Fat Breakdown

Materials

- 250 ml beakers or clear plastic cups (8 oz), 2 per group
- detergent (dish soap)
- vegetable oil
- water
- stirring rods or spoons
- measuring spoons

Watch what happens when water-insoluble lipids are broken down with dish detergent.

1.2.6 Understand that specialized cells within multicellular organisms form different kinds of tissues, organs, and organ systems to carry out life functions.

2.1.2 Understand how to plan and conduct scientific investigations.

Procedure

- Pour about 120 ml (~4 oz.) of water into two separate beakers.
- Carefully add 1-2 teaspoons of vegetable oil to each beaker. Note the separation of oil and water. Discuss and record observations over the next five minutes.
- Add a small amount of detergent (½ teaspoon or less) to one beaker.
- Gently stir each beaker, using separate spoons, for 15 seconds.
- Discuss and record observations over the next 5 minutes.
- Set the beakers aside for one hour. Observe them again and record any changes that occurred during the hour.

Challenge

Why do detergents make washing dishes easier? Does the type of lipid make a difference? Try this experiment again using butter or Crisco instead of oil.

What's going on?

Lipids (fat, grease, oil) are hydrophobic, meaning they won't dissolve in water. For this reason water is not very helpful in cleaning these substances. Detergents like dish soap bond to the lipids so that they can be broken down and dissolved in water. This is similar to how bile (a chemical produced by the liver) breaks down fat in our digestive systems into smaller components that can be used by our bodies.

Resources

Blood and Guts: A Working Guide to Your Own Insides, by Linda Allison, 1999

Eyewitness: Skeleton, by Steve Parker, 2000

Reader's Digest: How the Body Works, by Steve Parker, 1999

The Usborne Internet Linked Complete Book of the Human Body, by Anna Claybourne, 2003

www.kidshealth.org

www.medtropolis.com/VBody.asp

www.michaelbach.de/ot/

www.hhmi.org/senses

www.colorcube.com/illusions/illusions.htm

Science On Wheels website: www.pacificsciencecenter.org/education/sow

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SCIENCE On Wheels

Blood and Guts

Dear Teacher,

Thank you for having the *Blood and Guts* van visit your school. We hope you enjoyed investigating the human body with your students during this Science On Wheels experience. This flier is intended to help continue the enthusiasm generated by our visit and extend your students' learning.

The following activities have been selected because they are straight-forward, require few materials, and support state adopted learning objectives. We have identified and listed two corresponding Science Grade Level Expectations (GLEs) for each activity. The one page insert is written for your students, with activities you may choose to do as a class, or copy for home use.

Thank you again for having the *Blood and Guts* van visit your classroom, and remember, have fun!

~Science On Wheels Teachers

Trick Your Taste Buds

Materials

- blindfolds
- plates
- freshly cut slices of raw potato* (3-5 per student)
- scent Samples (3-5 per pair of students: vanilla extract, peppermint, peanut butter*, cinnamon, lemon peel, coffee, etc.)

Taste and scent are linked together in our brains. Try this activity to see if you can trick your taste buds.

1.2.1 Analyze how the parts of a system interconnect and influence each other.

2.1.2 Understand how to plan and conduct scientific investigations.

Procedure

- Pair up students and provide each pair with a plate of 6-10 potato slices, 3-5 scent samples and a blindfold.
- Students take turns performing the taste test as follows:
  1) Put on the blindfold to help focus on your senses of taste and smell.
  2) Pinch your nose and taste 1 slice of raw potato. Note the flavor.
  3) This time instead of holding your nose, have your partner hold one of the sample scents under your nose for you to smell while you eat the next potato slice. Note the difference in flavor. Repeat with all scents and then switch with your partner.
- Discuss what the students discover about the relationship between taste and smell. Why might your sense of taste seem weaker when you have a cold?

Challenge

Predict and explore how different variables affect flavor. Consider the temperature, texture and sound (snap, crackle, pop) of the food you eat.

What's going on?

What we call 'flavor' in the food we eat is actually the brain interpreting a mixture of sensations: smell, texture and taste. In fact about 70-75% of what we interpret as taste actually comes from our sense of smell. Our taste buds can interpret only 4 basic tastes - bitter, sweet, salty and sour. A person's sense of taste can often be confused by comments or suggestions of other people or by mixed signals sent to the brain. For example, your students may have mistaken the potato to be an apple, because they look and feel similar to one another.

* Some people may have allergies. In the case of the potato, use another bland food, like crackers or rice cakes. Potato works well because it looks and feels like an apple. You may choose any number of smells, but try to choose a variety of sweet, spicy, bitter, and salty.

Bendable Bones

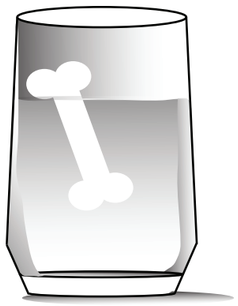
Discover why the human body needs calcium for healthy bones and teeth.

1.1.1 Understand how to use physical and chemical properties to sort and identify substances.

2.1.2 Understand how to plan and conduct scientific investigations.

Materials

- 2 clean chicken bones (thicker ones like a leg bone are preferable)
- 2 large beakers or wide-mouth glass jars
- vinegar
- water
- string
- metal washers



Procedure

- Give students an opportunity to see and feel a clean chicken bone.
- Suspend a bone between two desks. Tie one end of a string to the middle of the bone and attach a paper clip (modified to look like a fish hook) to the other end of the string. How many metal washers can the bone hold up before it bends (1/2 inch at the middle) or breaks? Record observations.
- Fill beakers; one with water and the other with vinegar. Place a bone in each of the beakers and let them sit for 3-4 days.
- Remove bones from beakers and allow students to see and feel them once again. Repeat the metal washer test and discuss similarities and differences.

Challenge

Will other liquids give you the same results? Try cola, orange juice, or milk. (Tip: if you are using milk, you probably should keep the liquids refrigerated).

What's going on?

Calcium is the major substance that gives our bones their strength and stiffness. While dairy products are a common source of calcium, it is also found in non-dairy foods such as salmon, broccoli and soybeans. Acids (like vinegar, cola, and orange juice) remove calcium ions from bone – essentially turning the bone into cartilage. While cartilage is a fairly strong material, bone provides greater strength and durability. Human bones are not often exposed to such acids, but they do lose stored calcium over time, resulting in osteoporosis in later life.

After Image

Discover how "tired" sensory receptors play tricks on you!

1.2.1 Analyze how the parts of a system go together and how these parts depend on each other.

2.1.2 Understand how to plan and conduct scientific investigations.

Materials

- multiple sheets of brightly colored construction paper
- a brightly lit white wall

Procedure

- Stand or sit facing a white wall.
- Hold the colored paper in front of you and stare at it for 30-45 seconds.
- When the time is up, move the colored paper from your sightline and continue to stare at the white wall. What do you see? Try this a few times with different colored paper.

Challenge

If you wanted to see a red after image, what color(s) would you have to stare at? How do you predict the after image would change if you put a large black circle in the middle of the construction paper?

What's going on?

There are color sensors located in the retina of the eyes called cones. Each individual cone is sensitive to red, blue or green. When you stare at a particular color for too long, the cones that perceive that particular color become fatigued. Once the color is removed from your vision you see a complimentary color because the complimentary color cones are not fatigued and are therefore collecting and transmitting information to your brain more effectively. For example, if you stare at red paper you will see blue-green when it is gone. After images typically last for less than five seconds before your vision returns back to normal.

DNA

Use common kitchen items to extract DNA from fruits & vegetables.

1.2.6 Understand that specialized cells within multicellular organisms form different kinds of tissues, organs, and organ systems to carry out life functions.

2.1.2 Understand how to plan and conduct scientific investigations.

Materials

- fruit or vegetables
- blender or food processor
- water
- salt
- dish detergent
- toothpicks
- meat tenderizer
- test tubes or similar
- isopropyl (rubbing) alcohol (refrigerated is better though not necessary)
- strainer
- measuring cups
- bowl
- microscope (optional)

Procedure

- Place 1 cup cold water, ¼ teaspoon salt, and ½ cup of fruit or vegetable in blender.
- Blend for 5-15 seconds (more time for firm veggies). You want to create a soup-like texture, but avoid totally liquefying.
- Strain the mixture into a small glass jar.
- Add 2 tablespoons of liquid detergent to the strained mixture and swirl the jar to mix the soap well without creating any suds.
- Let the mixture sit for 5-10 minutes.
- Pour the mixture into test tubes (small, clear plastic cups will work).
- Wet a toothpick, dip it in the meat tenderizer and stir it into the mixture. Stirring vigorously here will yield poor results.
- Carefully pour alcohol into each test tube or plastic cup. Ideally, you should pour the alcohol down the side so that it forms a clear layer above your "soupy" mixture. Add about as much alcohol as you have mixture.
- Strain the mixture into a small glass jar.
- Watch as the DNA precipitates out of solution (the mixture). Little bubbles will form and rise to the top. The DNA will attach to these bubbles. If you gently stir the alcohol layer with a toothpick or a small hook (try a paperclip), you will see some slime-like, stringy stuff near the top. This is the DNA.
- If you have access to microscopes and clean slides, look at the DNA under magnification.

Challenge

Try different fruits and vegetables: which yield the best results? Does it matter if the fruit or vegetable matter is cooked first?

What's going on?

Blending breaks up the vegetable or fruit into smaller pieces but doesn't necessarily break open individual cells. The detergent bonds with certain components (lipids) within the cell membrane, breaking open the cell and allowing everything in the cell to spill out. The DNA remains interwoven around proteins for protection and structure. The enzymes in meat tenderizer cut those proteins, allowing the DNA to separate. The alcohol floats on top because it is less dense. The DNA is also less dense so it rises to the top as well, whereas most of the rest of the cell stays in the water/soap mixture. The DNA precipitates because it is insoluble in the alcohol.