in the cycle. Human hunting or trapping activity could impact either population. Ask the students to imagine the outcome if the lynx were exterminated. Note the well-known impact on deer populations throughout North America—populations no longer regulated by natural predators. Studies have shown that natural predation pressure maintains the overall health and size of prey populations at optimal levels.

Graphics for the Lynx and snowshoe hares are below:



Sarah Groth- Senior-Biology Education

CELL MEMBRANES FROM EGGS:

Materials:

- Water
- Oil
- Egg
- 150-200 mLFlask
- Eye dropper
- Small dish

Procedure:

1. Explain to students that we are made up of cells and that I will be doing a demonstration about cell membranes. Explain what a cell membrane is.
2. Obtain your flask and add 100 mL of water to the flask.
3. Then add 25 mL of oil to the flask.
4. Shake and then let separate. Explain how a type of membrane is formed so that the water and oil can not mix. This is how a cell membrane works. The cell membrane keeps the outside environment out of the cell to protect it. Ask: If all cells are made from preexisting cells, how does a cell membrane split and multiply?
5. Then, crack open the egg and put it into a small dish.
6. Using an eye dropper suck out some of the yolk and squirt drops into the oil and water mixture.
7. Wait for the reaction of the egg and the surrounding water and oil to form cells. This will demonstrate how a cell membrane can split and multiply.

Discussion:

Ask: Why is it important for a cell to have a cell membrane? Students will learn from this demo that cells keep themselves together using cell membranes. Students will also learn about the importance of a cell membrane for the cell and how it replicates.

SMALL CELLS RULE!

Materials:

- 1 large potato
- Knife
- A dark colored food coloring (blue is best) or iodine
- 2 beakers

Procedure:

1. Take the large potato and cut it into 2 cubes. On cube will be 1 cm3 and the other should be about 3 cm3
2. Soak both cubes in the iodine or food coloring solution for 4-6 minutes. The iodine will react with the starch to form a dark blue color in the potato (the same thing will happen with the food coloring)
3. As the potato absorbs the solution, the color will travel further into the potato.
4. Remove the cubes after 4-6 minutes.
5. Cut both cubes in ½
6. Compare the traveling of the blue color (the smaller cube should be almost completely blue, while the larger cube should have a slightly white center.

Discussion:

This experiment will demonstrate why it is advantageous for cells to be small in size. Because volume increases at an exponential rate when surface area increases, smaller cells will have a greater surface-area-to-volume ratio. The smaller size allows the cell to absorb nutrients at a higher efficiency than larger cells.

Preston Stafford – Junior - Biology Major

MARTIN GARDNER'S HEXAPAWN FOR TEACHING EVOLUTION

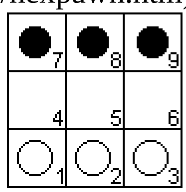
In a 1963 *Scientific American* article, Martin Gardner proposed the game of Hexapawn as a game that a simple machine could learn to play. Hexapawn is played with three white and three black pawns on a 3x3 square board. A player wins when either: one of their pawns reaches the other side or the other player has no legal move when their turn comes. The player who goes first in Hexapawn will always lose if she is playing against a knowledgeable player. Martin Gardner thought this was a game that could be learned by a very simple computing machine. There are now Hexapawn programs written in Basic, for the HP 41C calculator and the iPhone.

What I propose is a variation of what Mr. Gardner originally proposed: 24 index cards showing each of the possible positions and 24 containers. Each container contains a colored M&M for each of the possible "computer" moves.

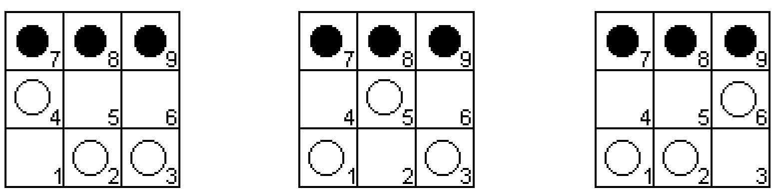
The rules are:

1. Each pawn can only move one square at a time
2. Capturing is done diagonally, just like in chess
3. You cannot move through a piece
4. If you can't move when your turn comes, you lose
5. If your piece reaches the other side of the board you win

Your first six boxes will look like this: (taken from http://www.hpmuseum.org/software/41td/hexpawn.htm)



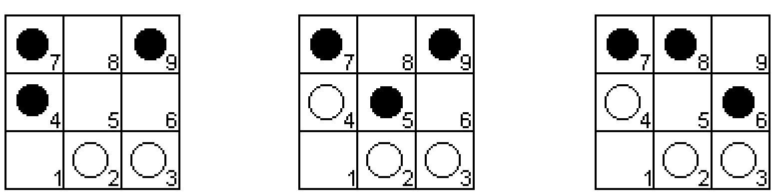
Leads to three possible positions after White's first move:



1 to 4 2 to 5 3 to 6

Let's say the human chooses the 1 to 4 position. The "computer" has three possible moves. Each move gets its own M&M. The student randomly chooses an M&M from the 1 to 4 container and makes the "computer" move to match the picture.

Red Blue Green



8 to 4 8 to 5 9 to 6

At first, the moves are simply random and the “computer” will lose most of the time. Every time the “computer” loses, the M&M for the last move the “computer” made gets eaten removing that choice from the available choices. Anytime the “computer” wins the M&M is put back into the container for that position.

It won’t be long before the computer wins all the time in accordance with Mr. Gardner’s prediction.

This can be used to teach the power of the Theory of Evolution. Random variation (picking the M&M) and selection (eating the M&M for the last unsuccessful move) allows the “computer” to evolve into an unbeatable opponent.

Misty Rains (Kintzley) - Post Graduate – Biology

ATP ENERGY JAR

Teaching the order of phosphorylation in the ATP/ADP cycle can be confusing, and students may struggle with the order of events. This example is a visual representation of when energy is lost and needed in the system

Materials:

- Jar with screw cap
- 4 strips of paper
- tape

1. Get a large jar with a screw top, such as a mayonnaise or canning jar.
2. Cut two strips of paper and fit them around the jar. Put a *P* on both of them.
3. Make a third strip of paper and fit it around the lid. Put another *P* on that strip.
4. Print the word *ENERGY* on a strip of paper and tape it so it hangs down the inside of the lid.

   This jar represents a molecule of ATP.
5. Remove the lid, and show how energy is released when a phosphate is removed.
6. Ask them what molecule remains, and they should say that it is ADP because of the two *P* s on the jar. When ADP is converted to ATP, a phosphate group is required, and it takes energy to phosphorylate the ATP.
7. Put the lid back on the jar, and show that the energy is now stored in the molecule.

Joyce Parrish - Senior - Biology Major

HOW THE LYTIC CYCLE AFFECTS NEIGHBORING CELLS?

Materials:

- Balloon
- Pin to pop the balloon
- Hole punch confetti

Procedure

- First put some hole punched paper (confetti) in the balloon
- Blow up the balloon
- Tell the students that each one of them is now a cell
- Go into the middle of the class and pop the balloon
- Ask the students how many of the cells are now effected

Explanation

This demo will emphasize why viruses are virulent. This will explain the lytic cycle of the viruses. When the cell lyses the viruses are expelled, free to affect other cells. So you can ask students surrounding the exploding balloon how many people (representing cells) are not infected by the virus.

MUSCLE CONTRACTION

Materials:

- Mousetrap

Procedure:

- Put the mouse trap together properly
- Explain that muscle contraction is like a mouse trap….all or nothing…set the mouse trap off, it goes all the way

Explanation

This demo will help explain the way muscle contraction works. It is either all or nothing, muscles don’t work halfway. They receive a signal and contract. They need ATP in order to release, just like when you have to reset the mousetrap. You can also explain rigor mortis at this point as well.

EVOLUTION MOUSE TRAP THEORY

Materials:

- Mousetrap

Procedure:

- Take the mousetrap apart piece by piece
- At each point, hold a class discussion about how the mousetrap is affected. Is it still functional? Can it be used for something else?

Explanation

Evolution is usually discredited by the theory that complex structures cannot be simplified. They sometimes use a mousetrap to prove this. If you remove one aspect of the mousetrap it is no longer functional. Well, it is no longer functional as a mousetrap, but it could be used for other things. For example, the bottom wooden part can be used for kindling wood. It’s no longer functioning as a mousetrap, but yet still functional as something totally different.

Jackie Paris – Senior Biology Major

Adaptations:

Opposable thumbs are one of the physical adaptations that humans have that most other animals do not have. Other animals move about in their environment smoothly without this adaptation, but how would humans do without thumbs? To simulate this in the classroom a roll of masking tape will be used to tape students hand so that they no longer have use of their thumbs. Have them make the number 4, so that they are placing their thumbs across the palm of their hands, making the tape wrap around the palm, about the level of the first knuckle, making sure to include the thumb. Enough pieces of a small candy in a wrapper, such as Starburst, Tootsie Rolls, Kisses for each student to have and small combs will be needed for each student. Once the students are tapped up, have them open the candy and comb their hair with only their 4 fingers. After a little bit of trying, tell them that they can use other tools, like their mouth and other body parts, but let them explore the other options without much direction. If they are feeling ambitious, have them untie and re-tie their shoes, again with no thumbs. After the activity talk with them about how they had to make modifications to do these everyday things that are typically very easy, because of thumbs. Ask if them if they think they would get better over time by practicing these activities with no thumbs?

Metabolism:

There is a good chance that there is a student in your class who is lactose intolerant or that they know someone who is. But do they really know what that means, and do they understand how this intolerance works? While going over metabolism, students commonly have a hard time picturing molecules breaking down because they have not seen this process or can relate it to something in their life. Here is the chance to prove that it really happens. To demonstrate this you will need a glass of room temperature milk in two test tube sized containers, two glucose test strips as well as Lactaid (or an equivalent product). With both containers of milk in front of you, place a glucose test strip into one of the test tubes to show that there is no glucose in the milk originally. Then, place Lactaid in the milk in the other test tube, letting it dissolve fully. Then, test this milk that has the Lactaid with the glucose test strip. The test strip will show a positive reading because there is no longer lactose in the milk, but rather its components due to metabolism. The Lactaid breaks down the lactose into galactose and glucose. People who are lactose intolerant do not have enough of the enzyme lactase, the primary component of Lactaid, in their small intestine to sufficiently break down this complex sugar on their own. The addition of Lactaid allows the lactose to be broken down so these more simply digested sugars are produced; therefore, individuals who are lactose intolerant can still consume food that contains lactose by taking products that are able to simulate what the digestive system is designed to do.

Kristen Hutchcraft – Junior Biology Major Nerve Demo

Introduction:

This demonstration shows just how sharp different sensations are and how our nerves react to those sensations. The brain uses a process called habituation to keep itself from overloading. Sharp sensations get the brains attention but everyday sensations do not get the brains attention.

Materials:

- Deck of Cards
- Pair of Socks

Procedure:

- Wear shorts or roll up your pants
- Take off shoes and socks Spend a few minutes building a card house
- Put back on the socks with your eyes closed, and try to locate the tips of your socks by pointing at them
- Keep your socks on and build the house again for awhile
- Now try to point to the tips of your socks

Discussion:

The first time that you put on the socks on it is a new sensation for your brain so it noticed the difference. The second time that you pointed to the socks your nerves were used to the sensation of the socks on. Thus, it was harder to locate the tips of the socks.

Safety:

- Don't fall off the chair trying to find your toes!

Food Webs and Chains

Introduction:

Food chains and webs are a part of every ecosystem. In this demonstration it shows how food webs and chains get tangled together and how they depend on each other. This will also show how the organisms depend on each other.

Materials:

- Scissors
- 50 1m lengths of string
- 50 arrow cut outs
- Animal and plant cut outs with holes punched

Procedure:

- Give the students a ziplock bag of the plants and animals, a string and arrows
- Take an organism out of the bag and create a food chain by linking the organisms together.
- Once the food chain is made let them put the arrows to follow the flow of the chain.
- Join the different chains together to make a web by putting the same organisms together and make new links
- Hold the web tight by each student
- Cut off a top predator to show the students what happen to the links. The rest of the food web will stay intact
- Then cut a primary producers are removed. Cut the links as the primary consumers die off all the others will die off.

Safety:

- Do not run with the scissors
- Recycle this experiment so you can use it for years to come

Cell Membranes from Eggs

Introduction:

In this demonstration a cell membrane will be formed by using an egg yoke. The membrane will capture either water, oil, or both. This way it will be easier to see the different cells.

Materials:

- Water
- Oil
- Egg
- Flask
- Eye dropper
- Small dish

Procedure:

- Add 100 mL of water to the flask
- Add 25 mL of oil to the flask Shake and then let separate
- Crack open the egg and put in a small dish
- Take the eye dropper and suck out some of the yoke squirt drops into the oil and water mixture.
- Wait for the reaction of the egg surrounding the water and oil to form cells

Discussion:

In this demonstration it will show how cell membranes can be formed. This demonstration should help students realize how cell membranes can split and multiply.

ATP Energy Release
Sara Robida

For this demonstration the teacher needs four blocks of wood sized so that they can be bound together with a regular rubber band. Three of the blocks should be labeled as “P”s, and the fourth should be labeled as an “A”. The A block and two P blocks should be bound together with glue, tape or rubber band in the following order: APP. The fourth block should be rubber banded to this complex next to the P. This assembly represents a molecule of ATP. When we discuss ATP as the energy source for cells, the students can have a hard time envisioning how the cleavage of a phosphate group releases energy. In this demonstration, we discuss ATP and then snip the outer rubber band, releasing one of the P blocks. The rubber band will fly off the assembly, its kinetic energy analogous to the energy released from ATP. This gives the students a visual reference of this process.ATP

Length of the GI Tract

my second demo is demonstrating the length of the GI tract. I will do this with a piece of rope that is 8.5 meters in length. Each section of the GI tract will be color coded to show how long each part is. I think that this will be more effective if i can get an anatomy model, either one that can be that shows theabdominal/thoracic area or even a skeleton. This was i can place the rope inside of the model and pull out each section one by one. Would you be able to get a model from the biology department?

Diffusion Demo

Cells use certain substances to carry on the activities that keep them alive. These substances enter through the cell membrane by a process called diffusion. Substances move from where they are more concentrated to where they are less concentrated. The cell membrane is semi permeable, which mean some things can pass freely back and forth due to their small size.

This lab demonstrates the idea of diffusion through a semi permeable membrane. The plastic bag is reprenting the membrane and the two substances are starch(a complex carbohydrate) and iodine(simple element).

The iodine moves freely through the plastic bag from an area of high concentration to an area of low concentration down the concentration gradiant. The changes in color represent the iodine diffusing into the starch. The starch is too large of a molecule to pass through the plastic bag and remains on the side of high concentration. The test tube is the control, the impermeable membrane that does not allow anything to pass through it.

Materials

3- Baby food jars or 250ml beaker
1- test tube
2- plastic bags
15ml of iodine
15ml of Starch solution
5ml pipet
2- Twist Tie

Procedure

Label the three jars A, B, C Put 5ml of iodine into jar A
Put 5ml of Starch solution into jar B Put 5ml of iodine into jar C
Put 5ml of iodine into one of the plastic bags and close the bags with the twist tie, make observations
Place the bag of iodine into jar B
Put 5ml of Starch solution into the second plastic bag and close it with the twist tie, make observations
Put the bag of starch solution into jar A
Put 5ml of Starch solution into the test tube and make observations
Place the test tube into jar C
Let stand overnight (Some reactions occur with in 2-3 hours)

Vanilla Balloon (Diffusion Demo)

Take a medium sized balloon and place 3ml or so of vanilla extract (Almond also works) intto he balloon and rub it around the interior of the balloon to coat as much of the inner surface as possible. Take a couple deep breaths and blow the balloon up. Tie it off. Allow the extract to begin to diffuse while you exaplain the principle of diffusion. Explain how the extract will move across the membrane of the balloon going from a high consentration to a low concentration of vanillin (the vanilla smelling particles of the extract) across the concentration gradiant. When you have finished your explaination of diffusion pass the balloon around and see if anyone can smell vanilla demonstrating that the vanillin has moved outside the inner membrane of the
balloon that it once coated in a high concentration.

Callender, Ashley M
Senior – Biology

Color of Osmosis

Materials Needed

One saucer, one clear cup, a rubber band, water, food coloring, and parchment paper.

Procedure:

Dissolve a teaspoon of salt into the cup of water that is completely full and cover it securely with the parchment paper and rubber band. Take the saucer and fill it up with water. Then place of few drops of food coloring in the saucer. Next place the cup with parchment paper in the saucer so that the cup is upside down. Wait to see the water in the cup change color.

Science Behind it:

The parchment paper is considered to be a permeable membrane. The colored water will flow through the membrane coloring the clear water in the glass.

Hayne, Margaret

Senior - Biology

Sock Cell Division (Mitosis)

Objective: To give a hands-on illustration of mitosis on a large scale. You can also do this as a group activity with your students and have them come up with different objects that represent each part of the cell.

Materials: Egg beater

Long thin strip of fabric
3 pairs of striped socks stuck together with a small piece of velcro
6 pieces of yarn about 1m in length
1 piece of yarn about 3m in length
Something to attach the yarn to that acts as centrioles
1 gallon size zip lock bag
6 rubber bands to attach the yarn to the socks

Procedure: Attach one end of the fabric to the beater and shrink (chromatin to chromosome).

Show one of the sock pairs and talk about chromosomes, sister chromatids, and centromeres.
Stripes on socks can be discussed as gene placement on chromosomes.
Show all pairs inside the ziplock (acting as nuclear envelope).
Take the three out of the ziplock (nuclear envelope dissolves) and attach them to the long piece of yarn attached to the wall/white board (line up on midplate).
Pull the yarn from the centriol and attach them to the socks (one to each sock- spindle fibers attach to chromatids).
Ask two volunteers to pull them apart (pulls chromatids apart into chromosomes).
Talk about cytokinesis.

Johnson, Kirsten
Senior – Biology

Bio-poison patrol: Liver Catalase reaction

Materials:
Goggles
Liver
(3) 150 mL beakers
Knife or scissors (to cut liver)
Glass stirring rod
Tray to catch mess
Forceps (to pick up liver)
Liver (cut into chunks about 3 cm x 3 cm)
1 bottle 3% or higher Hydrogen Peroxide (H_2O_2)
Lighter/matches
Wooden splint
Materials for extension:
Temperature: Thermometers, ice and boiling water
pH: Lemon juice, ammonia and pH paper

What I'm going to do: The possibility of life exists because of chemical reactions. Life would cease if reactions were too slow, which is why there are such things as catalysts. Catalysts speed up reactions by lowering the activation energy of the reaction, but are not altered or used up in the process. Enzymes, which are proteins, are a special form of catalyst found in living organisms. This piece of liver (hold it up) contains a high concentration of the enzyme Catalase. This beaker contains a substance poisonous to our bodies, hydrogen peroxide (H_2O^-).When I drop the liver in, what will happen? *The substrate is catalyzed producing bubbles and heat*. What are the products of this reaction? *Water, Oxygen and heat*. How could you test that oxygen is the gas being produced? *Glowing splint will relight in the presence of oxygen because of its flammability.* How can you be sure that the liquid left is water? *Test the pH of the liquid, and/or add a new piece of liver to see if any reaction occurs (there shouldn't be one).* Could a used piece of liver be used to catalyze another reaction? *Yes because the enzyme is not used up in the reaction.*

Extension: Testing the effect of temperature and pH
To determine whether or not temperature has an effect on Catalase activity place one piece of liver on the ice and one in the boiling water for five minutes. Then take the clean beakers and pour 50 mL of hydrogen peroxide (H_2O_2) in each. Take the liver from the package (control liver) and place it in the beaker, then place the liver from the ice in another beaker and the piece from the boiling water in the last beaker. Observe what happens. What happens to the reaction times when the body has a fever or gets too cold? To test whether pH has an effect on Catalase activity clean the beakers and place 10 mL of lemon juice in one with 40 mL of hydrogen peroxide (H_2O_2), plain hydrogen peroxide (H_2O_2) in the second and 10 mL of ammonia and 40 mL of hydrogen peroxide (H_2O_2) to the last beaker. Using the pH paper measure the pH of each beaker and record it on the board. Place three fresh pieces of liver in the three beakers and observe the reactions. At what pH does the Catalase (liver) react best with the substrate (H_2O_2)?

Heart Trouble

Materials: Quart container

Vinyl tubing

1ft section of tubing with an inside diameter of ½ inch

1ft section of tubing with and inside diameter of ¼ inch

2 Nylon barb adapters

½ inch x ¾ inch

¼ inch x ¾ inch

2 1000 mL beakers

Water

Red dye (food coloring, koolade, etc.)

Safety: Goggles

Lab coat to protect clothes from splash of red dye

What I'm going to do: Have an assistant plug the ends of the tubing then fill quart container with 1000 mL water dyed with red dye to look like blood. Explain that the larger diameter tubing represents a regular artery and the smaller diameter tubing represents an artery constricted due to stress or plaque buildup. Ask students what they think will happen? How much water will come from the larger tube, how much from the smaller? Ask assistant to place the ends of the tubes into the two separate beakers and release tubes. Colored water should flow out both ends. The smaller tube should fill less of its beaker than the large tube by about half. Ask students why this happens. Tell students that flow is inversely proportional to resistance so if resistance is greater (like in the smaller tubing) then flow will be less.

Follow up questions: After the demonstration ask the students:

What would happen to the heart of a person who has constricted vessels?

What other systems in the body would this effect?

Patton, John
Senior – Biology

Five Dollars Free! But there's a catch…

Procedure:

1) Find someone that would like to win five dollars
2) Hold out the bill and have the volunteer hold their thumb and forefinger "at the ready" just below the bottom of the bill.
3) Explain that if they anticipate the drop, they owe you five dollars.
4) Drop the bill for them to catch
5) Repeat to prove that they can not catch the bill
6) Explain that this time you will tell them when you are going to drop the bill with the word "Go." This may take one or two tries, but the volunteer will most likely catch the note.

Concepts: This demonstration is three-fold. One, it demonstrates the amount of time required for your eyes to send the message to your brain to send the message to your hand to grab the bill. Two, if the volunteer catches the bill with the auditory cue, it demonstrates the difference in reaction time when comparing visual to auditory cues. Three, it demonstrates the acceleration due to gravity.

Things to Consider: Make sure that your hands are dry so that the bill does not stick to your finger, but will fall freely.

Eye See a One-Eyed Human

Procedure:

1) Cut a hole in the middle of a piece of cardstock or paper
2) Have a volunteer hold the paper in front of their face with arms outstretched.
3) Tell the volunteer to slowly bring the paper closer to their face while focusing on an object through the hole.
4) Have the volunteer bring the paper to their face so that it is touching their nose.
5) Ask if the volunteer is looking through the paper with both eyes. (their answer will most likely be 'yes')
6) Show the volunteer to the students, proving that the hole in the paper is really only over one eye.

Concepts: This demonstrates that we all have a dominant eye, and though we believe that we are looking through both eyes to focus on an object, one eye is more dominant that the other.

he Vanilla Balloon

Materials: 1 balloon (medium to large sized)

Imitation Vanilla extract

Procedure: 1. Stretch the mouth of the balloon over the opening of the vanilla extract bottle and pour a little into the balloon, it just can be a quick inversion of the bottle.

2. Blow up the balloon and tie it off.

3. Pass the balloon around your classroom and ask your students if they can smell the vanilla through the outside of the balloon (they can).

Discussing this demonstration in your classroom:

This is a great representation of how to show that cells get their nutrients via a process called osmosis. When the balloon is blown up, it causes small gaps in between the rubber molecules of the balloon which allows the vanilla molecules to fit into the gaps of the rubber molecules. This allows someone to smell the vanilla on the outside of the balloon. The vanilla acts on the balloon the same way that osmosis works, a solvent passes through the semipermeable membrane of a cell solvent from an area of high solute concentration to low solute concentration.

Safety: No particular cautions are needed

Disposal: All of these materials may be put into the trash.

Source: Bill Nye the Science Guy

Voss, Ashley

Senior – Biology

Energy in Chemical Bonds

Objective: To show that molecules consist of smaller molecules (or atoms) bound together and that those bonds contain energy that is released when the bonds are broken.

Materials: Two wooden blocks, a heavy elastic band, scissors.

Procedure: Take two wooden blocks (same or different sizes) and connect them by wrapping the elastic band around them. Explain that this represents two molecules (blocks) being held together by a chemical bond (elastic band). The blocks may have names or symbols, such as ADP and P printed on them. Using the scissors, cut the elastic. The elastic will fly away from the blocks, showing the release of energy. The blocks now represent the two separate molecules.

<u>How viruses replicate</u>

Materials: Large round balloon
About 20 red raffle tickets
About 4 blue raffle tickets of a different color
Pin
Round yellow stickers, _"
Transparent tape

Preparation: Set aside one of the 20 red raffle tickets. Push all remaining raffle tickets (red and blue) into balloon. Blow up balloon, tie off end. Put a circle of tape on the back side of the set-aside raffle ticket. Have remaining materials at hand.

Presentation: Explain to class that many diseases are caused by viruses. Viruses are much smaller than the cells in our bodies, and they cannot make copies of themselves. They need to get our body cells to make copies for them.

If the balloon represents a body cell, the virus is much smaller, maybe the size of a raffle ticket (hold up balloon and ticket). In order to make copies of itself, the virus attaches itself to the outside of the cell (stick ticket onto balloon). Then the virus directs the cell to make copies of the virus (shake the balloon for dramatic effect, it is "making viruses.") Eventually there will be so many virus copies inside the cell that the cell will burst (using pin, pop balloon with flourish!) and virus copies will spread all over the place (the tickets should have blown all over).

Our bodies fight this by attaching antibodies to the viruses so the white blood cells can wipe them out. (Stick yellow round stickers onto the red raffle tickets to represent "antibodies".) But once in a while, when the virus is reproducing, it doesn’t make an exact copy of itself (hold up one of the blue tickets). Then the antibody for the original virus doesn’t recognize it, and it goes right past it, it lets the virus go. The new virus can make us sick again.

Source: Bill Nye the Science Guy, episode on "The Immune System."

Demonstrations by Erin Lively

Biology Major

#9. PHOTOSYNTHESIS AND RESPIRATION VISUAL FOR GRADES 6-8.

Materials small to medium cardboard box

small bag of sugar

small water bottle

red and blue balloons

lamp

pictures of a chloroplast and a mitochondria.

Method Stand the box on end with the bottom facing the students. Put all of the materials inside of it. Ask the students what the chloroplasts need to start photosynthesis. As they are named, pull out each on and place it next to the box. Then show how the water, carbon dioxide-red balloon, and light energy from the sun go into the chloroplasts/chlorophyll. Then, ask what the end products are. As they are named, pull out the sugar and the oxygen-blue balloon. For respiration, follow the reverse process.

Demonstrations by Paul Jaeger

Biology Major

#17. ENDOTHERMIC VS. EXOTHERMIC TEMPERATURES USING NON-CONTACT THERMOMETERS.

Materials: Madagascan Hissing Cockroach (Exothermic Specimen)

Human (Endothermic Specimen)

Non-Contact Thermometer (The one I used was obtained from Harbor Freight. Price about $20)

Procedure: This demo is a very good way to demonstrate, in tangible terms, that there is a difference between endothermic and exothermic organisms. I suggest using more than one species but for the time constraints of the event I chose only two. Organisms like reptiles, amphibians, and large arthropods are great examples of exotherms. (My pet cane toad for example worked great and didn't mind being scanned) Any mammal or bird will work for an endothermic species. First, get a reading from the surrounding area, a table works fine and record the reading, this will be your ambient temperature. Next take your friendly little roach and take his temperature, it should be very close but slightly above room temperature. Then scan the mammal, its temperature should be considerably above room temperature and the exotherm test subject. My results were as follows: Ambient room temp: 22.4C Exotherm: 23.4C Endotherm: 35.1C It would be interesting comparing various endothermic temperatures within each other to see the variances in core body temp and hypothesizing why that might be. I think that this simple demo has great potential to lead into many different avenues of discussion.

#20. WHAT'S A SELECTIVELY PERMEABLE MEMBRANE AND HOW DOES IT WORK?

Scientific Principles: Demonstrating the function of the selectively permeable membrane of cells.

Demonstrating how molecules move from high concentration to low concentration (diffusion).

Materials: One balloon

One shoebox with lid

Masking tape

Any type of extract (vanilla, cinnamon, mint, etc.)

Procedure: 1. Put 7-9 drops of extract in a balloon.

2. Blow up the balloon, and tie it off.

3. Have a student smell an empty shoebox and the balloon, and have them tell the class what it smells like (should smell like cardboard (shoebox) or latex (balloon) or nothing…)

4. Place the balloon containing the extract in the shoebox, and tape down the lid.

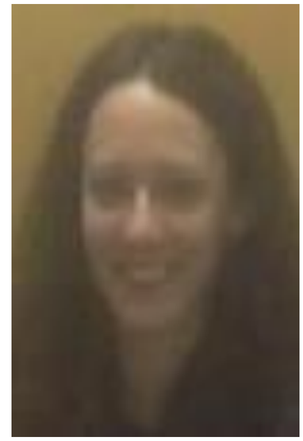
5. Throughout the class, have the same student, or random students come up and smell the inside of the box. Each time, the box should smell more and more like the extract.

When to use this:This model is a great way of showing how certain molecules can cross a selectively permeable membrane, and how some cannot. Also, it is a great demonstration of diffusion. The balloon has microscopic holes in it (selectively permeable just like the membrane of a cell). There is a high concentration of the extract within the balloon, but an extremely low concentration outside the balloon. So based on the fact that there is a high concentration inside, and a low concentration outside, the gaseous molecules of the extract are able to diffuse through the microscopic holes in the balloon, until it reaches equilibrium. So why is the smell getting through the balloon, but the balloon is still inflated (the air can't get through)? This is how the model demonstrates selective permeability. The molecules of the extract can move through the balloon's microscopic holes, because they are much smaller than the air molecules that are keeping the balloon inflated, just like certain molecules can get through the membrane of a cell, but others cannot.

Demonstration by Shannon Winter

Biology Major

#23. DOMINANCE AND RECESSIVNESS



Objective: To show by analogy the difference between dominant/recessive and codominant.

Materials**:** 6 small and 4 larger drinking glasses or beakers

Water

Red food coloring

Bleach

Yellow food coloring

Procedure**:** Fill two small glasses with water colored a deep red with food coloring. Fill two more small glasses with plain water. Point out three apparently empty larger glasses. (In the third of these, there should be 1 ml of bleach, put there before class). Tell the students that the red and clear waters represent genes. Now pour some of the red solution from each of the two glasses (parent genes) into the first large glass (F1 generation). The solution is still red, showing that the phenotype for two homozygous genes is the same as that of the parents. Repeat for the two glasses of clear water, showing that the phenotypes are still the same as that of the parents. Now pour simultaneously from both the red and clear glasses into the third glass (with the bleach). The resulting solution (heterozygous) will be clear showing the trait of only one parent. Ask the class which gene was dominant. Answer: The clear water. The second experiment involves two small glasses, one with red water and the other with yellow water. When the two are poured together into an empty larger glass, the result is an orange-colored solution. This represents codominance or blending inheritance in the F1 generation. Neither of the two genes (colors) was dominant over the other.

This demo can be found at: FIFTY-SIX QUICK DEMONSTRATIONS FOR BIOLOGY CLASSES

Richard Lord, Presque Isle High School

http://web.archive.org/web/19971023004508/http://nesen.unl.edu/methods/biodemo.html#demo17

#24. HIV SIMULATION

Materials: Clear Plastic Cups (small)

Starch in One or Two of the Cups

Water in All Cups

Sexual Behavior Cards

Iodine

Procedure:

Do NOT initially tell the students that this is an HIV simulation. Let their contractions of the virus be a surprise!

1. Give each student a cup and a sexual behavior card.

Sexual Behavior Cards:

Have "Sex" w/ as many persons as you can

Have "sex" w/ 2 persons

Have "sex" w/ only 1 person

Do NOT have "sex" w/ anyone

2. Put starch in two of the cups. These will be the HIV carriers. Give the students with the starch cups a sexual behavior card that says they will have sex w/ everyone they can talk into having sex. On ONE of those cards for the HIV carrier, write that they can only ACCEPT water when they mate. They are not allowed to pour their water into anyone else's cups. This will simulate a person who knows they have HIV and practices safe sex by using a condom. The other infected HIV carrier will not know they have HIV and will unknowingly infect others.

3. Allow students to socialize for about a minute or two. When students "have sex" they pour their liquid into each other's cups (unless otherwise specified).

4. Now TELL the students that two people where infected with HIV virus. Explain how one person knew they were a carrier (and used a condom), and the other person did not know they were a carrier. To test for HIV, use Iodine. A positive test will turn black.

The original demo can be found at: GeeWhiz Science!

From Mary Chambers, formerly a Science Teacher, Now a principle at Moore Middle School,

http://www.meigsmagnet.org/~franklint/geewhiz.html

Demonstrations by Tanner Linsacum

Biology Major

#25. STEEL ON FIRE

Materials: -Steel rod

-Steel wool

-Matches (flame source)

Procedure: Attempt to light the steel rod on fire. Following the failure to ignite the rod, attempt to light the steel wool.

Purpose: This is a quick activity to do when introducing surface area-to-volume ratio in cells. The smaller the cell, the greater surface area-to-volume ratio it has. All substances that enter or leave a cell must cross the cell's surface. If the ratio is too low, substances can not enter and leave at a quick enough rate to meet the cell's needs. Therefore, it's important that the cell remains small so that the surface area-to-volume ratio is large enough for the cell to survive. The steel wool demonstrates this. Because it's much smaller than the rod, the flame is exposed to a larger surface area and is able to ignite it. The rod is much larger and therefore has a smaller surface area-to-volume ratio. The flame is exposed to a much smaller surface area and therefore is unable to ignite it.

#28. SPREAD OF DISEASE

Scientific Principles: Disease spread, Acids and bases, Cleanliness, Health safety

Materials: Dixie Cups (one for each student)

Water

Ammonia and phenolphthalein (indicator)

or

Starch solution (water and cornstarch) and iodine (indicator)

Procedure: (There are two ways to do this depending upon the indicator)

Pair: “Ammonia with Phenolthaline” and “Starch with Iodine”

1. Fill all the cups with water.
2. Then depending upon the disease and its statistics (5 out of 100 people, etc.), add either the ammonia or the starch to the appropriate number of cups.
3. Have the students “share” cups by mixing the ingredients of their cup with one other person.
4. Repeat step 3 up to four times.
5. Then as the teacher come around with the “magic” solution, the indicator, and put a couple of drops into each cup.
6. If the student has contracted the disease their water should change colors, pink for ammonia and black for iodine.
7. I would recommend the starch and iodine pair, because ammonia has a smell to it, and the students are not dumb they will figure it out.

Demonstration by John Hoke

Biology Major

#30. Relating An Apple To The Livable Space for Terrestrial Organisms

Materials: Apple, Fruit peeler, Trash can

Procedure: 1) Assess prior knowledge by asking, "How much of the world is covered in water?"

2) Proceed to shave off two thirds of the apple leaving the remaining peel.

3) Grab a piece of the peel. Show To students and say this represents the relative thickness of the biosphere this apple.

This is a simple demonstration which can be used as an introduction to lecture on ecology.

Where the Dominos Roam"

Materials:

- Dominos
- Overhead projector or ELMO

Procedure and Explanation:

To demonstrate a density-dependent factor that effects a population such as a disease, you set up 20 dominos in close proximity to each other. Then, you “infect” one domino and when it falls into another domino it “infects” that one and so on. Then, you set it up again with only 10 dominos and spread them out more. The second time only 1 or 2 dominos should get “infected” showing how the higher density of a population increases the effects of disease in the population.

To demonstrate a density-independent factor that effects s population such as an earthquake, you set up the 20 dominos in close proximity to each other. Then, you simulate an earthquake by bumping or moving the overhead projector (hopefully all the dominos will fall.) Then, you set it up again with only 10 dominos and spread them out more. Once again, you simulate an earthquake by bumping or moving the overhead projector (hopefully once again knocking all the dominos down.) This shows that no matter how many organisms are in the population of a given area all will be affected by the earthquake and density does not increase the effect of the earthquake on the population.

When to use:

This is a great way to show the difference between density-dependent and density independent factors that effect populations in an ecology unit.

THE CELL MEMBRANE AND SURFACE AREA

M. Travis O'Hair - Biology

Purpose: To demonstrate how cell size is dictated by maimum surface area for reactions to occur.

Materials: 2 film cannisters, 1 tablet of Alka Seltzer, stop watch, water

Procedure:

1. Place enough water into the 2 film canisters so that they are about half full.
2. Take 1 Alka Seltzer tablet and cut it in half.
3. Leave one half of the tablet solid (not crushed) and crush the other half into small pieces.
4. Ask the students to make a prediction as to what they believe will happen when the two examples are placed into the cannisters. Why?
5. Have one student be in charge of timing this experiment with the stop watch.
6. Place both halves of the tablet into separate cannisters and replace the lids.
7. Time how long it takes for each half to blow the top off of the film cannisters.
8. Were the students correct? Discuss why or why not.

Principal involved: This demonstration highlights how cell size is dictated by a maximum suface area for reactions to occur. When done correctly, the cannister with the crushed Alka Seltzer should blow first because of a greater surface area.

ENZYME-SUBSTRATE ACTIVITY

Anna Beckman - Biology

Purpose: to demonstrate the effects of only one substrate for every enzyme

Materials: water, hydrogen peroxide, 2 clear jars or beakers, raw liver, knife to cut liver

Procedure: Fill one jar/beaker with an inch of water and the other container with about 3 inches of hydrogen peroxide. Cut a 1 inch cube of liver and place it in the water. Make observations. Cut a 1 inch cube of liver again and place it in the hydrogen peroxide. Make observations.

Science behind the demo: The liver in the water should not have any reactions. The liver in the hydrogen peroxide should have caused an off white foam to appear. This reaction demonstrates the break down of hydrogen peroxide. The enzyme catalase in liver will break down the substrate hydrogen peroxide.

CAPILLARY ACTION

Anna Beckman - Biology

Purpose: to show how capillary action allows plants to "drink"

Materials: celery stalks (fresh with leaves), food color, 2 clear jars or beakers, water

Procedure: Fill both containers half full of water. Place one celery stalk in one container and another celery stalk in the other container. Place about 10 drops of one food color in one of the containers and 10 drops of another color in the other container. Allow the stalks to sit overnight. Make observations.

Science behind the demo: Plants obtain water from their roots. In order for the water to reach the top of the plant, a force known as capillary action takes place to allow the water to travel upwards. After sitting overnight, each stalk should be changed to a different color as the water travels up the stalks.

APPLE DEMO

Ashley Parker - Biology

Materials

- Plastic or wood apple
- Real apple
- Picture of an apple
- Paper with the word apple written in red letters

The objective is to have the students learn and practice skills of observation.

Procedure

1. Take wood or plastic apple out of the bag and have the students write down everything they see.
2. Take the real apple out of a bag and have them write down what they see compared to the first apple.
3. Take the picture of the apple out and have them compare that apple to the previous two.
4. Next present the paper with the word apple written on it, and have them compare this to the previous three.
5. Discuss observations

The idea is that students will be able to tell differences between the apples. The reason a fake apple is used is to show students that what might look like one thing, under close examination, is actually something different. The page with the word apple written in red is more abstract in nature. It might be useful to discuss people who don't read English and ask if it would still be an apple.

This demo not only gives the students practice at observation, but also with comparing and contrasting. This would be great activity to do before going on a field trip where observations would be taken.

BOOK DEMO

Ashley Parker - Biology

Materials

- Book with pages cut (approx. in half) and randomly distributed

Procedure

1. Randomly distribute the pages to the students and have them read over the page they recieve.
2. Have the students tell you characters, places, thoughts and ideas that are on their page.
3. Write them down for the whole class to see.
4. After the majority has shared what is on their page, try to put a story line to it.

In science we never get to see the whole story. We merely have bits and pieces in random order. We are then required to try to put together the whole picture from what we know, and what we feel will happen.

Exothermic Almonds

Greg Dunn - Biology

Materials: One test tube with 50 mL of water in it, a thermometer, a ring stand or tin cup with a hole for the test tube, one almond rolled in ash and matches/lighter.

Procedure: Tell the audience that the water is room temperature and that only by introducing some outside source of heat can it change temperature. Our fuel will be one single almond and if we know that 1 mL of water is warmed by 1˚ C then we can infer that the almond has released 1 calorie. (our dietary calorie is equal to 1,000 calories).

Science: The energy that we consume is burned off in our cells just as it is seen in the demonstration, organisms require slower more controlled burning than what is observed but the bond energy is still the source of the energy in both.

Iron in Cereal **Jayne Shumaker**

Procedure: Place the entire box of Total cereal into a large bowl.
Use your hands to crush the flakes to pin-head
size pieces. Add water and stir for 15-20
minutes.
Continue adding water as necessary to ensure the mixture is thin
and soupy. Tape a small magnet on the end of the glass rod.
Stir the cereal soup with the magnet for several minutes.
Small pieces of iron will collect on the magnet.

Explanations: The human body needs iron to carry oxygen throughout the body. The iron in the cereal
is pure iron. The very small particles react with hydrochloric acid in the digestive system
to be easily absorbed by the body.

The Diaphragm and the Lungs **Guinevere Kulyan**

Materials: clear twenty-ounce bottle (old soda or water bottles work well), three large balloons, rubber band, scissors, y-valve (such as would be used to split a hose), clay or play-dough, straw.

Procedure: A common misconception students have is that the lungs themselves are what cause air to

enter them when we breathe. To show students the importance of the diaphragm you can build a simple lung model. Use the scissors to cut the bottom off of the bottle. Using clay, mount the straw into one branch of the y-valve so that air can still move through the y-valve into the straw and visa-versa. Place one balloon over the end of each of the remaining branches of the y-valve. Use clay to mount the y- valve and straw in the bottle so that the straw is coming out of the mouth of the bottle. Be sure to use enough clay so that the y-valve is secure and so that air will only leave or enter the bottle through the straw at that end. Tie the end of the third balloon in a knot and cut the top of the balloon off. Make sure that the other balloons are flat. Place the last balloon over the large open end of the bottle and secure with a rubber band. When you pull on the knot of the final balloon, the balloons inside the bottle should inflate. (Note: This is difficult to see, but if you watch closely the balloons should inflate slightly. Also, this is possible to do with better results using a two-liter bottle, provided you can find a balloon large enough to fit around the end).

Living or not? **Sarah Bieber**

Place a petri dish of water on an overhead projector, then ask the student to help you determine whether your new play toy is alive or not. You place a box over the petri dish and drop your 'critter' in. Then you remove the box and let the student watch the critter 'swim' around the dish. You may do this several times, having them write down whether or not they think it is alive and why they made that decision. Then discuss the qualities of life with the class.

The critter is made by dropping a drop of DuCo Cement into the water. It should have a head and possibly a long flagella-like tail, which helps with the illusion of life.

Proof of Stomata **Danny Quinn**

Purpose: To prove that there are stomata on leaves

Materials: Glass soda bottle (plastic will not work), ivy leaf and stem, clay, straw, pencil

Procedure: Fill the bottle to near the top with water. Wrap the clay around the stem of the leaf. Place the stem into the bottle. The end of the stem must be below the surface of the water. Cover the mouth of the bottle with the clay. Push the pencil through the clay to make an opening for the straw. Insert the straw so that its opening is in the air space in the bottle. Squeeze the clay around the straw. Suck the air out of the bottle through the straw. If there is a good seal air bubbles will come out of the stem of the leaf into the water.

Leaf Straw **Danny Quinn**

Purpose: To demonstrate the purpose of stomatas on a leaf

Materials: Glass soda bottle, leaf and stem, clay, straw, pencil, mirror.

Procedure: Cut the stem in half lengthwise from the bottom to about halfway up toward the flower. Pour about .5 cups of water into each glass. Add enough food coloring to make the water in each glass a deep color, one red and one blue. Place one end of the flower into each glass. Leave the flower standing on the water for 48 hours

Results: The flower will turn half red and half blue

Why? Small tubes, xylem, run up the stalk to the flower. This is the mechanism that carries nutrients to the rest of the plant.

3. Food Calories: - Ethan Emery

Food Calories:

-Place 25 ml of water (25 g) in a small beaker and measure the temperature in degrees Celsius.
-Measure the mass of a high fat nut (Brazil nuts, cashews and even peanuts work well).
-Stick a long pin through a cork and place the nut on the point of the pin.
-Ignite the nut. This may take a couple of tries.
-Hold the beaker above the burning nut so that the flame will heat the water.
-When the flame goes out, measure the final temperature of the water.
-Use the data to calculate the number of food calories in the nut.

Food calories = (mass of H_2O in grams X change in temperature) / 1000

-Find the accepted value for the calories of your type of nut and compare the experimental value to the theoretical value.

This demonstration can be performed will less formal apparatus if necessary. A pop can with the lid cut off will transmit the heat better than the glass beaker. The thermometer can be dispensed with if ice is melted rather than water heated. Fill the can about half full of ice. Hold the can over the burning nut and melt the ice. When the ice goes out, measure the volume in mL or water produced (ice melted). Since it takes 80 calories to melt 1 mL of ice, the number of food calories can easily be calculated.

Food calories = (0 X volume of ice that melted in mL) / 1000

4. Osmosis and Eggs - Laura Sanches

Take regular eggs that you can buy at the store. Cover them with vinegar until the whole egg is covered. Let this sit for at least 24 hours. It really works well after 48 hours. This will allow the shell to come right off. In case the shell is hard to get off, hold it under running water while rubbing. Be very gentle because it is easy to break the egg.

Put the eggs into different solutions to show movement across a membrane (osmosis) and observe the results. It is a good idea to keep the eggs in the solution for 24 hours to have best results. This is a good demo to explain hypotonic and hypertonic. Two solutions that are good to use are water (regular tap water works fine) and corn syrup (a strong brine solution should also work). The egg will become hypotonic after it has been in water (water will have moved into the egg), and corn syrup works well to show hypertonic (water moving out of the egg). Other solutions would work also, and I suggest playing around with it for a while to see what else would work.

Jeremy Newman

1. OIL SLICK

Purpose- This demonstration is a designed to stimulate student's thinking on humans' ecological impact on the environment. It illustrates how an oil spill may not be able to be completely cleaned up. The oil disturbs the barb's ability to hold the feather together. Even when the oil is cleaned off, barbs do not return to their normal state.

Materials- 1-2 long feathers, motor oil,1 wide beaker, water, soap

Action- The feather is shown to the class. Be sure to show the way the barbs hold the feather together. Dip the feather into a beaker 2/3 full of water. Show that the feather still holds its integrity. Then pour approx. 1 cm of oil on top of the water. Dip the oil into the oil/water mixture. Show that the barbs do not hold the feather together anymore. Wash the feather with soap and water. Then check to see if the barbs hold together. (they shouldn't)

Questions- Teachers can ask about other affects that an oil spill has on an ecosystem. Are there any ways to prevent human caused disasters? Can students take any action in their communities.

Jeremy Newman

2. FIELD CAPACITY

Purpose- This demonstration is to show how different textures of soil can hold different amounts of water. Soil texture directly affects what can grow on top of it.

Materials 2-3 different soil textures (dry), Pots for each soil texture (with holes in bottom, Water, 1 liter flask.

Action- Each soil is put into a separate pot and lightly packed down. Water is slowly poured over each of the soils. When the water runs through the bottom, stop immediately. Measure the amount of water that was added to each sample.

Questions- Teachers can ask about the relation of surface area to texture. What do students think can grow on each of the soils? What type of soil is in their areas? Discussion can also lead to the affects of "Fat Clays" such as betonite on the foundations of houses.

THE NATURE OF BONES

The objective behind this demo is to help students understand that it is the combination of soft connective tissue and mineral matrix that allow bones to function so well in support and movement.

Materials: Vinegar, Jar, Chicken or turkey bones (cleaned), Bar-b-Que. grill

What to do: Place some of the bone in the jar and cover with vinegar. Let the mixture sit for about one week. This will remove the minerals from the bones and leave only the soft connective tissues.

The remaining bones place on the grill and bake until they are blackened. The high temperature cooking will denature the soft connective tissue and leave only the mineral matrix. Or if you are daring burn the bone in front of the students, in well ventilated area.

What happens: The demonstration on bones starts with a general questioning of what bones are made of, and their function in the body. An intact bone can be used with the question/group discussion on the nature of bones. Then remove one of the demineralized bones and ask why the bone bends so much, and ask the possible causes of this flexible bone. The next step is the crumble one of the burnt bones. You can pass around the bits and ask the texture of the bits. Then ask the possible cause of this change in the bone.

ENZYME ACTIVITY

Purpose: Allows student to see an enzyme working

Grade Level: 9-12

Colorado Standard: 3.0 (3.2, 3.3)

Materials: potato (or liver), hydrogen peroxide, test tube

Directions: Fill a test tube about 3cm with hydrogen peroxide

Add 1cc of macerated potato or liver

The students should see bubbling.

Why? (science behind the experiment) Because an enzyme in the potato catalyzes the breakdown of the hydrogen peroxide, producing bubbles. The hydrogen peroxide breaks down to water and oxygen.

Supplemental Activity: To prove that the gas is really oxygen an indicator can be used. A smoldering piece of wood will also work. Put the end, which is still smoldering in the top of the test tube. The flame should reignite.

This demonstration would be useful in a lecture about enzymes. Specifically what they are, what they do, denaturation, and shape.

Safety: If you decide to use a flame to test for oxygen gas, make sure you have a fire extinguisher present.

Jennie A. Lundgren

THE IMPORTANCE OF CEREBROSPINAL FLUID TO THE HUMAN BRAIN!

Purpose: To demonstrate the importance of Cerebrospinal fluid to the human brain.

Grade Level: This demonstration is applicable for second grade through twelfth grade. Because this activity can be used to spawn many discussions and topics about the human brain from simple to complex it can be used in all of these grade levels and many different classes. It would fit easily into human biology, physical education, health, and family living classes.

Colorado Model Content Standard for Science Applicability: Standard 3.3 "Students know and understand how the human body functions, factors that influence its structures and functions, and how these structures and functions compare with those of other organisms." Is directly addressed in this demonstration since this demonstration directly shows how important cerebrospinal fluid is to the brain.

Materials: unbroken raw eggs, a clear plastic or glass container that will hold approximately 2-3 cups of liquid with a lid that will not leak when the container is shaken with liquid in it (a jar or Tupperware), a pitcher with tap water in it

Directions:

1. Have available a number of unbroken raw eggs, the container with lid, and a pitcher with water in it.
2. Explain to the students that the egg is representative of the human brain, the container with the lid is representative of the skull, and the water is representative of the cerebrospinal fluid which surrounds the human brain.
3. Place one unbroken raw egg carefully into the container.
4. Pour the water from the pitcher into the container. Be careful not to break the egg. Fill the container to the brim with water (This is important! You do not want air bubbles after you put the lid on)
5. Ask the students to note how the egg rises as you pour in water. And how it seems to be lighter when supported by the water.
6. Place the lid on the container and seal it. Make sure the lid is secure.
7. Shake the container with the egg and water in it. Ask your students to note how the egg fared from the shaking.

Optional:

1. Shake the container with the egg in it but no water as a contrast to shaking it when full of water.
2. Show how the amount of water in the container affects the cracking of the egg by pouring some out or adding more which would increase the pressure on the egg.
2. If it is a non-breakable container with a secure lid, drop the container with the

egg to show how a sudden impact might affect the brain differently than shaking.

3. Shake the container with the egg and water in it for different amounts of time to see how the egg/human brain fares after certain time period.

Note:

A. The egg will almost always break if shaken long enough.

B. Before performing this experiment try it out with the container you plan to use.

Safety: Precautions must be taken so that if the egg does break students do not ingest the raw egg purposefully or accidentally by touching it and then touching their mouths. The water should be kept off of the floor or promptly wiped up so no falling accidents will occur. Lastly, if the container (glass) should break the demonstrator should quickly and safely clean up the broken glass without student intervention.

Science: In an adult human skull there is at any one time 125-150 ml of cerebrospinal fluid and 150-180 mm water pressure. Four hundred to 500 ml of cerebrospinal fluid are produced daily since the fluid constantly leaves the brain with waste products. The cerebrospinal fluid of the human brain has four purposes; To distribute hormones to the appropriate part of the brain, to wash the brain and excrete the waste products, to buoy the brain up, and lastly to protect the brain. This demonstration deals mainly with the last two purposes, buoying the brain and protection.

Step 5 illustrates the buoying effect. The human brain weighs 1300 g, however with the support of the cerebrospinal fluid its weight is reduced to 50 g.

The next purpose demonstrated is the protection that cerebrospinal gives the brain as represented by the water and egg. This is especially effective if option A. is also demonstrated. However, the cerebrospinal fluid cushions our brains through our daily movements, even such rough times as riding a roller coaster or jumping up and down. If a violent hit or thrash occurs the cerebrospinal fluid will offer no protection and the brain will hit the skull and result in a concussion. A concussion bruises the brain and a large enough bruise or bruises can cause death or serious brain damage. Thus it makes sense to protect our head in risky situations by wearing a helmet which adds another layer of cushioning.

The shaking of the egg in step 7 and option D. directly shows the affect on the brain of an infant who has been shaken. A baby who has been shaken is said to have Shaken Baby Syndrome which can cause brain damage leading to mental retardation, speech and learning disabilities, paralysis, seizures, hearing loss, or death. There are approximately 50,000 cases yearly of Shaken Baby Syndrome in the United States. Because a baby’s brain is underdeveloped a concussion occurs easier and with more serious consequences than an adult concussion. The undeveloped blood vessels on the outside of the brain are also very likely to tear which in turn causes blood to pool in the skull.

One concept, which is demonstrated in option B, is the accumulation of cerebrospinal fluid in the skull resulting in additional pressure on the brain. This congenital disease is called Hydrocephalus. Normally cerebrospinal fluid is absorbed into the bloodstream in a one way direction away from the skull. In persons with hydrocephalus the fluid is not absorbed and accumulates, thus building up pressure in the skull. There are many causes of it including; spinal bifida, hemorrhage, meningitis, head trauma, tumors and cysts. It can be treated by a one way shunt which directs excess cerebrospinal fluid into the abdomen on heart chamber where it is absorbed with no problem. Untreated, hydrocephalus can cause physical, developmental and visual disabilities.

Sources: Silvia Helena Cardosa, PhD; Center for Biomedical Informatics; State Universtiy of Campinas, Brazil

Hydrocephalus Association; 8707 Market Street, Suite 955;San Francisco, CA 94102; (415) 732-7040

Shaken Baby Fact Sheet;http://www.biausa.org/shakenbaby.htm

Sports & Concussion Safety: http://www.biausa.org/sportsfs.htm

Suzanna Percy

17. IS SAMMY ALIVE?

Objective: Students will understand the scientific definition and the characteristics of life; moreover, they may explore characteristics of a quality life.

Materials: The Sammy Story; An open, exploring, inquisitive mind

Procedure:

1. Begin reading the "Is Sammy Alive?" story.
2. Whenever the story asks "Is Sammy Alive?" stop and ask the students their opinion. Students should be able to justify their answers.
3. At the end of the story, discuss Life based on the science definition.

The Stage

Sammy was a normal, healthy boy. There was nothing in his life to indicate that he was anything different from anyone else. When he completed high school, he obtained a job in a factory, operating a machine press. On this job he had an accident and lost his hand. It was replaced with an artificial hand that looked and operated almost like a real one.

Is Sammy Alive?

Soon afterward, Sammy developed a severe intestinal difficulty, and a large portion of his lower intestine had to be removed. It was replaced with an elastic silicon tube.

Is Sammy Alive?

Everything looked good for Sammy until he was involved in a serious car accident. Both of his legs and his good arm were crushed and had to be amputated. He also lost an ear. Artificial legs enabled Sammy to walk again, and an artificial arm replaced the real arm. Plastic surgery enabled doctors to rebuild the ear.

Is Sammy Alive?

Over the next several years, Sammy was plagued with internal disorders. First, he had to have an operation to remove his aorta and replace it with a synthetic vessel. Next, he developed a kidney malfunction, and the only way he could survive was to use a kidney dialysis machine (no donor was found for a kidney transplant). Later, his digestive system became cancerous and was removed. He received nourishment intravenously. Finally, his heart failed. Luckily for Sammy, a donor heart was available, and he had a heart transplant.

Is Sammy Alive?

It was now obvious that Sammy had become a medical phenomenon. He had artificial limbs, nourishment was supplied to him through his veins; therefore he had no solid wastes. All waste material was removed by the kidney dialysis machine. The heart that pumped his blood to carry oxygen and food to his cells was not his original heart. But Sammy's transplanted heart began to fail. He was immediately placed on a heart-lung machine. This supplied oxygen and removed carbon dioxide from his blood, and it circulated blood through his body.

Is Sammy Alive?

The doctors consulted bioengineers about Sammy. Because almost all of his life sustaining functions were being carried on by machine, it might be possible to compress all of these machines into one mobile unit, which would be controlled by electrical impulses from Sammy's brain. This unit would be equipped with mechanical arms to enable him to perform manipulative tasks. A mechanism to create a flow of air over his vocal cords might enable him to speak. To do all this, they would have to amputate at the neck and attach his head to the machine, which would then supply all nutrients to his brain. Sammy consented, and the operation was successfully performed.

Is Sammy Alive?

Sammy functioned well for a few years. However, a slow deterioration of his brain cells was observed and was diagnosed as terminal. So the medical team that had developed around Sammy began to program his brain. A miniature computer was developed: it could be housed in a machine that was humanlike in appearance, movement, and mannerisms. As the computer was installed, Sammy's brain cells completely deteriorated. Sammy was once again able to leave the hospital with complete assurance that he would not return with biological illness.

Is Sammy Alive?

The End

If Sammy is not alive at the story's end, exactly when did Sammy stop being alive?

Questions:

1. What are the characteristics of life?
2. Does life entail a quality life?
3. Is there a difference between living and life?

Standard: 3. 1: Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment.

Works Cited Biology Class Demonstrations:
http://pc65.frontier.osrhe.edu/hs/science/demobio.htm

Suzanna Percy

18. SPREAD OF DISEASE

Objective: The students will understand and conceptualize how disease can rapidly spread through a population in epidemic form, and they will know key terminology about this issue: carrier, symptoms, pathogen, STD, and transmission.

Introduction: A disease spreads most rapidly and dangerously when a carrier, someone who can spread the disease, has yet to show symptoms of the disease and makes a few contacts. This lab will demonstrate how fast disease can spread with just a few contacts, or transmissions. By keeping track of the contacts, the original carrier can be identified through an elimination process.

Materials: Clear cups (# in class), Distilled Water, I% NAOH, phenolphthalein, pipette for indicator

Procedure:

1 . A population is started by each student acquiring a 1/4cup of distilled water (already filled). One person is infected; their cup contains the 1% NAOH.

2. Sexual contact is determined by combining the solutions into one cup. After the cups are mixed, each partner takes 1/2 the solution back. Each person will leave the contact with the same amount of fluid.

3. Only a few contacts are needed (3) for the point to be made. The teacher is encouraged to do the experiment several times with differing contact numbers.

4. When done, everyone will add 3 drops of indicator.

5. If your cup turns pink, you have been infected.

**This demonstration shows vast spread of disease in minimal contacts.

Be Aware: · NAOH can cause skin bums; a highly diluted solution is all you need.

· If the pH rises above pH IO, phenolphthalein will not indicate a basic solution (turn pink).

Questions: 1. How does this demonstration show the impact of disease carriers and the dormancy of certain diseases?

2. How can epidemics effect society?

3. How can a society's values and culture effect epidemics?

Standard: **3. 1:** Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment.

Tara Moore

19. BALLOON LUNG

Topic Area: Human Respiratory System

Purpose: To show students how volume and air pressure play a role in the inflation and deflation of the lungs (breathing)

Grade Level: Introductory Biology Class (freshman) or Human Anatomy and Physiology (sophomore-senior)

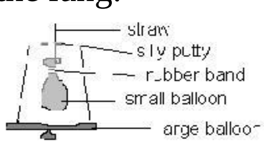
Standards Covered: Standard 3.3---introduces the idea of how the human body functions and the factors involved

Materials: plastic cup, 1 small balloon, 1 large balloon, straw, silly putty, rubber band

Directions

1. Cut a hole the size of a straw in the bottom of the plastic cup
2. Cut the straw in half and insert into the hole in the cup about half way
3. Slip the small balloon over the end of the straw within the plastic cup
4. Put a rubber band around the end of the balloon to hold it snug to the straw
5. Cut the large balloon in half and stretch the tied end around the open end of the cup
6. Mold an ample amount of silly putty around the straw to seal all holes around the plastic cup
7. To make work, pull down on the balloon attached to the bottom of the cup and watch the inner balloon fill with air
8. Return the bottom balloon to original position and watch the inner balloon deflate

Science behind what is happening: The large balloon in this demonstration is used as the diaphragm. When the diaphragm is pushed downward, it creates a pressure gradient. The volume increases in the lung cavity (cup) causing less pressure in the cavity compared to the atmospheric pressure. This gradient causes air to rush in through the straw (trachea) and inflate the lung (small balloon). When the diaphragm returns to its original position the opposite happens. Volume decreases in the lung cavity causing more pressure in the lung than there is outside (atmospheric pressure). Finally, air rushes out of the lung (exhalation) and deflates the lung.



Erinn Boyle

20. FERMENTATION TUBE

Materials: Test tube ,Test tube rack, Bent glass tube, Rubber stopper with hole, Yeast, Glucose solution, Food coloring

Purpose This experiment is a visual that can really help students to better comprehend fermentation and basic cell- physiology. It utilizes materials found in every science class room and is a simple and rapid experiment. The CO_2 produced by the yeast as a bi-product of fermentation will force the drop of food coloring to move outward and eventually out of the bent glass tube because the environment with the closed tube has a greater concentration of the gas than the outside. This can also be a demonstration of movement of free energy. High School level.

Directions

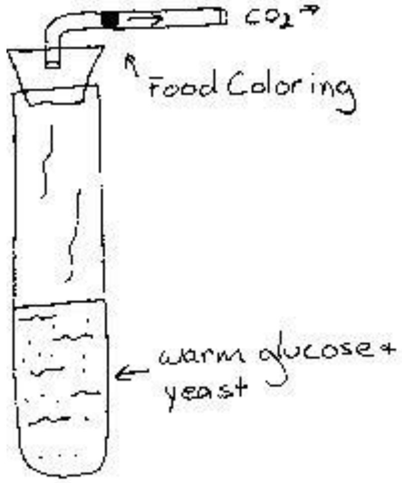
1. Put test tube in test tube rack
2. Warm glucose solution to about 40^0 Celsius
3. Put glucose in test tube
4. Add yeast to glucose solution
5. Mix the yeast/glucose mixture
6. Put the rubber cap with the bent glass rod on top of the test tube
7. Add a drop of food coloring to the tip of the bent glass tube and let it run back to near the rubber cap
8. Watch as the CO2 pushes the food coloring out of the tube

Safety Issues This is really not a toxic lab. The food coloring can stain skin and clothes, so watch out for that. Also, don't ever put a rubber lid without a hole on top of the tube with the fermenting ingredients. This could cause an explosion.

Something Went Wrong? One area where it is easy to go wrong is the temperature of the water. The closer the temperature to the ideal for the enzymes involved, the faster the reaction will proceed. This is also a good lesson in rate of reaction if you vary the temperature of the glucose solution.

Another area is age of yeast. If your yeast has been in the cupboard too long, this experiment may not work at all.

One more idea is that this reaction occurs in a fairly short period of time. All parts must be completed in rapid succession.



Erinn Boyle

21. FERMENTATION BREAD

Materials: ¾ T Yeast, 2-3 C Flour, ½ T Table Sugar, 1 C Warm Water, Mixing Bowl, Large Sandwich Bag, 1 T Olive Oil,
OPTIONAL: Oven, Tomato Sauce, Mushrooms, Mozzarella Cheese, Pepperoni

Purpose: This is a great visual for teachers who are trying to get students to understand fermentation and what occurs. It is not a scientific, completely revealing lab, but it is a great visual lab that shows students what happens to bread as yeast divide and release CO2. It is also fun, because if you have a home economics room or any room with an oven of any kind, you can continue the lab and make pizza for all. It could be a reward that begins a new unit on cell physiology for good performance in a previous unit

Level This lab can be performed by students of any level from about 6th grade on. It is a fun lab that allows students to learn about science through association.

Directions

1. Mix warm water with table sugar until it dissolves.
2. Add yeast to mixture and mix
3. Wait 5 minutes for the yeast to begin fermentation
4. Add all other ingredients to mixture and kneed the bread for 5 minutes. (this is very active—students like the physical nature of this part).
5. Ask students to describe the bread (measure it and roughly figure out area and tell about consistency)
6. Put bread into plastic bag and place it underneath the bowl you used for mixing
7. Wait 30 minutes (in the mean-time you could ask students, depending on their level, about their expectations and how they formed their expectations. A short lecture on fermentation could be useful as well
8. Take bread out from underneath bowl and ask students to again make observations about the bread and the changes it went through. Ask them why they think it changed.
9. (optional) Roll out bread as pizza and add toppings.
10. Bake at 425^0 F If possible, have students make observations through the oven door window (DON'T open door!) and have them make observations of what happens to bread.
11. EAT! While consuming, ask students why the bread stopped rising in the oven. This can begin discussion of enzymes…etc.

Something Went Wrong?

1. The bag should be sealed…as little oxygen as possible should be in the environment in order for the bread to rise.
2. Old yeast?
3. Warm Enough Water?
4. Kneeded Enough?

Erinn Boyle

22. CHROMOTOGRAPHY

Materials List: Chromotography paper, Water, Test tube, Test tube cap with paper holder, Water soluble markers

Purpose: This lab can be used to teach students about pigments in plants and it can be used to teach students about proteins and molecular structure. Chromotography is most often done in the lab to determine pigments in leaves, but it takes time to find leaves (especially in the winter), make extracts of them and wait for the pigments to separate out. This lab substitutes markers for leaves and proceeds very rapidly (~10 minutes). It pertains to proteins as the lightest molecules will travel the furthest on the paper. You could talk about primary, secondary, tertiary and quaternary structure. Finally, this can be a lab to introduce students to PCR and genetics, which also proceeds along the idea that heaviest molecules (in DNA) travel slower.

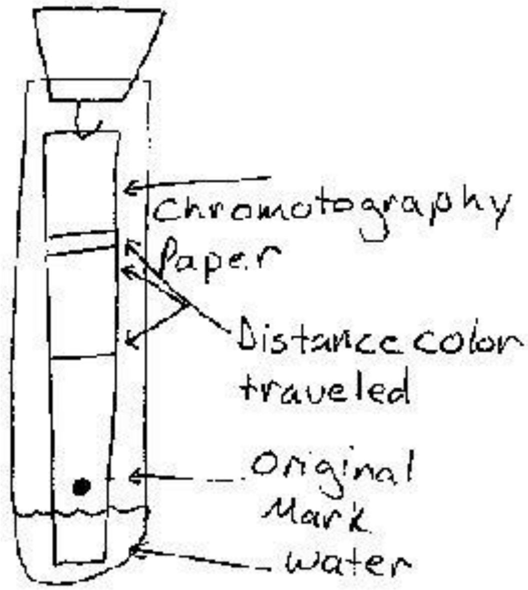
Directions

1. Fill test tube with 1" water
2. In one space, put the dots of as many colors as desired. This space should be 1 ½ inches above the bottom of the chromotography or filter paper.
3. Clip paper to lid of test tube and close the system.
4. Wait 10 minutes and see how colors have moved up the paper (by capillary action). Yellow will move the farthest. Ask students why

Something Went Wrong?

1. Make sure that the marker on the paper is never touching the water. This will color the water and ruin the experiment.
2. Are your markers water-soluble?
3. Make sure to wait long enough
4. Did you use FILTER or CHROMOTOGRAPHY paper?

Level This is a fun inquiry-based experiment that works best with students who understand basic biology and chemistry.



CELLULAR RESPIRATION (Tara Denison)
Blow through a straw into a bromthymol blue solution. Bromthymol blue is an acid/base indicator that is slightly basic and has a blue color. As you blow into the solution, CO_2 (from your breath) makes the solution slightly acidic. This turns the solution a light yellow. This is proof that our bodies do, indeed, produce CO_2 via cellular respiration.

Materials: bromthymol blue, straw, beaker

THE CELL (Kim Hulse)

This is a great demonstration or model that allows students to make the abstract idea of a cell concrete. All you need is a small rectangular box, a plastic baggie, gelatin, balloons, and assorted beads. The box represents the cell wall of a plant. The baggie represents the nucleus of the cell while the gelatin represents the cytoplasm. The balloons represent vacuoles and the beads represent the organelles of the cell. After a study of the cell and its parts, this makes a great "dissection" activity.

EMULSIFICATION (Jill C Reynolds)

This is a good demonstration to show how bile emulsifies fats and makes them easier to digest. You will need a jar with a tight lid, vegetable oil, water, and detergent. Pour water half way into the jar, add any color of food coloring to it. Then fill the other half of the jar with oil. Cover and shake. Note that they do not mix. Remove cover and add some detergent. Cover and shake again. Note that this time the oil breaks up into tiny droplets and mixes with the water. This is called emulsification. Explain that this occurs in the small intestine and that it increases the surface area of the fat droplets so they can be easily broken down by digestive enzymes. It is also why detergents are able to remove grease from your clothes.

ENZYME ACTION (Donna M Wilson)

To start the discussion of enzymes, hand out to each student a chocolate covered cherry. Explain how the cherry is coated with a thick crystal sugar and then dipped in chocolate. The enzyme invertase is mixed in with the sugar. During the time that the candy is packaged, shipped, stored, and sold, the invertase causes a breakdown of the solid sugar creating a thick sugar syrup. While the sugar might have eventually broken down on its own it would have taken a very long time without the enzyme. Enzymes are organic catalysts which increase the rates of chemical reactions.

LIVING OR NONLIVING (Nicholas F Barnes)

In this demo, a "critter" is created with super glue and distilled water in a petri dish. The dish is placed on the overhead so the students can see this "critter" move around the dish. A good conversation is then generated to discuss what is characteristic of living and nonliving things. I would use this demo towards the beginning of the year to help the students to understand the study of biology.

ECOSYSTEM BOUNDARIES (Kim Hulse)

Two colors of paint and white posterboard work well to demonstrate the overlap of ecosystems. Primary pigments (red, yellow, blue) work best, because when blended together they make easily recognizable colors. Paint the two colors near each other without letting them touch. These two colors represent two ecosystems. Then, while the paint is still wet, show how when the two ecosystems (colors) begin to overlap, they blend together in the real world and on the page.

TRANSMISSION OF INFECTIONS (Jill C Reynolds)
This activity simulates the transmission of infectious agents and is great to use with the entire class. It can take as long as you want it to to run. Use it as a minilab or an introduction to a new unit. Materials needed include clear plastic cups or beakers, saltwater, fresh water and a small amount of silver nitrate solution.

In advance, speak to two students. Ask one not to interact (mix) with anyone and ask the other to interact with as many people as possible. The one student whom you have asked to interact will begin with a half a glass of clear saltwater while the rest of the of the students will receive the same amount of fresh water in their cups. Ask the students to interact with other students by pouring their water into the other persons glass and then having the other person pour half the liquid back into their glass. After a few minutes stop the interactions. Drop one drop of the silver nitrate solution into each cup and explain that if it turns cloudy then they had become infected. Many interesting avenues can be taken with this activity. If students keep track of whom they interacted with and in which order, the class can actually determine who was the original infected person. This is similar to how health officials try and trace the progress of an infectious disease.

WHAT TEMPERATURE IS IT? (Kim Hulse)

Have a student put one hand in cold water and the other in warm water. While their hands are in the water, have them explain to the class what temperatures they can feel. Then have them quickly place both hands in room temperature water. The hot hand will feel the water as cool and the cold hand will feel the water as warm. This is a good demonstration that shows the inaccuracy of the human body as a thermometer.

NEED FOR A THUMB (Donna M Wilson)

This activity demonstrates the utility of our opposable thumbs. Tape a students thumb to the adjacent index finger. Ask them to try to perform a number of normal everyday activities such a picking up and holding a variety of objects. It will quickly illustrate some of the many ways that we utilize the use of our thumbs in everyday activities.