Teaching Plan

Goal: Introduce multiple food science concepts in a module-based lesson.

Agenda:

Introduction (5min)
Modules (15min each)
    Taste Test with and without Smell
    Home-made Butter
    Extracting Iron from Cereal
Closing (10min)

Materials Summary:

- Various scented and tasteable foods. Suggestions:
    Orange
    Lemon
    Mint
    Chocolate
    Bacon
    Tomato
    Jalapeno
    Coffee
    Jellybeans (good for many flavors)

- Room-temperature heavy cream
- Marbles (optional)
- Jars
- Spoons or knives
- Salt (for taste)
- Crackers

- Dry cereals
- Plastic bags
- Medium-strength magnets
-Magnifying glass (optional but helpful)

Scientific Background

Taste Test With and Without Smell

Taste and smell are intricately related, with 70-75% of what we percieve as taste coming from our sense of smell. Because taste buds can only recognize bitter (alkalinity), salty (Cl^-), sweet (glucose or sucrose), sour (acidity), and umami (amino acids), the sense of smell is needed to augment the sense of taste. Compared to the relatively few sensations of taste, there are over 10,000 different odors identifiable. Because of this, the brain couples smell with taste, with smell augmenting our taste. When our sense of smell is removed, our ability to taste is

significantly reduced.

Flavor is not limited to the 5 basic tastes. Although we are not sure of the exact mechanism of how they come together, the general idea is that when chewing, air is forced through the naval passages, and the combination of smell and taste create “flavor.” And not only does play smell play a role in flavor, but it also plays a role in memory. Oftentimes, certain smells are associated with distinct memories (e.g. your grandmother’s kitchen on Thanksgiving day) due to the novelty or uniqueness of smells.

Home-made Butter

There are a variety of dairy products that can be extracted from milk:

Milk: Exactly what comes out of the cow. Is usually homogenized to mix well and pasteurized to kill bacteria before sold.

Lowfat milk: Milk can be separated into the “heavy” fat portion and the “light” water portion. Lowfat milk contains less of the fat.

Heavy cream: Contains more fat content than normal milk. Aka whipping cream.

Butter: The butterfat more solid portion of milk.

Buttermilk: The liquid portion of milk.

By churning heavy cream, the liquid is aerated, creating microbubbles within the liquid. The fat molecules align themselves along the inside walls of these bubbles, creating semi-solid fat globules. Continued shaking combines these bubbles when they collied and break, forming larger globs of butter until one cohesive mass of butter is formed. Throughout this process, buttermilk is formed and should be decanted in order to further concentrate the semisolid butterfat.

Extracting Iron from Cereal

Today’s mass-produced food is often fortified with vitamins and minerals to make up for those lost during the processing. Cereal in particular is often enhanced with iron, generally in the form of small iron filings. These are mixed into the product when the cereal is made, and are homogeneously distributed throughout the dry product. Usually, there is so little iron in each piece of cereal that it is not noticeable. These small iron filings can be extracted by powderizing the cereal to release the filings and so cereal won’t be picked up by a bar magnet.

Iron is added to cereal because it is an essential component of our diets. It is necessary in growth, maintenance, and cell division. The World Health Organization estimates that 30% of the world is anemic-a condition due to iron deficiency. Although too much will result in problems, we need a certain amount to have healthy oxygen transport and electron transfer.

<u>Taste Test With and Without Smell</u>

Materials:

- Orange
- Lemon
- Mint
- Chocolate

- Bacon
- Tomato
- Jalapeno
- Coffee

Procedure:
1) Have mentees pinch/plug nose and close eyes
2) Provide samples. Have mentees guess identity
3) Have mentees open nose but not eyes. Retry samples

Variations and Discussion Points:
- Cool down the substances and notice how taste and smell are dampened.
- How hard is it to guess the identity without smell?
- Is it equally hard to guess a substance based on taste alone, or are some substances more smell or taste-dependent?
- Why can't you taste very well when you have a cold?
- Can certain bad smells "block" your taste for a while?

Home-made Butter

Materials:
- Room-temperature heavy cream (keep chilled until ~1 hr prior to experiment to prevent bacterial growth)
- Marbles (optional)
- Jars
- Spoons or butter knives
- Salt (for taste)
- Crackers
- Napkins
- Coffee filters or cheesecloth

Procedure:
1) Pour cream into clean container
2) Place clean marble in container with cream
3) Have mentees shake well for approximately 10min
4) Alternate churning and draining buttermilk. Use coffee filters or cheesecloth if necessary
5) Butter is ready to eat. Salt for flavor

Variations and Discussion Points:
- Try to churn butter using whole and skim milk instead of heavy cream and notice that it is impossible.
- Taste the buttermilk byproduct and notice how different it is in consistency from the butter.
- Why is butter bad for you?
- Discuss how milk and heavy cream are both liquid suspensions, with the butterfat being

homogenously distributed among the buttermilk.
- How is heavy cream (what is used in the demo) different from milk?

Extracting Iron from Cereal

Materials:

- 2-3 types of cereal, with different iron content
- Plastic bags
- Medium-strength magnets

Procedure:

1) Give equal amounts of cereals in bags
2) Have mentees crush cereal
3) Extract iron filings with bar magnet

Variations and Discussion Points:

- Try other dry foods such as pasta, flour, and baking mixes. Do they differ in iron content?
- Why is iron added to food?
- Why does your body need vitamins and minerals?
- What foods do you normally get essential vitamins and minerals from?
- Can you correlate % daily iron dose with amount of iron collected?
- Why can't you pick up cereal with a magnet normally?
- Why don't you taste the iron in your cereal?
- What does iron do in your body?

Closing Activity and Discussion

Discuss what they learned. Hand out worksheet to gauge learning.