Fast Food Nation

By Eric Schlosser

The bitter truth about fast food

It's no good denying it: people like fast food because it can taste pretty good. But what they may not know about is the cocktail of chemicals that gives the French fry its taste - nor the grisly events in the slaughterhouses that can put something nasty in the burger along with the beef. Eric Schlosser follows the food chain in the US, home of the fast food franchise

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Pull open the glass door, feel the rush of cool air, walk in, get in line, study the backlit color photographs above the counter, place your order, hand over a few dollars.

Watch teenagers in uniforms pushing various buttons, and moments later take hold of a plastic tray full of food wrapped in colored paper and cardboard. The whole experience of buying fast food has become so routine, so thoroughly unexceptional and mundane, that it is now taken for granted, like brushing your teeth or stopping for a red light. It has become a social custom as American as a small, rectangular, hand-held, frozen and reheated apple pie.

Over the past three decades, an industry that began with a handful of hot dog and hamburger stands in southern California has spread to almost every corner of the globe.

Fast food is now served at restaurants, stadiums, airports, zoos, schools and universities, on cruise ships, trains and aero planes, at supermarkets, petrol stations and even in hospital cafeterias. Americans now spend more money on fast food - $110 bn last year - than they do on higher education. They spend more on fast food than on movies, books, magazines, newspapers, videos and recorded music - combined.

What people eat (or don't eat) has always been determined by a complex interplay of social, economic and technological forces. The early Roman Republic was fed by its citizen-farmers; the Roman Empire, by its slaves.

During a relatively brief period of time, the fast food industry has helped transform not only our diet, but also the landscape, economy, workforce and popular culture. Fast food and its consequences have become inescapable, regardless of whether you eat it twice a day or have never taken a single bite. In some cases (such as the malling and sprawling of the west), the fast food industry has been a catalyst and a symptom of larger economic trends.

In other cases (such as the rise of franchising and the spread of obesity), fast food has played a central role. Hundreds of millions of people buy fast food every day without giving it much thought, unaware of the subtle and not so subtle ramifications of their purchases. They rarely consider where this food came from, how it was made, what it is doing to the community around them. I think people should know what lies behind the shiny, happy surface of every fast food transaction. They should know what really lurks between those sesame-seed buns. As the old saying goes: You are what you eat.

During my research for the book, I ate an enormous amount of fast food. Most of it tasted pretty good. That is one of the main reasons people buy fast food; it has been carefully designed to taste good.

The taste of McDonald's French fries, for example, has long been praised by customers, competitors and even food critics. James Beard, the legendary American gourmet, loved McDonald's fries.

Their distinctive taste does not stem from the type of potatoes that McDonald's buys, the technology that processes them, or the restaurant equipment that fries them. Other chains buy their French fries from the same large processing companies, use Russet Burbanks and have similar fryers in their restaurant kitchens.

The taste of a fast-food fry is largely determined by the cooking oil. For decades, McDonald's cooked its French fries in a mixture of about 7% cottonseed oil and 93% beef tallow. **The mix gave the fries their unique flavor - and more saturated beef fat per ounce than a McDonald's hamburger**.

Amid a barrage of criticism over the amount of cholesterol in its fries, McDonald's switched to pure vegetable oil in 1990. The switch presented the company with an enormous challenge: how to make fries that subtly taste like beef without cooking them in tallow.

A look at the ingredients now used in the preparation of McDonald's French fries suggests how the problem was solved. At 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 their differences. Both are man-made additives that give most processed food its taste. The initial purchase of a food item may be driven by its packaging or appearance, but subsequent purchases are determined mainly by its taste.

About 90% of the money that Americans spend on food is used to buy processed food. But the canning, freezing and dehydrating techniques used to process food destroy much of its flavor.

Since the end of the second world war, a vast industry has arisen in the US to make processed food palatable. The names of the leading fast-food chains and their bestselling menu items have become famous worldwide, embedded in our popular culture. Few people, however, can name the companies that manufacture fast food's taste.

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 reputation of beloved brands. The fast-food chains, understandably, would like the public to believe that the flavors of their food somehow originate in their restaurant kitchens, not in distant factories run by other firms.

The New Jersey Turnpike runs through the heart of the flavor industry, an industrial corridor dotted with refineries and chemical plants. International Flavors and Fragrances (IFF), the world's largest flavor company, has a manufacturing facility in Dayton, New Jersey.

The plant 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 non-disclosure form, promising not to reveal the brand names of products 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 and fragile flavor chemicals, shielded from light by the brown glass and round plastic caps shut tight. The long chemical names on the little white labels were as mystifying to me as medieval Latin. They were the odd-sounding names of things that would be mixed and poured and turned into new substances, like magic potions.

I was not invited to see 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 flavor of crisps, corn chips, breads, crackers, breakfast cereals and pet food. The confectionery lab devises the flavor for ice cream, biscuits, sweets, toothpastes, mouthwashes and antacids.

Everywhere I looked, I saw famous, widely-advertised products sitting on laboratory desks and tables. **The beverage lab is full of brightly colored liquids in clear bottles. It comes up with the flavor for popular soft drinks, sport 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 lab coat, carefully preparing a batch of biscuits 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 behind the counter at countless fast-food restaurants.

In addition to being the world's largest flavor company, IFF manufactures the smell of six of the 10 bestselling perfumes in the US, including Estee Lauder's Beautiful, Clinique's Happy, Lancome's Tresor and Calvin Klein's Eternity.

It also makes the smell of household products such as deodorant, dishwashing detergent, bath soap, shampoo, furniture polish and floor wax. **All of these aromas are made through the same basic process: the manipulation of volatile chemicals to create a particular smell.** The basic science behind the scent of your shaving cream is the same as that governing the flavor of your TV dinner.

Scientists now believe that human beings acquired the sense of taste as a way to avoid being poisoned. Edible plants generally taste sweet; deadly ones, bitter. Taste is supposed to help us differentiate food that's good for us from food that's not.

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 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 food can be responsible for as much as 90% of its flavor.

The act of drinking, sucking or chewing a substance releases its volatile gases. They flow out of the mouth and up the nostrils, or up the passageway at the back of the mouth, to a thin layer of nerve cells called the olfactory epithelium, located at the base of the nose, right between the eyes.

The brain combines the complex smell signals from the epithelium with the simple taste signals from the tongue, assigns a flavor to what's in your mouth, and decides if it's something you want to eat.

Babies like sweet tastes and reject bitter ones; we know this because scientists have rubbed various flavors inside the mouths of infants and then recorded their facial reactions.

A person's food preferences, like his or her personality, are formed during the first few years of life, through a process of socialization. Toddlers can learn to enjoy hot and spicy food, bland health food, or fast food, depending upon 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 filters out the overwhelming majority of chemical aromas that surround us, focusing intently on some, ignoring others. 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 work hard to promote. Childhood memories of Happy Meals can translate into frequent adult visits to McDonald's, like those of the chain's "heavy users", the customers who eat there four or five times a week.

The human craving for flavor has been a largely unacknowledged and unexamined force in history.

Royal empires have been built, unexplored lands have been traversed, great religions and philosophies have been 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 frequently determined by how their products taste.

The flavor industry emerged in the mid-1800s, as processed foods began to be manufactured on a large scale.

Recognizing the need for flavor additives, the early food processors turned to perfume companies that had years of 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 20th century, Germany's powerful chemical industry assumed the lead in flavor production. 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 flavoring compound of grape Kool-Aid.

After the second world war, much of the perfume industry shifted from Europe to the US, settling in New York City near the garment district and the fashion houses. The flavor industry came with it, subsequently moving to New Jersey to gain more plant capacity.

Man-made flavor additives were used mainly in baked goods, sweets and soft drinks until the 50s, 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-60s, the American flavor industry was churning out compounds to supply the taste of Pop Tarts, Bac-Os, Tab, Tang, Filet--Fish sandwiches and thousands of other new foods.

The American flavor industry now has annual revenues of about $1.4bn. Approximately 10,000 new processed food products are introduced every year in the US. Almost all of them require flavor additives.

And about nine out of every 10 of these new food products fail. The growth of IFF, in fact, 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 fifteen fold since the early 70s, and it now has manufacturing facilities in 20 countries.

The quality that people seek most of all in a food, its flavor, is usually present in a quantity too infinitesimal to be measured by any traditional culinary terms such as ounces or teaspoons.

Today's sophisticated spectrometers, gas chromatographs and headspace vapor analyzers provide a detailed map of a food's flavor

components, detecting chemical aromas in amounts as low as one part per billion.

The human nose, however, is still more sensitive than any machine yet invented. A nose can detect aromas present in quantities of a few parts per trillion. Complex aromas, such as those of coffee or roasted meat, may be composed of volatile gases from nearly a thousand different chemicals. 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 the amount of water needed to fill five average-size swimming pools.

The flavor additive usually comes last, or second to last, in a processed food's list of ingredients.

As a result, the flavor of a processed food often costs less than its packaging. Soft drinks contain a larger proportion of flavor additives than most products. The flavor in a 12 oz 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 sweets, 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 70s 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 Food and Drug Administration (FDA) does not require flavor companies to disclose the ingredients of their additives, so long as all the chemicals are considered by the agency to be GRAS (generally regarded as safe).

This lack of public disclosure enables the companies to maintain the secrecy of their formulas. The ubiquitous phrase "artificial strawberry flavor" gives little hint of the chemical wizardry and manufacturing skill that can make a highly processed food taste like a strawberry.

A typical artificial strawberry flavor, such as that 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, ethlyl lactate, ethyl methylphenylglycidate, ethyl nitrate, ethyl propionate, ethyl valerate, heliotropin, hydroxyphenyl-2-butonone (10% solution in

alcohol), a-ionone, isobutyl anthranilate, isobutyl butyrate, lemon essential oil, maltol, 4-methylactophenone, methyl anthranilate, methyl benzoate, methyl cinnamate, methyl heptine carbonate, methyl naphthyl ketone, methyl salicylate, mint essential oil, neroli essential oil, nerolin, neryl isobutyrate, orris butter, phenethyl alcohol, rose, rum ether, gundecalactone, vanillin and **solvent.**

A single compound often supplies the dominant aroma, providing an unmistakable sense of the food. Ethyl-2-methyl butyrate, for example, smells just like an apple. Today's highly processed foods offer a blank palette: whatever chemicals you add will give them specific tastes.

Adding methyl-2-peridylketone makes something taste like popcorn. Adding ethyl-3-hydroxybutonoate makes it taste like marshmallow. The possibilities are almost limitless. Without affecting the appearance or nutritional value, processed foods could even 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 60s were the heyday of artificial flavors. The synthetic versions of flavor compounds were not subtle, but they did not need 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, etc. Consumers prefer to see natural flavors on a label, out of a belief that they are healthier.

But the distinction between artificial and natural flavors can be somewhat arbitrary and absurd, based more on how the flavor has been made than on what it actually contains.

"A natural flavor," says Terry Acree, a professor of food science technology 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 you distil it from bananas with a solvent, amyl acetate is a natural flavor. When you produce it by mixing vinegar with amyl alcohol, adding sulpheric acid as a catalyst, amyl acetate is an artificial flavor. Either way, it smells and tastes the same. The phrase "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 healthier 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, which is derived through a different process (by mixing oil of clove and the banana flavor, 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 manufactured at the same chemical plants, places that few people would associate with Mother Nature. Calling any of these flavors "natural" requires a flexible attitude toward the English language and a fair amount of irony.

The small and elite group of scientists who create most of the flavor in most of the food now consumed in the US are called "flavorists". They draw upon 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 where delicate aromas, subtle flavors 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 charming, cosmopolitan and ironic. They were also discreet, in keeping with the dictates of their trade. They were the sort of scientist who not only enjoyed fine wine, but could also tell you the chemicals that give each vintage its unique aroma.

One flavorist compared his work to composing music - a well-made flavor compound will have a "top note", 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 mix. "A little odor goes a long way," one flavorist said.

In order to give a processed food the proper taste, a flavorist must always consider the food's "mouth feel" - the unique combination of textures and chemical interactions that affects how the flavor is perceived.

The mouth feel can be adjusted through the use of various fats, gums, starches, emulsifiers and stabilizers. The aroma chemicals of a food can be precisely analyzed, but mouth feel is much harder to measure. How does one quantify a French fry's crispness? Food technologists are now conducting basic research in rheology, a branch of physics that examines the flow and deformation of materials.

A number of companies sell sophisticated devices that attempt to measure mouth feel. The TA.XT2i Texture Analyzer, produced by the Texture Technologies Corporation, 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 - the bounce, creep, breaking point, density, crunchiness, chewiness, gumminess, lumpiness, rubberiness, 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 through fermentation, enzyme reactions, fungal cultures and tissue cultures.

All of the flavors being created through these methods - including the ones being synthesized by funguses - are considered natural flavors by the FDA.

The new enzyme-based processes are responsible for extremely lifelike 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, as well as 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 will not reveal the exact origin of the natural flavor added to its French fries. In response to enquiries from Vegetarian Journal, however, McDonald's did acknowledge that its fries derive some of their characteristic flavor from "animal products".**

Other popular fast foods derive their flavor from unexpected sources. Wendy's grilled chicken sandwich, for example, contains beef extracts. Burger King's BK broiler chicken breast patty contains "natural smoke flavor". A firm called Red Arrow Products Company specializes in smoke flavor, which is added to barbecue sauces 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 requirement 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 70,000 of them to produce a pound of carmine, which is used to make processed foods look pink, red, or purple.**

Some strawberry yoghurt gets its color from carmine, and so do many frozen fruit bars, sweets 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 wasn't any 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 which seems out of step with our brand-conscious, egocentric age.

When I suggested that IFF should put its own logo on the products that contain its flavors - instead of allowing other brands to enjoy the consumer loyalty and affection inspired by these 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 praises one another's work. Grainger can often tell, by analyzing the flavor formula of a product, which of his counterparts at a rival firm devised it. And he enjoys walking down supermarket aisles, looking at the many products that contain his flavors, even if no one else knows it.

Grainger had brought a dozen small glass bottles from the lab. As he opened each bottle, I dipped a fragrance-testing filter into it. The filters were long, white strips of paper designed to absorb aroma chemicals without producing off-notes. Before placing the strips of paper before 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, salted onions and shrimp.

Grainger's most remarkable creation took me by surprise. After closing my eyes, I suddenly smelled a grilled hamburger. It smelled like someone else in the room was flipping burgers on a hot grill. But when I opened my eyes, there was just a narrow strip of white paper and a smiling flavorist.

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