raft
RESOURCE AREA FOR TEACHING

STEAM
SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

LEARNING ACTIVITY

Trimming the Fat

A Quick and Easy Lipids Test

Students test food samples for relative amounts of oils or fats (**lipids**) based on the transmission of light through paper in this simple activity.

Activity Challenge

Determine which food samples contain the most and least fats or oils by observing the amount of light that passes through the paper samples.

Preparation

1. Review the Materials Needed list and gather the required items.
2. Find a workspace that can get messy.
3. Put about 2 teaspoons of each food sample in its own small container.
4. Line up the samples on a sheet of paper placed on a tabletop or counter. Write the contents of each container on the paper, just in front of each sample, or write the contents directly on each container.
5. Draw a testing grid, like the one on the next page, on a piece of paper. Draw a 2 inch square area for each sample. Label each square.

To Do

1. Dip a cotton swab, craft stick or equivalent into the first sample.
2. Rub the dipped end onto the matching labeled square in the grid.
3. Blot off any excess material with a rag or paper towel.
4. Repeat steps 1-3 for each remaining food sample using a fresh swab or stick for each sample (to avoid cross-contamination). One square should be rubbed with water.
5. Wait until the sample square that you rubbed with water dries.

Observations

- Hold the testing grid up to a light source. Identify the spots left by the samples that are **translucent** (partially see-through/allows light to pass). This indicates that a sample contains fat (**lipids**).
- Compare the samples to identify the ones that are the least/most translucent. This provides a relative measure of the amount of lipids in each of the samples.

Materials Needed

- Approximately 10 liquid or spreadable foods: Some all or mostly fat, like vegetable oil or butter; some high fat, like salad dressing or cream cheese; some low fat, and some fat-free, including water.
- Small containers, like paper cups, for each of the food samples.
- Absorbent rag or paper towel
- Cotton swabs, craft sticks or equivalent
- Pen or pencil
- Copy paper, brown paper bag, or newspaper

Grade Range

K-2
3-5
6-8

Topics/Skills

Science: Observation, Organic Molecules, Properties of Light

Learning Standards

NGSS: Structure and Properties of Matter, Wave Properties, Light

Duration

15-20 minutes

Prep Time

5-10 minutes

Extensions

- Try rubbing the samples on different types of paper, for example: copy paper, brown bag paper, newspaper. Note any differences you observe.
- Do any foods labeled "fat-free" leave a translucent spot? Why or why not?
- Compare samples of saturated vs unsaturated fats. (This information should be on the label). Do you see any differences?

The Science behind the Activity

Paper is made of many strands of fiber that are bound together. There are many tiny voids between the fibers that are filled with air. Light waves are bent (change direction) when they pass through the boundaries between different materials. This phenomenon is called "**refraction**". Refraction randomly scatters light as it passes through the fiber to air boundaries in a sheet of paper, making it **opaque** (light blocking). Lipids and water can fill the voids between the paper fibers when rubbed on the paper. Paper fiber to air boundaries **refract** (bend) light the most. Paper fiber to lipid boundaries refract light the least. Paper fiber to water boundaries refract light less than air and more than lipids. The less bending and scattering that a light is subject to when passing through paper, the more translucent the paper will be. Since lipids cause the least refraction, lipid soaked paper will be the most translucent.

The experiment also demonstrates the phenomenon called **evaporation**. Evaporation is the process of a liquid turning into gas (**vapor**). Water much more readily evaporates at room temperature than lipids. Immediately after applying the food samples and water to the paper, all squares will exhibit different amounts of translucency. After between 5 to 30 minutes, the water will have evaporated, leaving the paper square that contained only water opaque again. The evaporation time will depend on the temperature, humidity, and type of paper. The squares containing lipids will remain translucent because lipids do not evaporate at room temperature. The samples will contain different ratios of lipids to water. The greater the amount of fat in the square, the greater the translucency will be.

Example Testing Grid

Butter	Fat-free sour cream	Soy sauce	Italian salad dressing	Ketchup
Dish soap	Vegetable oil	Chili sauce	Milk	Water