"I know where the bodies are buried. I buried them."

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beer which has generated tens of millions of dollars in sales.

Everyone walked over to a tree bearing Allspice tangelos—a hybrid of a tangerine and a grapefruit—which had lumpy exteriors, like lizard skin, and spongy rinds. Hassel described what to look for when evaluating a specimen. "You've got the essential oils in the peel," he said. "I always like to scrape the peel first, just to see what the essential oil is like. That is one aspect of the fruit. The second thing, obviously, is the juice. They can be very similar and very different, and in citrus processing we always separate the oil from the peel, and then the juice from the fruit. You never want the two to meet, because the acid in the juice will chew up the peel oil." Essential oils have been distilled from spices and other botanicals since at least the Middle Ages, later gaining wide use as natural flavorings. Hassel told me that the reason for this was stability. It doesn't take long for juice to rot, but oils, especially when refined, have a longer shelf life. (It takes a ton of lemons to press about six pounds of lemon oil.) Slices of tangelo were passed around, and Hassel dug his nail into the rind, which yielded droplets of citrus oil. He then brought the rind to his nose and inhaled. The oil, he said, wasn't especially aromatic.

Hagen was holding a slice to her nose, too. "To me, it is sweet mandarin," she said. "Light lemon."

"Not too much anthranilate, right?" Hassel said, referring to a family of chemicals commonly found in grapes and strawberries.

"No," Hagen said. "Sweet orange. Light lemon."

Hassel inhaled again. "Not too tart," he said.

"Certainly no allspice in there," Hagen said. "It's a misnomer."

Hassel said that he had expected the fruit to contain compounds that have malty, yeasty flavors, some of which are found in Gouda cheese, but they weren't there. Unimpressed, he tossed the slice away.

Hagen was still sniffing. "Just clove," she said. "That's all."

Flavor is a cognitive figment. The brain fuses into a single experience the results of different stimuli registered by the tongue, nose, eyes, and ears, in addition to memories of previously consumed meals. For reasons that are not fully understood, we perceive flavor as occurring in our mouths, and that illusion is nearly unshakable, as is made clear by our difficulty identifying, with any reasonable specificity, the way each of our various senses contributes to the experience. In 2006, Jelly Belly, the candy manufacturer, produced a jelly-bean that mimicked the flavor of an ice-cream sandwich. When the company manufactured a prototype with a brown exterior and a white interior, people identified the flavor accurately during a trial, and said that it was a good representation of an ice-cream sandwich. Jelly Belly then made an all-white prototype; many trial respondents found it confusing, misidentifying its flavor as vanilla or marshmallow. As Hagen told me, "Color can play tricks on your mind, for sure."

Hagen hoped to sample more than fifty of the collection's citrus specimens, but she was interested primarily in the aromas. Our sense of smell plays a much larger role in defining flavor than our sense of taste does. Taste receptors on the tongue are primarily limited to the detection of saltiness, sweetness, bitterness, sourness, and umami—a Japanese term for the brothiness that one encounters when tasting MSG. These receptors may also perceive fattiness, though this sensation is so poorly understood that it is hard to say for sure. Scientists have identified the function of fewer than thirty taste receptors, and still do not know which ones are responsible for the perception of saltiness and sourness. Jay Slack, one of Givaudan's chief research scientists, told me, "We are just beginning to scratch the surface of what happens when a molecule binds with the tongue, and then all of the biochemical events that happen after that to get a perception. If you imagine a domino trail, we've knocked off maybe four or five dominoes, and have a thousand more." Taste receptors are blunt instruments. With taste alone, one cannot distinguish a grape lollipop from a watermelon one; coffee is like hot water with a bitter aftertaste, and Coke a bland sugary solution. The limitations of taste are unsurprising when one considers its evolutionary purpose. Our biological progenitors, living in the wilderness, needed to know only what

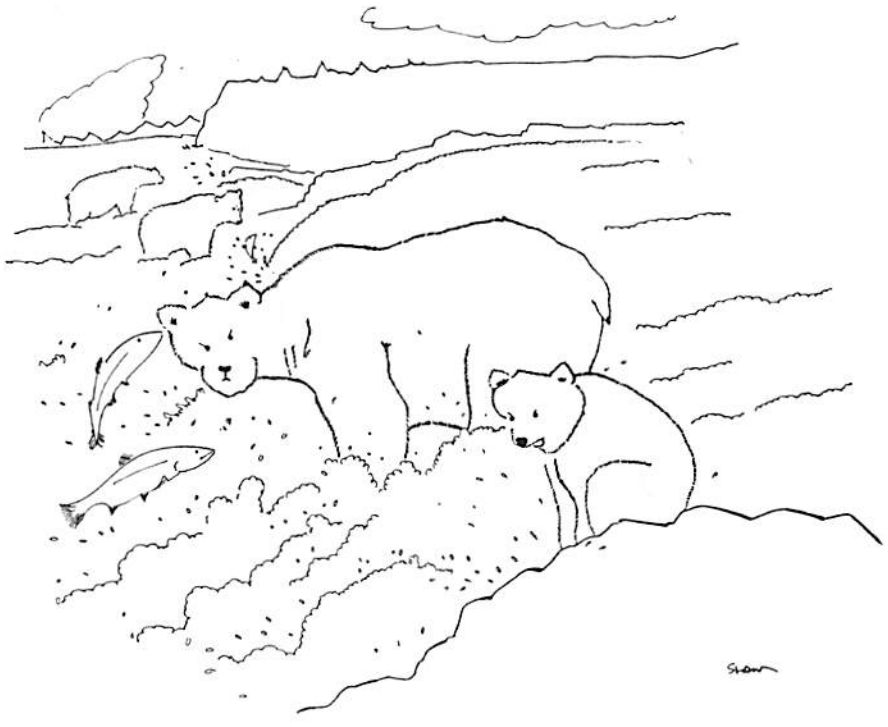
was worth eating and what wasn't. If something tasted sweet, there was a good chance that it provided energy; saltiness suggested the presence of minerals; sourness indicated the level of ripeness, and bitterness the presence of poison.

Smell is a more supple and primordial sense, and its centrality is evident in the way the human brain is arranged. Our forebrains evolved from tissues that once focussed on processing smells, and there are three hundred or so olfactory receptors in the nose. When we taste or see or hear something, the information must pass through the thalamus, a kind of relay station in the brain that allows us to attend to different aspects of perception. (If you suddenly notice a stop sign on the road, for instance, the thalamus has most likely directed your attention to it.) Smells, for the most part, are fed directly from the nose to a "presemantic" part of the brain where cognition does not occur, and where emotions are processed. The bypassing of the thalamus may be one reason why smells can be so hard to describe in detail, and also why aromas stimulate such powerful feelings. The smell of rotten meat can trigger sudden revulsion in a way that merely looking at it cannot.

Smell probably became wrapped up with eating because of its ability to predict. Each whiff is a harmless sample of a potentially risky food. To apprehend something by smell, it must be evaporating, even if only minutely. Chemical compounds that evaporate are said to be "volatile." Chocolate has many volatile compounds. So does lemon sorbet. A hot cup of coffee contains roughly five hundred volatile chemicals. When we eat, volatile chemicals in our food flow through a cavity at the back of the mouth into the nose. Some of them are extremely potent. The smell of roast lamb comes from minute quantities of sulfur compounds. Volatile chemicals can be mysterious. For many decades, we have known that a compound called vanillin plays a large role in determining our sense of vanilla, but the beany aroma that often makes high-quality vanilla seem full-flavored had long eluded science. People in the industry call the search for a complete mapping of a substance's volatile chemistry "chasing zero," and I met with a scientist working for Givaudan who had spent a great deal of time chasing this beaniness to zero. Doing so required multidimensional chromatography—a process for separating trace molecules out of a mixture—and expensive equipment. Last year, after evaluating hundreds of chemicals, he hit upon the three relevant molecules. "We found the beany contributors!" he told me. "We were very excited." The molecules were present at the level of parts per billion.

I asked Hagen how many chemicals she thought she could identify in a single bite of food. "I want to say twenty," she said. "If I am tasting a citrus fruit in the field, I could probably pick out ten chemicals for sure, and I could probably speculate about twenty-five more." Other flavorists said they could do about the same, and hearing them speak about the bouquet of Mountain Dew or Sprite—evaluating its arc, from top notes to bottom notes—you might think they were discussing a 1980 Montrachet. (Hagen told me that she thought Dr Pepper was "amazing," with a floral note that was unique and high. She spoke with awe of orange Gatorade: "I mean, that is *beautiful.*") During a meeting with several flavor professionals in New Jersey, I compared a flavor chemist's ability to break down the structure of a soft drink to the skills of Robert Parker, the wine critic. I was quickly corrected. "That's kind of like hocus-pocus," one of them said. "Parker may say that a wine has a nutty note or is oaky, but a lot of things can be behind that, and I don't think he's matching aspects of the flavor to a chemical compound and going, 'O.K., this note here, it comes from methyl isobutyrate.' " And yet controlled experiments show that, no matter what a person's professional vocabulary or expertise, aromas remain a blur: the average person, with minimal training, can perceive about three or four distinct components in a given aroma; professional flavorists—without leaning on their chemical knowledge of particular types of food—can do no better.

Even the most familiar products can bewilder us. Coca-Cola, for instance, is primarily a citrus beverage, its flavor derived from lemon, orange, and lime oils, combined with vanilla, cinnamon, other spices, and corn syrup. Its flavor has little in common with the astringent-tasting kola nut, from which it takes its name, and its caramel coloring is largely imposed. For many people, describing Coke's flavor as a combination of different parts is nearly impossible. (In one study, two-thirds of the subjects could not tell the difference between Classic Coke and Diet Coke.) If you close your



"I want a bagel!"

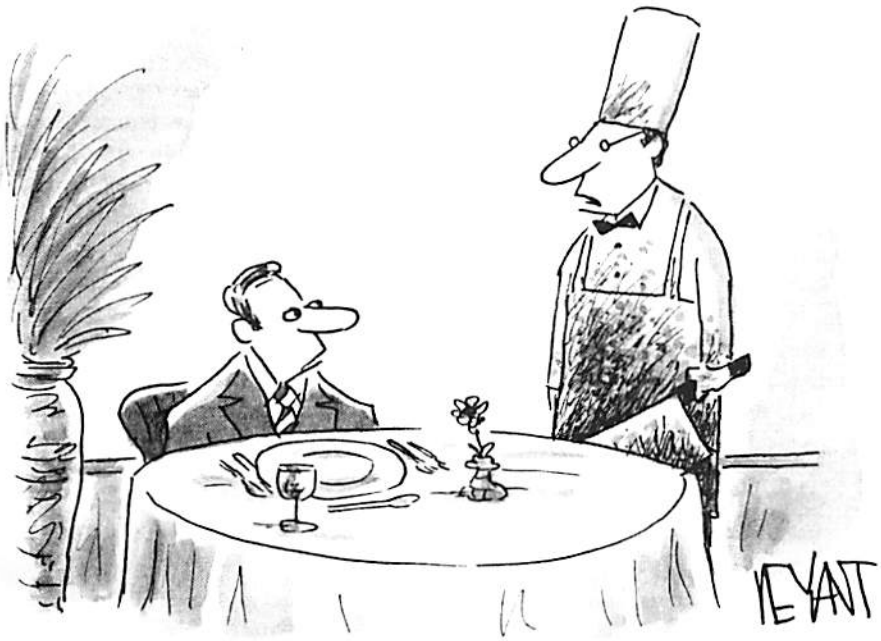
eyes, inhale deeply, and try to pay close attention to the volatile chemistry of Coke, it is possible to pick out a few basic elements, but for the average consumer the flavor is "cognitively impenetrable." That is, if you ask someone "What does Coke taste like?" the answer will be tautological: "It tastes like Coke." This presents a conundrum that many flavorists try not to think about. If consumers are cognitively unable to regard a flavor meaningfully, is there any point to what flavorists do? Hagen once told me, "My husband loves football, and so when I am watching the players on the sidelines drink Gatorade I'm thinking that they have no idea how complex that lemon-lime is. All they know is that it is quenching their thirst and it tastes good." Still, she was hoping to discover the next big drink. Coke's success is, in part, a testament to the sophistication of its formula, its exquisite balance, even if it does confound our senses.

By late morning, Hagen, Hassel, and the rest of the Givaudan team had begun eating salted crackers, trying to calm their palates after tasting so many citrons, oranges, and pomelos. The team had worked its way through half a dozen clementines. The Marisol clementine was a touch overripe, and its oil was oddly insectile. "It smells like crushed lightning bugs," Hagen said approvingly, as she held a Marisol rind to her nose. "Kind of like formates. When you crush an ant, there is formic acid, so formates belong to a family of molecules that are, to me, all buggy." The Nour clementine, from Morocco, was sweet. "There is something here that reminds me of bubble gum," Hagen said. "Very kid-friendly. Isoamyl acetate, which is the chemical that reminds people of Circus Peanuts." Hagen loved Hubba Bubba bubble gum as a child, and she thought that the Nour might have commercial potential. "It has a little bit of an edge," she said. "A friendly edge."

Exotic flavors rarely have immediate commercial appeal. Often, they must ease their way into the market, usually in combination with an old and well-loved companion. When, in the early nineties, Snapple paired kiwi with strawberry flavoring for its juice drink, the notion was considered highly innovative. Snapple had been working with the oldest American flavor house, Fritzsche Dodge & Olcott, which was acquired by Givaudan in 1991. Leonard Marsh, one of Snapple's founders, told me that the flavorists made a variety of fruit flavors for him, including kiwi, which he initially rejected. "It didn't taste good on its own," he told me. "I said, 'Can you mix this with something like strawberry?' " The result was wildly popular—and highly profitable for Givaudan. A former Givaudan executive told me, "We were selling Snapple fifty-five-gallon drums of kiwi-strawberry drink. At one point, we had purchased all the kiwi juice that was available globally."

Hagen told me that her favorite white-space flavor—the one she wished she had created—was Red Bull, because it succeeded in getting consumers to embrace the surreal. The co-founder of Red Bull, Dietrich Mateschitz, acknowledges that the company went out of its way to develop a flavor that was unorthodox. ("Some people say medicine never tastes good," he told me. "You can translate this into our taste philosophy.") Other flavorists were perplexed by Red Bull, which was created in 1987. "Have you ever tasted such a crazy flavor?" Hagen said. "What is it? There is nothing like it, and every once in a while you come across a flavor that is not especially balanced but for some reason it takes off." Today, it is virtually impossible to market an energy drink that does not have the same unbalanced characteristics that Red Bull has. "It scores terribly when you put it in front of consumers who don't think it is an energy drink," a salesman for one of the top flavor houses told me. "But the spiky note in there now defines 'energy.' So when I build energy flavors with our client it has got to taste bad. If you give the consumer a great-tasting orange flavor for an energy drink, their liking drops way down, because it doesn't have that 'energy note' they expect."

Midway through the trek, it became evident that the fruits of greatest interest to the flavorists had off notes that, in combination with more palatable natural chemicals, added enough aromatic discordance to make the flavors unique. The Jamaican Ugli fruit, a large tangelo with rough greenish-yellowish skin, which has slowly been gaining a commercial following, had a sulfuric undertone that Hagen suspected was caused by prenyl mercaptan—which is often found in skunky beer. "With Corona, because it is in a clear bottle, when light hits it, it oxidizes, so that's why you put a lime in Corona—to kill this mercaptan," Hagen said. "It is this yucky bad note that people like. And you're, like, O.K., whatever." When I tasted the



"Can I get you anything from the meat bar?"