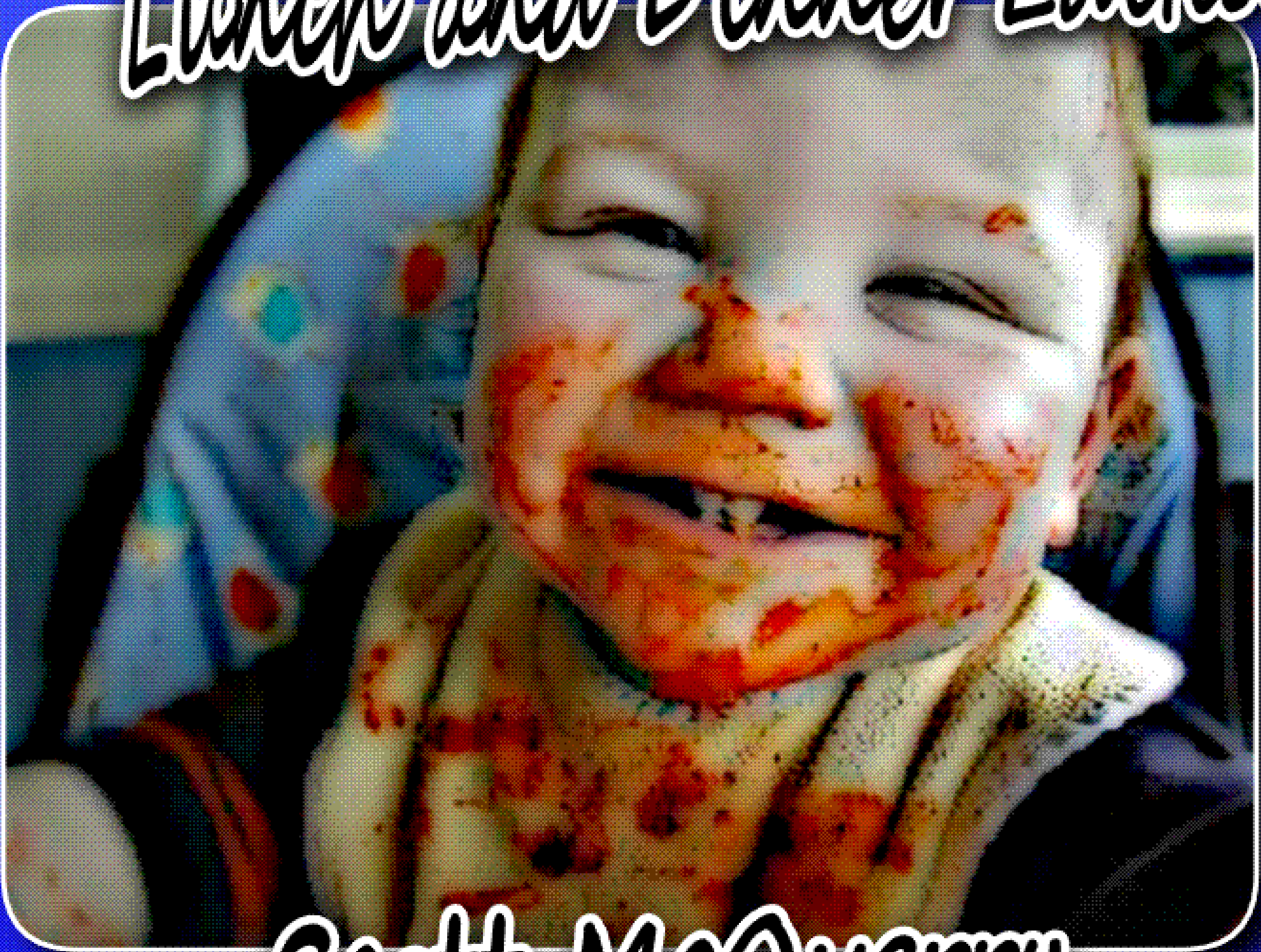
The Science of Food:

Lunch and Dinner Edition



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TO INSPIRE SCIENTIFIC CURIOSITY AND LEARNING FOR A BETTER COMMUNITY

ESP: Caution... Contents May Be Hot!!!

The conduction of heat through metal objects will be explored.

Materials:

One Styrofoam cup
Three metal spoons
Thermometer
Hot water

Activity:

1. Heat water on the stove to boiling.
2. Place a thermometer into the cup and fill it three-quarters full (you will want to measure this amount!)
3. Record the temperature every 15 seconds until the temperature begins to level off.
4. Empty the water, insert a spoon and fill the cup with the same amount of hot water once again.
5. Record the temperature once again.
6. For experimentation, add more spoons to the cup.

Explanation:

Energy (in the form of heat) is transferred from the water into the spoon. The metal within the spoon not only can conduct electricity, but it can also conduct heat as well. When the water is added to the cup, you should observe that the temperature does not reach as high as the cup without the spoon. Heat is conducted through the metal. You can use the conduction of heat for any hot liquid. For example, if your coffee is too hot, placing a metal spoon in the liquid will cool it at a faster rate than by allowing it to sit by itself.

Independent variable: Number of spoons

Dependent variable: Temperature of the water

Hypothesis:

If the NUMBER OF SPOONS is (increased/decreased), then the TEMPERATURE OF THE WATER will (increase/decrease).

Wash 'em Good!

Proper hand washing techniques are vital for everyone's health.

Materials:

Small bottle of water-soluble glow in the dark or fluorescent paint
1 medium-sized bottle of unscented, white lotion or dishsoap (8-12 oz)
1 black light

Activity:

1. Mix the paint and lotion together in a reusable container.
2. Squirt a penny-sized amount of lotion onto each child's hand and have them rub their hand together.
3. Go to the bathroom and have each child wash his or her hands or help them wash their hands.
4. When they return, turn off the lights in your room and have them place their hands under the black light. The places they did not wash will glow under the black light.

Explanation:

Bacteria are everywhere. Some of them are useful, many of them are neither good nor bad, but a few can make us sick. Many bacteria get from place to place by hitchhiking on people. They can be found in the folds of skin, in our noses and throats, on our hair, and under our fingernails. We can also pick up bacteria from things we touch. Bacteria can be transferred to food from dirty hands, dirty aprons, utensils, food contact surfaces, and equipment. More than 16% of food borne disease outbreaks have been traced to poor personal hygiene of people working with food.

You should always wash your hands:

Before you handle food
After using the bathroom
After eating or drinking
After handling dirty plates or garbage
After working with raw foods
After touching other parts of your body like your nose, mouth, hair, and skin
After handling dirty utensils, objects, or equipment

To wash hands properly you should:

Use soap and hot water
Wash for at least 20 seconds
Dry with a single use towel

Taking a Bath with your Salad

Students will explore the concept of osmosis with a very simple activity.

Materials:

Lettuce leaves
Salt water
Fresh water

Activity:

1. Place one lettuce leaf in a bowl of salt water and another in fresh water.
2. Ask the students what they predict will happen to the lettuce in each container after a few minutes.
3. The lettuce will wilt in the salt water and remain firm in the fresh water.

Explanation (The EASY one):

The higher concentration of water inside the veggie forces water out, thus making it limp and disgusting.

Explanation (The HARD one):

Osmosis is a special kind of diffusion that pertains specifically to water: the movement of water across a selectively permeable membrane that permits the passage of water but inhibits the movement of the solute. The water moves down a concentration gradient from the region of its higher concentration of free water molecules (less solutes) to the region of its lower concentration of free water molecules (more solutes), or from high pressure to low pressure.

Osmosis is vitally important for plants because it enables the plant to take in nutrients from the soil; the soil water is hypotonic to the root cells. Osmosis also makes the cells swollen and gives rigidity to the plant. Water in the cell exerts pressure against the cell wall. This pressure give strength to the plant cells and help to keep the plant erect. Forget to water a house plant and the cells lose water, the pressure decreases, the cells become limp and the whole plant wilts. Wash off the salt solution and immerse the salad greens in pure water and if the membranes were not broken, osmosis will rehydrate the cells back to their firm state.

Walls vs. Membranes

The difference between a cell wall and a cell membrane will be demonstrated.

Materials:

Balloon
Pantyhose

Activity:

1. Make an analogy between the cell membrane being a balloon.
2. Blow up a balloon till it pops in your face.
3. Now, pull a pair of pantyhose out, place the balloon INSIDE the pantyhose and proceed to inflate the balloon.
4. It will amaze the kids that the balloon WILL NOT BURST!

Explanation:

A cell wall is an interconnecting chain of polymer-like molecular chains, quite a bit like the structure of the nylon pantyhose upon close inspection - tight fibers that interweave each other reinforcing the entire structure. Without this tremendously tough and rigid cell wall, the membrane is left exposed to the environment. The membrane has very little strength and is there primarily to access and exchange certain meaningful items the cell needs. T

Waiter!!! There's a fungus in my bread!!!

Children will explore the actions of a well-used fungus.

Materials:

Teaspoon measure
Active dry yeast
Two bottles of soda pop
Water
Two "helium quality" balloons (not the small water-balloon size!)

Activity:

1. Remove the contents of one of the bottles of soda...enjoy!
2. Fill the bottle up with an equal amount of water.
3. Put a teaspoon of dried yeast in each bottle.
4. Seal the bottles with the mouth of the balloons.
5. Place the bottles in a warm place, but not in direct sunlight!
6. Allow the bottles to remain still for 24 hours. You can check the size
7. of the balloons every 8 hours and see the difference.

Explanation:

Yeast is a very well-known and important fungi! It is commonly used in most breads to allow the dough to "rise" as it fills with gas. The balloon on top of the soda pop will become noticeably larger since the yeast feeds on the sugar in the liquid. As it uses up the sugar, the yeast gives off carbon dioxide gas, which fills up the balloon. Without any sugar in the plain water, the yeast cannot give off any gas!

If you can show your child a piece of bread, have them look closely at all of the "holes" in the surface. These "holes" are bubbles of carbon dioxide gas that is made by the yeast while the bread is being made!

ESP: Peanut Power

Hidden chemical energy within food will be converted to heat energy.

Materials:

Small bag of unsalted, mixed nuts
A cork
A needle
Foil square (about 12 inches)
Matches/lighter
Clock with a second hand
Outdoor or well-ventilated area

Activity:

1. Carefully push the eye of the needle into the smaller end of the cork.
2. Gently push the pointed end of the needle onto a small nut.
3. Place the cork/peanut onto the metal foil. (You may want to weigh down the foil with misc. objects).
4. Ignite the nut with the match/lighter and begin recording how long it burns. BE VERY CAREFUL WITH THIS STEP. THE NUT WILL BURN FOR A LONG TIME. BE CERTAIN TO PROVIDE THE NECESSARY SAFETY PRECAUTIONS WITH THIS EXERIMENT.
5. Change the size of the nut for experimentation.

Explanation:

Just about everything has potential energy stored within it. The energy stored in food (such as a nut) is typically released within our bodies to do work. Mixed nuts contain stored chemical energy which is released when it is burned into heat energy.

Independent variable: Size of the nut
Dependent variable: Time for the nut to burn
Hypothesis:

If the SIZE OF THE NUT is (increased/decreased), then the TIME FOR THE NUT TO BURN will (increase/decrease).

How "Happy" is Your Meal?

Children will identify how much fat is in a common restaurant meal.

Materials:

McDonald's Happy Meal
Blender
Measuring cups for liquid (clear)
Sauce pan
Tall skinny and clear container (i.e. olive container)

Activity:

1. Break up the burger and fries (not the toy!) into small pieces and blend on high until the mixture is well pulverized.

2. Scoop 2 tablespoons of the mixture into the sauce pan and add two cups of water.

3. Boil the mixture gently for 15 minutes.

4. Fill the tall/skinny container with the mixture.

5. Refrigerate overnight.

6. Remove the mixture from the refrigerator and measure the amount of fat that will be found on top of the mixture.

Explanation:

The fat will form a layer at the top of the mixture and will turn into a solid as it cools. You can calculate the percent of fat in the meal by dividing the total amount of fat (in cups or milliliters) from 2 cups (or 474 milliliters) and multiplying by 100. For example, if you find $\frac{1}{2}$ cup (118 milliliters) of fat floating in your mixture, you can say that the total amount of fat in the Happy Meal is 25%.

FYI-The translucent white material floating on the top is saturated fat. The thin orange near the top is trans-fat. All nutrients show up as a dark brown at the bottom.

Bread Science 101

Chinese Taro Root Buns

From Chinese *baozi* to Armenian *lavash,* bread comes in thousands of forms. What do they have in common? On the most basic level, they all involve cooking a mixture of milled grains and water.

Armenian *lavash*

Imagine a continuum of breads, ranging from the thinnest flatbreads to the fluffiest *brioche.* Some are amazingly simple: *Matzoh,* for example, is nothing more than flour and water, baked until crisp. Raised breads, on the other hand, involve the complex interactions between flour and the leaveners that give them their porous, tender quality.

Leaveners come in two main forms: baking powder or soda and yeast.

Matzoh

Baking powder or baking soda work quickly, relying on chemical reactions between acidic and alkaline compounds to produce the carbon dioxide necessary to inflate dough or batter (more on this later). Baking powder and baking soda are used to leaven baked goods that have a delicate structure, ones that rise quickly as carbon dioxide is produced, such as quick breads like cornbread and biscuits.

Saccharomyces cerevisiae, or baker's yeast. Photos courtesy of Peter Hollenhorst and Catherine Fox.

Yeast, on the other hand, is a live, single-celled fungus. There are about 160 species of yeast, and many of them live all around us. However, most people are familiar with yeast in its mass-produced form: the beige granules that come in little paper packets. This organism lies dormant until it comes into contact with warm water. Once reactivated, yeast begins feeding on the sugars in flour, and releases the carbon dioxide that makes bread rise (although at a much slower rate than baking powder or soda). Yeast also adds many of the distinctive flavors and aromas we associate with bread.

But leavening agents would just be bubbling brews without something to contain them. Here's where flour comes in. There are lots of different types of flour used in bread, but the most commonly used in raised bread is wheat flour. This is because wheat flour contains two proteins, *glutenin* and *gliadin*, which, when combined with water, form gluten. As you knead the dough, the gluten becomes more and more stretchy. This gum-like substance fills with thousands of gas bubbles as the yeast goes to work during rising.

Starch, a carbohydrate that makes up about 70% of flour by weight, also gets in on the act. When starch granules are attacked by enzymes present in flour, they release the sugars that yeast feeds on. Starch also reinforces gluten and absorbs water during baking, helping the gluten to contain the pockets of gas produced by the yeast.

Sometimes, a baker will let the dough rise several times, allowing the gluten to develop more completely and the yeast to add more of its flavors. When the dough is finally cooked—either in an oven, over a fire, or in a steamer, depending on what kind of bread you're baking—the yeast inside it continues feeding, and the pockets of gas in the dough continue to expand. As the temperature of the cooking dough rises, the yeast eventually dies, the gluten hardens, and the dough solidifies.

http://www.exploratorium.edu/cooking/bread/bread_science.html