Spicy/Hot, Cooling, and Other Taste Sensations

In addition to the primary sensations of taste, our taste buds also register a set of sensations related to the chemical properties of some foods that with exposure we learn to enjoy. In culinary applications, *chemesthesis*—sensations caused by chemical compounds—contributes to the taste of everything from hot peppers to pungent garlic to cooling menthol candies.

Spicy hot sensations are the most common form of culinary chemesthesis. Compounds such as capsaicin in hot peppers both irritate cells and trigger the same mechanism used to detect hot temperatures, using a neurotransmitter called *substance P* (*P* is for *pain*; go figure). In one of nature's quirkier moves, substance P is slowly depleted as it is used and takes time—many days, possibly weeks—to replenish. This means that if you eat hot foods often enough, you will build up a tolerance for hotter and hotter foods as your ability to detect the presence of compounds like capsaicin decreases. Because of this, asking someone else if a dish is spicy won't always tell you if it's safe to jump in; he or she may be a regular eater of spicy foods. Also, as you expose yourself to spicy food, you'll need more and more of the ingredients that bring the heat to get the same level of sensation.

Spicy pungent sensations can be triggered without tripping the hot temperature mechanism. Garlic, wasabi, and mustard can all cause a smarting, mind-searing reaction, as do some stinky French cheeses that have sharp, caustic qualities. Szechuan (also known as Sichuan) peppers, used in Asian cooking, and Melegueta peppers, used in Africa, cause a mild pungent as well as a numbing sensation.

Chemesthesis includes a number of other sensations besides spicy hot and pungent. Peppermint candies get their cooling effect from the chemical menthol, which occurs naturally in mint oils from plants such as peppermint. Menthol activates the same nerve pathways that cold temperatures do, which is why chewing mint gum or eating mint candies can cause a tingling cold reaction.

Our mouths capture data for other aspects of oral irritation, too. *Astringency*, a drying, puckering reaction, occurs when certain compounds (normally polyphenols) dry the mouth out, possibly by binding to proteins in saliva that normally provide lubrication. Astringent foods include persimmon, some teas, certain unripe fruits, and lower-quality pomegranate juices (the bark and pulp are astringent). Carbonated beverages also cause cellular irritation, partly masking other taste sensations at the same time. Try sipping on some bottled seltzer water

Spilanthol, the active ingredient in the edible flower Szechuan buttons (also known as sansho buttons, buzz buttons, or electric buttons and unrelated to Szechuan peppers), triggers receptors that cause a numbing, tingling sensation. The "buttons" are actually the flowers of the *Acmella oleracea* plant. The tingling reaction is like licking the terminals on a nine-volt battery—a curious sensation, should you be up for splurging on an online purchase.

and then "de-fizzing" it (screw the cap back on, shake the bottle, and carefully unscrew the lid to slowly vent the gas). Depending upon the brand, you may be shocked at how salty the flat water will taste. (Carbonation also interacts with an enzyme, carbonic anhydrase 4, to activate our sour taste receptors, but for now it's unclear why it doesn't actually taste sour to us.) Sour foods can also trigger oral irritation, although much less noticeably so than many of the other taste sensations involved in chemesthesis.

> Most European cultures don't consider spicy/hot to be a primary taste; other cultures, like the Thai, do, and Ayurvedic medicinal practices on the Indian subcontinent define "warm" as part of basic food prescriptions. Why the difference? One theory suggests genetic differences in taste receptors between Europeans and natives of other regions. (More taste receptor cells = more cells that can be irritated.)

Tips	• Spicy foods decrease the perception of sweetness and saltiness; they can increase the ability to detect some odors while decreasing others.
To make something spicier	• Use hot ingredients such as cayenne pepper (capsaicin) or black pepper (slightly pungent due to the compound piperine).
If a dish is too spicy	• Capsaicin is a nonpolar molecule (see page 59), which is why sugary and fatty ingredients are better able to partly neutralize it while drinking water does little to reduce the burning sensation. Dairy works well, for multiple reasons: casein proteins bind to capsaicin and lactose sugars help dissolve capsaicin into solution. If a dish is too hot, ideally add dairy; otherwise, add something with sugars or fats to reduce the heat.

DIY Scoville Scale

Wilber Scoville, an American pharmacist, spent a lot of time at the turn of the 20th century looking at how to extract compounds from plants. His most famous contribution is an *organoleptic test*—one that relies on the senses—for measuring the amount of capsaicin in hot peppers. Organoleptic tests aren't particularly accurate (what one person senses will be different over time and different from what others sense), but they do have the advantage that you can do them at home.

Scoville's method, first published in 1911, is easy, relying on dried powders from various peppers (a.k.a. capsicum): "One grain [64.8 mg] of ground capsicum is macerated over night in 100 cc. of alcohol [78.9g], and after thorough shaking, filtered. This alcoholic solution is then added to sweetened water in definite proportions until a distinct but weak pungency is perceptible on the tongue." He doesn't specify how much sugar to use in "sweetened water," but 10% sugar to water is a reasonable start, should you wish to try it; for alcohol, use a neutral grain alcohol like vodka. To determine the Scoville score for a pepper, calculate how diluted the ground capsicum is in the just detectably hot solution. Use a few varieties of hot peppers so you can do relative comparisons!

Peppermint Chocolate Mints

Junior Mints, Peppermint Patties, Andes, After Eight—the abundance of candies that are sugar and menthol coated in chocolate is proof enough of the popularity of the cooling sensation of menthol. Try making your own, using high-quality chocolate.

In a mixing bowl, measure out and mix until the ingredients become a consistent, thick paste:

- **1 cup (120g) powdered sugar**
- **1 tablespoon (15g) room-temperature butter**
- **2 teaspoons (10 mL) milk or corn syrup (use corn syrup if you want a more syrupy, less brittle center)**
- **2 teaspoons (10 mL) peppermint extract**
- **1 teaspoon (5g) granulated sugar**

Next, form the paste into whatever shapes you'd like your mints to take. There are a number of ways to do this. The easiest is to roll them into small balls (like Junior Mint candies); you can also form a log with the paste and slice off round discs. Once you have the shapes, let them rest on the counter for an hour or two to partly dry, or store them in the freezer for 30 minutes to firm up.

In a second bowl, melt **4–8 ounces (110–220g) dark, bittersweet chocolate**, following the directions for tempering (see page 157). If you don't mind cheating, use chocolate candy coating instead, which has different fats instead of cocoa fat and doesn't need to be tempered.

Using a fork (a plastic one with the center tines snapped off works well), dip the peppermint into the chocolate, flipping each candy to coat it, and then lightly tap the fork up and down on the edge of the bowl to thin the coating. Transfer the candies to a plate or cookie sheet lined with parchment or wax paper and allow them to set at room temperature. (Setting them in the fridge or freezer won't correctly temper the chocolate!)

Commercial manufacturers use a bunch of tricks to make candies. Take an After Eight mint, with its liquid center: the makers create the filling by mixing an enzyme, invertase, in with the sugar. Over a few days, that enzyme breaks down sugar (sucrose) into simpler sugars (fructose and glucose), which happen to be somewhat syrupy. (See page 432 for more about enzymes.) Don't expect to be able to perfectly replicate your favorite chocolate mint candy!
