Monday Math & Science:

The 5 Basic Tastes

Key messages:

Taste is the human strategy to identify a food. Taste receptors on the tongue can identify 5 basic taste sensations: salty, sweet, sour, bitter and umami. The ability to taste first appeared over 500 million years ago as a way to avoid toxins and to find nutrients in foods.

The **salty** taste refers to the presence of sodium in a food.

Sweet relates to the presence of carbohydrates, a source of energy. Studies have shown that humans are prone to accept and prefer sweet tastes due to the "safety" that they provide.

Sour is related the presence of acid or may indicate that a food is decaying.

Bitter is the body's defense mechanism against toxins or potentially poisonous substances, especially found in plant alkaloids.

Umami refers to amino-rich foods.

It is important to note that these tastes may change from their original form through the cooking process. For example, raw meat has umami-rich proteins, it is not until the meat is cooked, say over a hot grill, that the amino acids are released, enhancing the sensation of umami, or deliciousness.

Activity: Taste Experiment.

You will need the following ingredients for this experiment: fresh rosemary, arugula, parmesan cheese, balsamic vinegar, and dried fruit such as apricot or fig.

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Taste Experiment:

The objectives for today's tasting activity are to illustrate the fundamental differences between taste and flavor and to understand how an individual's perception of flavor really dictates what they choose to eat.

Before we begin, rub your fingers along the rosemary and breathe in. This is where we reset our senses.

The first item to taste is arugula. Before you place the arugula in your mouth, hold your nose with one hand and place the arugula in your mouth. Taste receptor cells on the tongue recognize the presence of bitter compounds found in the arugula. Now let go of your nose and breathe in. Now, you might sense a strong bitter flavor, some might find the arugula to be peppery.

Alkaloids are found in plants as chemical defenses meant to discourage animals from eating them (McGee, 271). Alkaloids can be potentially toxic and produce bitterness (Dulac,The Physiology of Taste, Vintage 2000). Many plants have evolved these alkaloids as a protective mechanism against foraging animals (Scientific American, 2001).

Humans first developed the sense of taste over 500 million years ago as a way to detect nutrients in foods and to avoid toxins. For early humans, bitter indicated poison. Today, however, we enjoy many foods that are bitter, such as coffee, grapefruit, and arugula.

Next, let's taste the sweet dried fig. Again, hold your nose and take a bite of the fig. What do you sense? Breathe in and notice the difference. Sweet foods are associated with the presence of carbohydrates, which means calories, which

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translates into energy. Early humans sought out foods with a sweet profile, as they were considered “safe” and nutritious (Mennella et al, Ontogeny).

The next item is a marcona almond, which has been toasted and salted. Here, we perceive the presence of sodium. Salt is often used to enhance the flavor of foods and can help mask bitter notes. A common pairing, for example, is bitter dark chocolate with flakes of sea salt. A salty quality can be a sign of a food rich in nutrients, including sodium, potassium or magnesium (PubMed Health, 2012).

Let’s move on to umami, which is the Japanese word for deliciousness. Umami is found in foods that have glutamate, an amino acid, such as meats, mushrooms, and tomatoes. In the Western world, aged parmesan cheese, which you taste today, is a food that has high amounts of glutamate. Notice the savory quality of the parmesan as you take a bite. It is no wonder that grated parmesan cheese is often used as a seasoning agent.

Finally, we have sour. We may think of lemons and limes when we think of sour, but the sour taste is much broader, including acidic foods, like vinegars, and fermented foods, like kimchi or yogurt. The balsamic vinegar is sour and pungent.

As we taste foods, taste receptor cells send messages to the brain, where a database of these tastes are stored. The more exposure to different foods, the more sophisticated this database becomes.

The final activity is to prepare a mini salad, using the ingredients in your kit. Place a piece of arugula, cheese, fig, and almond, into the soufflé cup that holds the balsamic vinegar. The idea is to make a little “shooter” and to experience the five tastes in one bite.

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As we have seen, taste alone does not determine a food's flavor. While taste receptor cells identify 5 basic tastes, the olfactory system can recognize thousands of aroma compounds. We have seen that taste, which occurs in the mouth, and smell, which occurs in the nasal cavity, work together to help the brain determine flavor. Our perception of flavor is a multisensory experience.

An individual's perception of flavor is unique. The perception of flavor and the acceptability of certain foods are quite dynamic and can vary by individual and age.