Eric Schlosser, **Why McDonald's Fries Taste So Good**

The french fry was "almost sacrosanct for me," Ray Kroc, one of the founders of McDonald's, wrote in his autobiography, "its preparation a ritual to be followed religiously." During the chain's early years french fries were made from scratch every day. Russet Burbank potatoes were peeled, cut into shoestrings, and fried in McDonald's kitchens. As the chain expanded nationwide, in the mid-1960s, it sought to cut labor costs, reduce the number of suppliers, and ensure that its fries tasted the same at every restaurant. McDonald's began switching to frozen french fries in 1966—and few customers noticed the difference. Nevertheless, the change had a profound effect on the nation's agriculture and diet. A familiar food had been transformed into a highly processed industrial commodity. McDonald's fries now come from huge manufacturing plants that can peel, slice, cook, and freeze 2 million pounds of potatoes a day. The rapid expansion of McDonald's and the popularity of its low-cost, mass-produced fries changed the way Americans eat. In 1960 Americans consumed an average of about 81 pounds of fresh potatoes and 4 pounds of frozen french fries. In 2000 they consumed an average of about 50 pounds of fresh potatoes and 30 pounds of frozen fries. Today McDonald's is the largest buyer of potatoes in the United States.

For another reading on food, see Pollan, page 539. —Eds.

The taste of McDonald's french fries played a crucial role in the chain's success—fries are much more profitable than hamburgers—and was long praised by customers, competitors, and even food critics. James Beard loved McDonald's fries. Their distinctive taste does not stem from the kind of potatoes that McDonald's buys, the technology that processes them, or the restaurant equipment that fries them: Other chains use Russet Burbanks, buy their french fries from the same large processing companies, and have similar fryers in their restaurant kitchens. The taste of a french fry is largely determined by the cooking oil. For decades McDonald's cooked its french fries in a mixture of about 7 percent cottonseed oil and 93 percent beef tallow. The mixture gave the fries their unique flavor—and more saturated beef fat per ounce than a McDonald's hamburger.

In 1990, amid a barrage of criticism over the amount of cholesterol in its fries, McDonald's switched to pure vegetable oil. This presented the company with a challenge: how to make fries that subtly taste like beef without cooking them in beef tallow. A look at the ingredients in McDonald's french fries suggests how the problem was solved. Toward the end of the list is a seemingly innocuous yet oddly mysterious phrase: "natural flavor." That ingredient helps to explain not only why the fries taste so good but also why most fast food—indeed, most of the food Americans eat today—tastes the way it does.

Open your refrigerator, your freezer, your kitchen cupboards, and look at the labels on your food. You'll find "natural flavor" or "artificial flavor" in just about every list of ingredients. The similarities between these two broad categories are far more significant than the differences. Both are man-made additives that give most processed food most of its taste. People usually buy a food item the first time because of its packaging or appearance. Taste usually determines whether they buy it again. About 90 percent of the money that Americans now spend on food goes to buy processed food. The canning, freezing, and dehydrating techniques used in processing destroy most of food's flavor—and so a vast industry has arisen in the United States to make processed food palatable. Without this flavor industry today's fast food would not exist. The names of the leading American fast-food chains and their best-selling menu items have become embedded in our popular culture and famous worldwide. But few people can name the companies that manufacture fast food's taste.

Without the flavor industry today's fast food would not exist.

The flavor industry is highly secretive. Its leading companies will not divulge the precise formulas of flavor compounds or the identities of clients. The secrecy is deemed essential for protecting the reputations of beloved brands. The fast-food chains, understandably, would like the public to believe that the flavors of the food they sell somehow originate in their restaurant kitchens, not in distant factories run by other firms. A McDonald's french fry is one of countless foods whose flavor is just a component in a complex

manufacturing process. The look and the taste of what we eat now are frequently deceiving—by design.

The New Jersey Turnpike runs through the heart of the flavor industry, an industrial corridor dotted with refineries and chemical plants. International Flavors & Fragrances (IFF), the world's largest flavor company, has a manufacturing facility off Exit 8A in Dayton, New Jersey; Givaudan, the world's second-largest flavor company, has a plant in East Hanover. Haarmann & Reimer, the largest German flavor company, has a plant in Teterboro, as does Takasago, the largest Japanese flavor company. Flavor Dynamics has a plant in South Plainfield; Frutarom is in North Bergen; Elan Chemical is in Newark. Dozens of companies manufacture flavors in the corridor between Teaneck and South Brunswick. Altogether the area produces about two-thirds of the flavor additives sold in the United States.

The IFF plant in Dayton is a huge pale-blue building with a modern office complex attached to the front. It sits in an industrial park, not far from a BASF plastics factory, a Jolly French Toast factory, and a plant that manufactures Liz Claiborne cosmetics. Dozens of tractor-trailers were parked at the IFF loading dock the afternoon I visited, and a thin cloud of steam floated from a roof vent. Before entering the plant, I signed a nondisclosure form, promising not to reveal the brand names of foods that contain IFF flavors. The place reminded me of Willy Wonka's chocolate factory. Wonderful smells drifted through the hallways, men and women in neat white lab coats cheerfully went about their work, and hundreds of little glass bottles sat on laboratory tables and shelves. The bottles contained powerful but fragile flavor chemicals, shielded from light by brown glass and round white caps shut tight. The long chemical names on the little white labels were as mystifying to me as medieval Latin. These odd-sounding things would be mixed and poured and turned into new substances, like magic potions.

I was not invited into the manufacturing areas of the IFF plant, where, it was thought, I might discover trade secrets. Instead I toured various laboratories and pilot kitchens, where the flavors of well-established brands are tested or adjusted, and where whole new flavors are created. IFF's snack-and-savory lab is responsible for the flavors of potato chips, corn chips, breads, crackers, breakfast cereals, and pet food. The confectionery lab devises flavors for ice cream, cookies, candies, toothpastes, mouthwashes, and antacids. Everywhere I looked, I saw famous, widely advertised products sitting on laboratory desks and tables. The beverage lab was full of brightly colored liquids in clear bottles. It comes up with flavors for popular soft drinks, sports drinks, bottled teas, and wine coolers, for all-natural juice drinks, organic soy drinks, beers, and malt liquors. In one pilot kitchen I saw a dapper food technologist, a middle-aged man with an elegant tie beneath his crisp lab coat, carefully preparing a batch of cookies with white frosting and pink-and-white sprinkles. In another pilot kitchen I saw a pizza oven, a grill, a milk-shake machine, and a french fryer identical to those I'd seen at innumerable fast-food restaurants.

The confectionary lab devises flavors for ice cream, cookies, mouthwashes, and antacids.

In addition to being the world's largest flavor company, IFF manufactures the smells of six of the ten best-selling fine perfumes in the United States, including Estée Lauder's Beautiful, Clinique's Happy, Lancôme's Trésor, and Calvin Klein's Eternity. It also makes the smells of household products such as deodorant, dishwashing detergent, bath soap, shampoo, furniture polish, and floor wax. All these aromas are made through essentially the same process: the manipulation of volatile chemicals. The basic science behind the scent of your shaving cream is the same as that governing the flavor of your TV dinner.

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Scientists now believe that human beings acquired the sense of taste as a way to avoid being poisoned. Edible plants generally taste sweet, harmful ones bitter. The taste buds on our tongues can detect the presence of half a dozen or so basic tastes, including sweet, sour, bitter, salty, astringent, and umami, a taste discovered by Japanese researchers—a rich and full sense of deliciousness triggered by amino acids in foods such as meat, shellfish, mushrooms, potatoes, and seaweed. Taste buds offer a limited means of detection, however, compared with the human olfactory system, which can perceive thousands of different chemical aromas. Indeed, "flavor" is primarily the smell of gases being released by the chemicals you've just put in your mouth. The aroma of a food can be responsible for as much as 90 percent of its taste.

The act of drinking, sucking, or chewing a substance releases its volatile gases. They flow out of your mouth and up your nostrils, or up the passageway in the back of your mouth, to a thin layer of nerve cells called the olfactory epithelium, located at the base of your nose, right between your eyes. Your brain combines the complex smell signals from your olfactory epithelium with the simple taste signals from your tongue, assigns a flavor to what's in your mouth, and decides if it's something you want to eat.

A person's food preferences, like his or her personality, are formed during the first few years of life, through a process of socialization. Babies innately prefer sweet tastes and reject bitter ones; toddlers can learn to enjoy hot and spicy food, bland health food, or fast food, depending on what the people around them eat. The human sense of smell is still not fully understood. It is greatly affected by psychological factors and expectations. The mind focuses intently on some of the aromas that surround us and filters out the overwhelming majority. People can grow accustomed to bad smells or good smells; they stop noticing what once seemed overpowering. Aroma and memory are somehow inextricably linked. A smell can suddenly evoke a long-forgotten moment. The flavors of childhood foods seem to leave an indelible mark, and adults often return to them, without always knowing why. These "comfort foods" become a source of pleasure and reassurance—a fact that fast-food chains use to their advantage. Childhood memories of Happy Meals, which come with french fries, can translate into frequent adult visits to McDonald's. On average, Americans now eat about four servings of french fries every week.

Quick frozen—for quick serving

An old-fashioned fried chicken dinner

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Remember how Mom used to get up early every Sunday to fix a scrumptious chicken dinner? We do . . . so we've patterned our newest TV Dinner after that good, old-fashioned feast. However, our complete chicken dinners are all cooked and ready to pop into the oven on their own individual serving trays. No thawing.

In 25 minutes, you'll be enjoying this irresistible well-balanced meal: Plenty of extra-meaty, extra-tender, golden-fried Swanson Chicken . . . garden-fresh vegetables . . . and fluffy mashed potatoes whipped in milk.

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A 1950s ad promoting a highly processed version of a "good, old-fashioned feast."

The human craving for flavor has been a largely unacknowledged and unexamined force in history. For millennia royal empires have been built, unexplored lands traversed, and great religions and philosophies forever changed by the spice trade. In 1492 Christopher Columbus set sail to find seasoning. Today the influence of flavor in the world marketplace is no less decisive. The rise and fall of corporate empires—of soft-drink companies, snack-food companies, and fast-food chains—is often determined by how their products taste.

The flavor industry emerged in the mid-nineteenth century, as processed foods began to be manufactured on a large scale. Recognizing the need for flavor additives, early food processors turned to perfume companies that had long experience working with essential oils and volatile aromas. The great perfume houses of England, France, and the Netherlands produced many of the first flavor compounds. In the early part of the twentieth century Germany took the technological lead in flavor production, owing to its powerful chemical industry. Legend has it that a German scientist discovered methyl anthranilate, one of the first artificial flavors, by accident while mixing chemicals in his laboratory. Suddenly the lab was filled with the sweet smell of grapes. Methyl anthranilate later became the chief flavor compound in grape Kool-Aid. After World War II much of the perfume industry shifted from Europe to the United States, settling in New York City near the garment district and the fashion houses. The flavor industry came with it, later moving to New Jersey for greater plant capacity. Man-made flavor additives were used mostly in baked goods, candies, and sodas until the 1950s, when sales of processed food began to soar. The invention of gas chromatographs and mass spectrometers—machines capable of detecting volatile gases at low levels—vastly increased the number of flavors that could be synthesized. By the mid-1960s flavor companies were churning out compounds to supply the taste of Pop Tarts, Bac-Os, Tab, Tang, Filet-O-Fish sandwiches, and literally thousands of other new foods.

In 1492 Christopher Columbus set sail to find seasoning.

The American flavor industry now has annual revenues of about $1.4 billion. Approximately 10,000 new processed-food products are introduced every year in the United States. Almost all of them require flavor additives. And about 9 out of 10 of these products fail. The latest flavor innovations and corporate realignments are heralded in publications such as *Chemical Market Reporter, Food Chemical News, Food Engineering,* and *Food Product Design.* The progress of IFF has mirrored that of the flavor industry as a whole. IFF was formed in 1958, through the merger of two small companies. Its annual revenues have grown almost fifteenfold since the early 1970s, and it currently has manufacturing facilities in 20 countries.

Today's sophisticated spectrometers, gas chromatographs, and headspace-vapor analyzers provide a detailed map of a food's flavor components, detecting chemical aromas present in amounts as low as one part per billion. The human nose, however, is even more sensitive. A nose can detect aromas present in quantities of a few parts per trillion—an amount equivalent to about 0.000000000003 percent. Complex aromas, such as those of coffee and roasted meat, are composed of volatile gases from nearly a thousand different chemicals. The smell of a strawberry arises from the interaction of about 350 chemicals that are present in minute amounts. The quality that people seek most of all in a food—flavor—is usually present in a quantity too infinitesimal to be measured in traditional culinary terms such as ounces or teaspoons. The chemical that provides the dominant flavor of bell pepper can be tasted in amounts as low as 0.02 parts per billion; one

drop is sufficient to add flavor to five average-size swimming pools. The flavor additive usually comes next to last in a processed food's list of ingredients and often costs less than its packaging. Soft drinks contain a larger proportion of flavor additives than most products. The flavor in a 12-ounce can of Coke costs about half a cent.

The color additives in processed foods are usually present in even smaller amounts than the flavor compounds. Many of New Jersey's flavor companies also manufacture these color additives, which are used to make processed foods look fresh and appealing. Food coloring serves many of the same decorative purposes as lipstick, eye shadow, mascara—and is often made from the same pigments. Titanium dioxide, for example, has proved to be an especially versatile mineral. It gives many processed candies, frostings, and icings their bright white color; it is a common ingredient in women's cosmetics; and it is the pigment used in many white oil paints and house paints. At Burger King, Wendy's, and McDonald's coloring agents have been added to many of the soft drinks, salad dressings, cookies, condiments, chicken dishes, and sandwich buns.

Studies have found that the color of a food can greatly affect how its taste is perceived. Brightly colored foods frequently seem to taste better than bland-looking foods, even when the flavor compounds are identical. Foods that somehow look off-color often seem to have off tastes. For thousands of years human beings have relied on visual cues to help determine what is edible. The color of fruit suggests whether it is ripe, the color of meat whether it is rancid. Flavor researchers sometimes use colored lights to modify the influence of visual cues during taste tests. During one experiment in the early 1970s people were served an oddly tinted meal of steak and french fries that appeared normal beneath colored lights. Everyone thought the meal tasted fine until the lighting was changed. Once it became apparent that the steak was actually blue and the fries were green, some people became ill.

The federal Food and Drug Administration does not require companies to disclose the ingredients of their color or flavor additives so long as all the chemicals in them are considered by the agency to be GRAS ("generally recognized as safe"). This enables companies to maintain the secrecy of their formulas. It also hides the fact that flavor compounds often contain more ingredients than the foods to which they give taste. The phrase "artificial strawberry flavor" gives little hint of the chemical wizardry and manufacturing skill that can make a highly processed food taste like strawberries.

A typical artificial strawberry flavor, like the kind found in a Burger King strawberry milk shake, contains the following ingredients: amyl acetate, amyl butyrate, amyl valerate, anethol, anisyl formate, benzyl acetate, benzyl isobutyrate, butyric acid, cinnamyl isobutyrate, cinnamyl valerate, cognac essential oil, diacetyl, dipropyl ketone, ethyl acetate, ethyl amyl ketone, ethyl butyrate, ethyl cinnamate, ethyl heptanoate, ethyl heptylate, ethyl lactate, ethyl methylphenylglycidate, ethyl nitrate, ethyl propionate, ethyl valerate, heliotropin, hydroxyphenyl-2-butanone (10 percent solution in alcohol), α-ionone, isobutyl anthranilate, isobutyl butyrate, lemon essential oil, maltol, 4-methylacetophenone, methyl anthranilate, methyl benzoate, methyl cinnamate, methyl heptine carbonate, methyl naphthyl ketone, methyl salicylate,

FOUND

from mcdonalds.com

MCDONALD'S FRENCH FRIES: LIST OF INGREDIENTS

French fries

Potatoes
Partially hydrogenated soybean oil
Natural flavor (beef source)
Dextrose
Sodium acid pyrophosphate (to preserve natural color)
Cooked in partially hydrogenated oils (may contain partially hydrogenated soybean oil and/or partially hydrogenated corn oil and/or partially hydrogenated canola oil and/or cottonseed oil and/or sunflower oil and/or corn oil)

Ketchup packet

Tomato concentrate from red ripe tomatoes
Distilled vinegar
High fructose corn syrup
Corn syrup
Water
Salt
Natural flavors (vegetable source)

Salt packet

Table salt

McDonald's attempts to provide nutrition and ingredient information regarding its products that is as complete as possible. Some menu items may not be available at all restaurants; test products, test formulations, or regional items have not been included. While the ingredient information is based on standard product formulations, variations may occur depending on the local supplier, the region of the country, and the season of the year. Further, product formulations change periodically. Serving sizes may vary from quantity upon which the analysis was conducted. Serving size designation for beverages refers to total cup capacity; the actual amounts of beverage (and ice) may vary. No products are certified as vegetarian; all products may contain trace amounts of ingredients derived from animals. If you wish further information or have special sensitivities or dietary concerns regarding specific ingredients in specific menu items please call us at the number below. This listing is continuously updated in an attempt to reflect the current status of our products and may vary from printed materials.

McDonald's Quality & Nutrition Information, McDonald's Corporation, 2111 McDonald's Drive, Oak Brook, IL 60523, 1-877-MCD-FOOD

mint essential oil, neroli essential oil, nerolin, neryl isobutyrate, orris butter, phenethyl alcohol, rose, rum ether, γ-undecalactone, vanillin, and solvent.

Although flavors usually arise from a mixture of many different volatile chemicals, often a single compound supplies the dominant aroma. Smelled alone, that chemical provides an unmistakable sense of the food. Ethyl-2-methyl butyrate, for example, smells just like an apple. Many of today's highly processed foods offer a blank palette: Whatever chemicals are added to them will give them specific tastes. Adding methyl-2-pyridyl ketone makes something taste like popcorn. Adding ethyl-3-hydroxy butanoate makes it taste like marshmallow. The possibilities are now almost limitless. Without affecting appearance or nutritional value, processed foods could be made with aroma chemicals such as hexanal (the smell of freshly cut grass) or 3-methyl butanoic acid (the smell of body odor).

The 1960s were the heyday of artificial flavors in the United States. The synthetic versions of flavor compounds were not subtle, but they did not have to be, given the nature of most processed food. For the past 20 years food processors have tried hard to use only "natural flavors" in their products. According to the FDA, these must be derived entirely from natural sources—from herbs, spices, fruits, vegetables, beef, chicken, yeast, bark, roots, and so forth. Consumers prefer to see natural flavors on a label, out of a belief that they are more healthful. Distinctions between artificial and natural flavors can be arbitrary and somewhat absurd, based more on how the flavor has been made than on what it actually contains.

Natural flavors and artificial flavors sometimes contain exactly the same chemicals, produced through different methods.

"A natural flavor," says Terry Acree, a professor of food science at Cornell University, "is a flavor that's been derived with an out-of-date technology." Natural flavors and artificial flavors sometimes contain exactly the same chemicals, produced through different methods. Amyl acetate, for example, provides the dominant note of banana flavor. When it is distilled from bananas with a solvent, amyl acetate is a natural flavor. When it is produced by mixing vinegar with amyl alcohol and adding sulfuric acid as a catalyst, amyl acetate is an artificial flavor. Either way it smells and tastes the same. "Natural flavor" is now listed among the ingredients of everything from Health Valley Blueberry Granola Bars to Taco Bell Hot Taco Sauce.

A natural flavor is not necessarily more healthful or purer than an artificial one. When almond flavor—benzaldehyde—is derived from natural sources, such as peach and apricot pits, it contains traces of hydrogen cyanide, a deadly poison. Benzaldehyde derived by mixing oil of clove and amyl acetate does not contain any cyanide. Nevertheless, it is legally considered an artificial flavor and sells at a much lower price. Natural and artificial flavors are now manufactured at the same chemical plants, places that few people would associate with Mother Nature.

The small and elite group of scientists who create most of the flavor in most of the food now consumed in the United States are called "flavorists." They draw on a number of disciplines in their work: biology, psychology, physiology, and organic chemistry. A flavorist is a chemist with a trained nose and a poetic sensibility. Flavors are created by blending scores of different chemicals in tiny amounts—a process governed by scientific principles but demanding a fair amount of art. In an age when delicate aromas and microwave ovens do not easily coexist, the job of the flavorist is to conjure illusions about processed food and, in the words of one flavor company's literature, to ensure "consumer likeability." The flavorists with whom I spoke were discreet, in keeping with the dictates of their trade. They were also charming, cosmopolitan, and ironic. They not only enjoyed fine wine but could identify the chemicals that give each grape its unique aroma. One flavorist compared his work to composing music. A well-made flavor compound will have a "top note" that is often followed by a "dry-down" and a "leveling-off," with different chemicals responsible for each stage. The taste of a food can be radically altered by minute changes in the flavoring combination. "A little odor goes a long way," one flavorist told me.

A flavorist is a chemist with a trained nose and a poetic sensibility.

In order to give a processed food a taste that consumers will find appealing, a flavorist must always consider the food's "mouthfeel"—the unique combination of textures and chemical interactions that affect how the flavor is perceived. Mouthfeel can be adjusted through the use of various fats; gums, starches, emulsifiers, and stabilizers. The aroma chemicals in a food can be precisely analyzed, but the elements that make up mouthfeel are much harder to measure. How does one quantify a pretzel's hardness, a french fry's crispness? Food technologists are now conducting basic research in rheology, the branch of physics that examines the flow and deformation of materials. A number of companies sell sophisticated devices that attempt to measure mouthfeel. The TA.XT2i Texture Analyzer, produced by the Texture Technologies Corporation, of Scarsdale, New York, performs calculations based on data derived from as many as 250 separate probes. It is essentially a mechanical mouth. It gauges the most important rheological properties of a food—bounce, creep, breaking point, density, crunchiness, chewiness, gumminess, lumpiness, rubberiness, springiness, slipperiness, smoothness, softness, wetness, juiciness, spreadability, springback, and tackiness.

Some of the most important advances in flavor manufacturing are now occurring in the field of biotechnology. Complex flavors are being made using enzyme reactions, fermentation, and fungal and tissue cultures. All the flavors created by these methods—including the ones being synthesized by fungi—are considered natural flavors by the FDA. The new enzyme-based processes are responsible for extremely true-to-life dairy flavors. One company now offers not just butter flavor but also fresh creamy butter, cheesy butter, milky butter, savory melted butter, and super-concentrated butter flavor, in liquid or powder form. The development of new fermentation techniques, along with new techniques for heating mixtures of sugar and amino acids, have led to the creation of much more realistic meat flavors.

The McDonald's Corporation most likely drew on these advances when it eliminated beef tallow from its french fries. The company will not reveal the exact origin of the natural flavor added to its fries. In response to inquiries from *Vegetarian*

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Journal, however, McDonald's did acknowledge that its fries derive some of their characteristic flavor from "an animal source." Beef is the probable source, although other meats cannot be ruled out. In France, for example, fries are sometimes cooked in duck fat or horse tallow.

Other popular fast foods derive their flavor from unexpected ingredients. McDonald's Chicken McNuggets contain beef extracts, as does Wendy's Grilled Chicken Sandwich. Burger King's BK Broiler Chicken Breast Patty contains "natural smoke flavor." A firm called Red Arrow Products specializes in smoke flavor, which is added to barbecue sauces, snack foods, and processed meats. Red Arrow manufactures natural smoke flavor by charring sawdust and capturing the aroma chemicals released into the air. The smoke is captured in water and then bottled, so that other companies can sell food that seems to have been cooked over a fire.

The Vegetarian Legal Action Network recently petitioned the FDA to issue new labeling requirements for foods that contain natural flavors. The group wants food processors to list the basic origins of their flavors on their labels. At the moment vegetarians often have no way of knowing whether a flavor additive contains beef, pork, poultry, or shellfish. One of the most widely used color additives—whose presence is often hidden by the phrase "color added"—violates a number of religious dietary restrictions, may cause allergic reactions in susceptible people, and comes from an unusual source. Cochineal extract (also known as carmine or carminic acid) is made from the desiccated bodies of female *Dactylopius coccus Costa*, a small insect harvested mainly in Peru and the Canary Islands. The bug feeds on red cactus berries, and color from the berries accumulates in the females and their unhatched larvae. The insects are collected, dried, and ground into a pigment. It takes about seventy thousand of them to produce a pound of carmine, which is used to make processed foods look pink, red, or purple. Dannon strawberry yogurt gets its color from carmine, and so do many frozen fruit bars, candies, and fruit fillings, and Ocean Spray pink-grapefruit juice drink.

In a meeting room at IFF, Brian Grainger let me sample some of the company's flavors. It was an unusual taste test—there was no food to taste. Grainger is a senior flavorist at IFF, a soft-spoken chemist with graying hair, an English accent, and a fondness for understatement. He could easily be mistaken for a British diplomat or the owner of a West End brasserie with two Michelin stars. Like many in the flavor industry, he has an Old World, old-fashioned sensibility. When I suggested that IFF's policy of secrecy and discretion was out of step with our mass-marketing, brand-conscious, self-promoting age, and that the company should put its own logo on the countless products that bear its flavors, instead of allowing other companies to enjoy the consumer loyalty and affection inspired by those flavors, Grainger politely disagreed, assuring me that such a thing would never be done. In the absence of public credit or acclaim, the small and secretive fraternity of flavor chemists praise one another's work. By analyzing the flavor formula of a product, Grainger can often tell which of his counterparts at a rival firm devised it. Whenever he walks down a supermarket aisle, he takes a quiet pleasure in seeing the well-known foods that contain his flavors.

Grainger had brought a dozen small glass bottles from the lab. After he opened each bottle, I dipped a fragrance-testing filter into it—a long white strip of paper designed to absorb aroma chemicals without producing off notes. Before placing each strip of paper in front of my nose, I closed my eyes. Then I inhaled deeply, and one food after another was conjured from the glass bottles. I smelled fresh cherries, black olives, sautéed onions, and shrimp. Grainger's most remarkable creation took me by surprise. After closing my eyes, I suddenly smelled a grilled hamburger. The aroma was uncanny, almost miraculous—as if someone in the room were flipping burgers on a hot grill. But when I opened my eyes, I saw just a narrow strip of white paper and a flavorist with a grin.