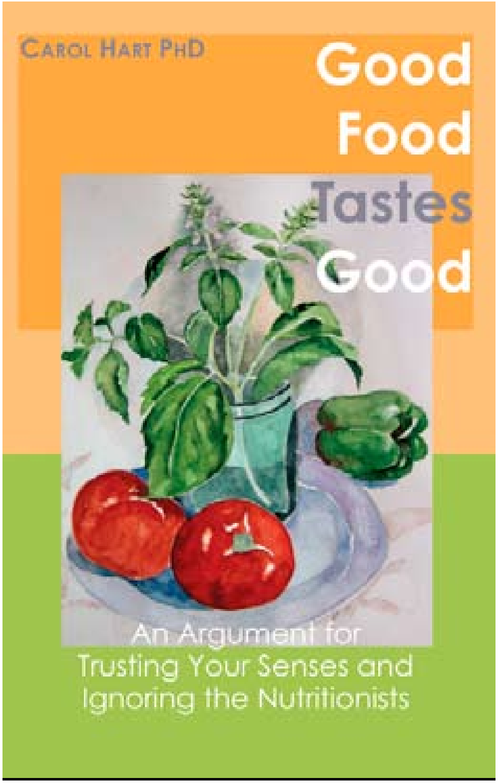

GOOD FOOD TASTES GOOD

An Argument for Trusting Your Senses and Ignoring the Nutritionists

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Introduction and Bill of Fare

I UNDERTOOK THIS BOOK TO ANSWER questions that I had about my food and that I believe other people have too. At the time, I had my food shopping and cooking routine down to about an hour a day, precious time grudgingly spent, since I viewed cooking only as a necessary chore. It was mostly one-stop shopping and one-dish meals—a lot of pasta, a lot of main-course salads, an occasional soup or bean dish or a stir-fry. The results were reasonably pleasant and nutritious—fairly low in saturated fat, containing modest amounts of animal protein with lots of vegetables, complex carbohydrates and fruit. I believe most nutritionists would have rated my menus at least an A minus or, if they were grading on the curve, an A plus with three gold stars.

But I wasn't so sure. For one thing, was I depending too much upon highly processed foods? Beginning with the most important meal of the day (most important, at least, to breakfast food marketers), I thought about the cereal I ate every morning. Knowing a little about food processing, I suspected that violent and extreme measures might be needed to coerce cereal doughs into those neat little flakes, puffs, loops and honeycombs. It was easy, it tasted good, and the Nutrition Facts label said it was full of essential nutrients, so I ate it. But still I wondered. Was it as good for me as, say, old-fashioned oatmeal, grits or farina? Are wheat, soy, oats and other grains in breakfast cereals (ditto breakfast bars, meat substitutes and snack foods) altered, chemically or nutritionally, by the processing techniques used to cook and shape them?

As it turns out, they are, with a drastic loss of protein quality resulting from the use of high-heat extrusion technologies. The nutritional value of whole-grain ready-to-eat breakfast cereals, praised by so many nutritionists, relates almost entirely to their high levels of vitamin fortification. But are chemically derived, sprayed-on vitamins in fact equivalent to those found naturally in foods? In the case of folate/folic acid, the answer is: "No, they definitely are not."

As for the unprocessed whole foods that formed a large part of my apparently healthy diet, what about pesticide residues? Should I go out of my way, and pay a bit more, to eat organic? I already knew the scientific argument. Unlike the infamous DDT, currently used pesticides break down rapidly after use, so post-harvest residues should be vanishingly small. But what if pesticides are illegally or incompetently used, at too high a dose or too close to harvest—should I buy organic as insurance? Then again, since the organic label fetches a price premium, couldn't there be fraud and mislabeling?

These issues turned out to be complex. There is more than one type of organic and more than one kind of conventional agriculture; sometimes it is a distinction without a meaningful difference. I am eating more organic produce now, but I choose my fruits and vegetables the old-fashioned way—by fragrance, firmness, moisture, color and other markers of freshness and goodness.

As I worked my way along the produce aisle, I generally reached for the plant foods I liked, spicy salad greens, bell peppers, scallions, tomatoes, cucumbers and most fruit, but sometimes conscientiously filled my shopping cart with foods I believed to be good for me but did not greatly enjoy—broccoli, for example, okay in a spicy peanut sauce over buckwheat noodles or as cream of broccoli soup, but otherwise tasting like the medicine it is reputed to be.

Were broccoli and its cruciferous kin (Brussels sprouts, cauliflower, cabbage) really so much better than arugula or leaf lettuce that, like them or not, I needed to take my medicine and eat them twice a week? Ditto tofu?

A fact I encountered early in my research, courtesy of the National Research Council, became a mantra of sorts, muttered *sotto voce* whenever I encountered yet another study advising me of cancer-causing substances in foods I happened to like, or of cancer-preventing substances in foods I could do without. *There are at least one million distinct, chemically active substances naturally present in our food.* Of these, only about twelve to thirteen thousand have been identified, and far fewer have been thoroughly studied. These individual studies may be important contributions to science, but they do not tell us how to eat. Broccoli is a highly respectable food for those who like it. Ditto tofu.

1
How Food Became Chemicals

> "This morning for breakfast he requested something called wheat germ, organic honey, and tiger's milk."
> "Oh yes. Those are the charmed substances that some years ago were thought to contain life-preserving properties."
> "You mean there was no deep fat? No steak, or cream pies, or hot fudge?"
> "Those were thought to be unhealthy. Precisely the opposite of what we now know to be true." ~Sleeper

*I*N HIS 1973 FILM *SLEEPER*, **WOODY ALLEN** plays a latter-day Rip Van Winkle who awakens in the 22nd century to discover, among other novelties, that scientists have decreed steak, cream pies and hot fudge to be the ultimate health foods. In an era of genetically and chemically engineered foods, the idea is not so unlikely, nor so funny, as it was just thirty-odd years ago. If it came to pass, it would be only one more bizarre spin on the carnival barker's wheel (Pick a food! Any food!) of nutritional advice.

In 1873, in fact, leading scientists would have agreed that steak, cream pies and hot fudge are healthier foods than wheat germ, which they would have classified as pigswill. Before the vitamins were discovered in the early twentieth century, researchers believed protein to be the only true nutrient, with all the other food components serving merely to provide energy. Foods that were believed to require extra energy to digest were the bad foods of the day and included raw fruits and vegetables. Poor working families were advised to eat meat as much as possible and told not to waste their money on fresh fruits and vegetables. One German nutritionist estimated that the average workman needed 118 grams of pure protein per day, which works out to about 1¼ pounds of Porterhouse steak or about six 4-ounce hamburger patties. Wilbur O. Atwater, a prominent American nutritionist, upped that estimate to 125 to 130 grams per day, reasoning that Americans worked harder!

EAT BY THE NUMBERS

Wilbur O. Atwater's ideas about protein may have gone out of vogue, but many of his other concepts and discoveries are important to nutrition to this day. The numbers on the Nutrition Facts label for the protein, fat, carbohydrate and calorie content of a food originated in the work of Atwater in the 1880s and '90s. He and his colleagues doggedly worked out the nutrient values for hundreds of foods. The basic rule-of-thumb values for calorie counting—9 calories per gram of fat, 4 calories per gram of carbohydrate or protein—are still known as the "Atwater factors." Many of his early values were faulty, but he revised them repeatedly and so did his successors.

In the late 1890s, Atwater brought his discoveries to the general public in a series of articles in *Century Magazine*, a prominent periodical of the day. To show how nutrition science could be applied to improving health, Atwater explained to readers that the nutritional value of a food could be worked out by subtracting the weight of its water content and "refuse," then calculating how much protein, fat and carbohydrate it supplied per pound. Then one could determine which foods should be preferred by comparing the cost per pound to the amount of real nutrients they contained. This sounds very scientific, and it is not that different from the perspective of some contemporary nutrition advice. There were just a few problems with how Atwater applied his concept.

Protein was the only nutrient recognized as essential, while the amount of protein required by the body was greatly overestimated. Fat and carbohydrate were understood to be merely fuel for the body. Since fat was the higher octane choice, Atwater considered it more nutritious than carbohydrate.

The vitamins had not yet been discovered and so did not figure into Atwater's calculations. His waste food category of substances condemned as "refuse" included wheat bran and potato skins—rich sources for micronutrients as well as fiber, for which Atwater recognized no benefits.

As a consequence, only high-protein and high-energy foods were considered nutritious and economical. Among the plant-based foods, beans could be recommended as a cheap source of protein, and the starches (wheat, corn, potato) were a cheap source of energy. All the fruits and vegetables were considered to be merely carbohydrate, water and refuse—and thus a waste of money.

While his recommendations were very obviously flawed, Atwater's fundamental assumptions about how the science of nutrition can and should be converted into dietary advice for the masses are still very much part of how nutrition educators communicate with the public.

Foods as delivery vehicles for nutrients

Atwater's fundamental argument is that one should select foods based on their chemical composition rather than their taste or their place in traditional cuisines. Selecting foods by their chemical composition raises the issue that we don't understand—in practicality, will never understand—the entire complexity of their chemistry. Not only are there one million distinct, chemical compounds naturally present in our food, according to the rough estimate offered by the National Research Council, but these one million compounds interact with each other and with our bodies (with considerable individual variations) in ways that are almost entirely unknown.

Equivalence within a chemical class

Since he assumed all proteins to be equivalent, Atwater asserted that there was no difference between meat and fish, except meat had more fat and fish more water, which made meat more nutritious than fish as well as more economical. Since nothing was known about amino acid balance, bean protein at $0.14 per pound was preferable to salmon protein at $1.53 per pound of pure protein.

This assumption of equivalence within a class is still a problem. Have you ever noticed that dietary substances in the news often have an 's' on their names—for example, isoflavones, omega-3 fatty acids, conjugated linoleic acids (CLAs)? Where the research has been done, it often turns out that the individual members of these classes have quite distinct properties. This can be an issue with processed foods that have been engineered and marketed as containing (for example) omega-3 fatty acids, if the fatty acids chosen are those that are less digestible or less potent. A French health agency recently advised that at least one of the CLAs has the same undesirable properties as the trans fats and should not be allowed as an additive or a supplement.

Choose the most economical, rather than the most delicious, sources of nutrients

Since Atwater believed all proteins are equivalent and viewed food merely as the vehicle for delivering nutrients to the body, he argued that one should always buy the cheapest protein available. Reasoning that a quart of oysters and a quart of milk contain "roughly speaking" the same "nutritive values," Atwater recommends milk. He recommends the cheapest and fattiest cuts of meat over the leanest (which contain more water) for the same reason. A whole flounder, in his analytic charts, contains only 5% nutritive ingredients, compared to 80% for salted fatty pork and 15% for lean chicken.

The focus on economy made some sense in Atwater's day, when a working class family spent at least 50% of their income on food, and most work was physical, requiring higher calorie intakes. It makes very little sense now, when food expenditures are only about 11% of the average family's budget, including takeout and eating out—and when the poorest are at greater health risk from too much rather than too little food.

Importance of a balanced diet

This is an idea that we tend to accept as self-evident, but is it? Truly imbalanced diets of a sort that would be debilitating or fatal in the long term—such as 100% carbohydrate or 100% protein—do not exist in nature. Most whole foods contain a combination of protein, carbohydrate and fat, even if the amount of carbohydrate in most animal tissues is negligible. The concept of a balanced diet begs the question of what the proper proportions should be, a topic still hotly debated. It implies that some nutrients are superior to others, or harmful in excess, which creates problems when specific foods are categorized as being good sources of the favored nutrient or particularly high in the undesirable nutrient. Since fruits and vegetables were poor sources of protein, Atwater considered them to be inferior foods.

The concept of a balanced diet gained legitimacy with the discovery of the vitamins. Yet so many foods are now highly fortified that deficiency is unlikely. A *balanced* diet is not the same as a *varied* diet, a concept supported by good evidence as well as good sense, as we will see in chapters 2 and 3. Atwater's perception of a balanced (but unvaried) diet led him to praise as ideal—"in accord with the highest physiological law"—the standard New England fare of salt codfish, potatoes, and pork and beans.

Instant applicability

Nutrition research is fascinating, but it should considered be a pure, not an applied science. Of those one million chemically distinct substances naturally present in our food, Atwater and his contemporaries had identified and studied perhaps one hundred. On that slender basis, they confidently proceeded to make wide-ranging (and incredibly wrong-headed) recommendations about how people should regulate their diets. As Harvey Levenstein comments, "if America turned *en masse* to follow their advice, rickets, beri-beri, scurvy, and other vitamin-deficiency diseases may have reached epidemic proportions."

Today nutrition scientists have identified roughly twelve thousand to perhaps thirteen thousand of the one million active substances in the diet. Much of that information is extremely useful for understanding the effects of food on the body, but the rest is pure science in preliminary stages of investigation. It hardly makes sense to change one's diet because scientists have just discovered that substance number 11,490 causes cancer at high doses in rats, whereas substance number 12,115 is protective under the same unnatural feeding conditions. Yet we continually read articles that tell us to do exactly that: to eat more blueberries because they are rich in beneficial anthocyanins, to avoid grilled meat because it has dangerous heterocyclic amines.

2
Eat It! It's Good for You!

To OUR ANCESTORS, A GOOD-FOR-YOU FOOD was one that made you feel good—strong and well—whereas a bad-for-you food was one that made you ill or failed to nourish. Since the beginnings of nutrition science, foods have been categorized as good or bad based on what was understood (often very little) about their chemistry. As a consequence, the simple act of eating has become a complex enterprise, not to be undertaken without professional advice and instruction. Yet that advice changed and continues to change—subject both to new research that overturns old assumptions, and to the influence of the food industry groups that fund much of this research and so determine what foods and what issues are to be studied.

In the late nineteenth century, Wilbur O. Atwater and his colleagues determined that there were three major classes of nutrients: fats, carbohydrates and protein. No sooner had they done so than they chose sides, declaring one group (protein) more vital or healthy than another (carbohydrate), and prescribing a daily ration of a whopping 125 to 130 grams of protein, plus an equal or greater proportion of fat, 125 to 150 grams.

However, a countermovement, led by vegetarians and teetotalers, was already growing in popularity that prescribed a modest 45 grams of protein per day. Confused authorities hedged their bets by splitting the difference, with early twentieth-century textbooks giving recommendations of 75 grams for a "low protein" diet and 100 grams for a "normal" diet.

So began a history of tweaking the numbers up or down in response to societal trends as well as new scientific information. Currently, the official, though hardly definitive, numbers are 46 grams of protein per day for a woman and 56 grams for a man. But there is, as we shall see, very little basis for prescribing how much protein—or carbohydrate or fat—should be consumed.

The discovery of the vitamins in the early twentieth century established the importance of fruits and vegetables, previously dismissed by Atwater as overpriced sources of carbohydrate and water. In the 1960s and '70s, fiber, formerly known as refuse, began to be credited with disease-preventing powers. These decades also saw the introduction of the cholesterol/heart disease hypothesis, with corresponding advice to cut the consumption of fat- and cholesterol-containing foods. So began the first of many campaigns to convince consumers that beloved staples (eggs, red meat, whole milk and butter) were actually dangerous to eat. In the 1970s, the American Heart Association began advising all Americans, regardless of disease risk, to eat no more than three eggs a week (a limit quietly annulled in their revised 2000 guidelines, which no longer specify how many eggs one is permitted to consume). In 1977, the U.S. Senate Nutrition Committee issued a novel set of dietary goals for Americans that called for reducing fat consumption from 42% to 30% and increasing carbohydrates from 46% to 58% of the diet. Reflecting these influences, *Jane Brody's Nutrition Book*, published in 1981, praised bread, rice, potatoes and pasta while characterizing chronic meat-eating as "potentially dangerous" and chronic egg-eating as "potentially damaging."

But, again, a countermovement was taking shape. Robert Atkins first published his high-protein/high-fat/low-carb diet theory in the early 1970s, but it took some thirty years of failed low-fat dieting and subsequent publications for the diet to really catch on. In the recent surge of popularity for Atkins-inspired diets, protein was again king. Fat, so long viewed with horror, was now tolerated: but the diet scales turned to condemn carbohydrates as an evil and dangerous category of foods, now blamed for obesity, diabetes and the dreaded metabolic syndrome. The 1980s let us have bread but not butter; twenty years later, we were allowed the butter but no bread to put it on.

Nothing has truly changed, of course. The common feature of these debates is the assumption that at least one of these three food groups is bad for you, as opposed to the dull, commonsense notion that simple overeating might be the problem. Those taking the extreme position demonize whole categories of food. More staid and cautious scientists simply debate the numbers—10% added sugars or 30%? 10%, 20% or 30% fat?

Yet there simply is no scientific basis for the whole enterprise of reducing the complexity of food to just a few major categories of chemical compounds, then prescribing the amount of each chemical to be consumed. Consider, first, that humans would never have been able to spread around the globe and adapt to astonishingly different diets—from the fatty, flesh-based diet of Alaskan natives to the lean, plant-based diet of Hindus—if we had a narrow range of nutritional requirements. Could it be that there is some optimal dietary balance that fights disease and enhances health and vitality? Yes, there could be. But that ideal balance might differ for different ethnicities or even for different individuals. And how will we discover what it is, given the limitations of nutrition studies?

It is certainly true that we continue to learn more and more about the nutritional effects of different proteins, fats and carbohydrates. Much of this new information confirms two basic propositions: first, that the physiological requirements for these nutrients are easily met without reading Nutrition Facts labels or making any special efforts at all; and second, that the individual compounds within these broad chemical classes (fats and carbohydrates in particular) can differ so much that there is no basis for setting requirements or limits. Let's look at what is known about the major food groups and the shaky-as-Jell-O basis for setting dietary guidelines.

PROTEIN—FROM BEEF TO BEANS TO BEEFSTEAK TOMATOES

We think of meat, fish, eggs and milk as the high-protein foods, but corn, wheat, apples and lettuce are protein too. All living creatures, whether animals, plants or bacteria, are made up of protein constructed from the same twenty amino acids. Of these twenty amino acids, nine are traditionally classified as essential or indispensable amino acids, meaning that the human body cannot synthesize them on its own and must obtain them from the diet. (If you are taking notes, the nine got-to-have-it amino acids are histidine, isoleucine, leucine, lysine, phenylalanine, threonine, tryptophan, valine and methionine. Most are abundant in the diet; the ones more likely to be in limited supply are lysine, threonine, tryptophan and methionine.)

If you are a vegetarian, semi-vegetarian, or just a literate cook, you are probably familiar with the concept of complementary proteins, which involves combining plant proteins in a meal or a dish to obtain the ideal balance of amino acids that the human body needs to build protein. Following this principle, combining grains (low in lysine) with beans (low in methionine) provides balanced protein to simulate a steak or a milkshake. In fact, it is incorrect to label plant proteins as "incomplete." All proteins, whether animal or vegetable, are complete. All of the amino acids are present in a chickpea just as they are in a chicken cutlet; it is just that the proportions are different, making the chickpea a less efficient source of protein for humans, but not an inadequate one. If you eat enough chickpeas, you will have enough protein.

People tend to equate muscle and protein. In fact, the body's structural elements (from cell walls to hair and fingernails) are all made up of protein, as well as most of the functional elements (hormones, enzymes, transport molecules). Most other important molecules in the body are synthesized from amino acids. Aside from water, the fat you see (or think you see) in the mirror, and a few minerals, we are all protein and nothing but protein. As protein researcher Dwight Matthews of the University of Vermont points out, death from starvation actually results from the loss of protein rather than the lack of food, since the body will feed on its own tissues to prolong life.

Many people assume that they need animal protein (or complementary vegetable proteins) in some form every day, and in the Western world, the meat and potatoes diet still dominates. But for much of human history and still in much of the world, people rarely had meat to go with their potatoes, fish with their rice, or cheese with their bread. It turns out the body is very good at recycling the amino acids it needs from worn-out proteins, if the dietary supply should fall short. Man can live by bread alone—as demonstrated by researchers at the University of Surrey, who performed a series of studies over the course of the last decade, showing that lysine (the limiting amino acid in wheat and rice) can be recycled. On a moderate or high protein diet, the rate at which proteins are turned over (synthesized, broken down, then re-synthesized) increases. Like people who exactly blow through their paycheck by the end of the week, the body can be a thrifty recycler when the protein supply is short, but will spend whatever it has to spend. The more protein it has, the more protein it will turn over.

The sticking point in protein research is whether that increased turnover rate in a protein-rich diet is a good thing or a bad thing. One group of researchers argue that people on low-protein diets may have impaired immunity: their bodies have enough protein for muscles, blood and tissue, but not quite enough for optimal immune functioning. The alternative view holds that there may be health risks to high-protein diets. While no one much likes to hear this in the carnivorous Western world, those diseases of overconsumption that are often attributed to high-fat or high-sugar diets can be linked, at least theoretically, to high-protein consumption. In particular, a lifetime of high-protein intake may eventually compromise kidney function, although this is certainly controversial and unproven.

Some nutritionists and many food marketers make a special point about the vitamins, protein and minerals children need for healthy, growing bodies. But, compared to other species, humans grow very slowly after early infancy. Both children and adults mostly need protein for replacing worn-out protein. The most recent (2005) report of the Food and Nutrition Board of the Institute of Medicine gives RDAs (recommended dietary allowances) for children over age one of about 1.0 gram of high-quality protein per kilogram of body weight (a kilogram equals 2.2 pounds). For adolescents the RDA drops to 0.9 gram (they don't really need all those cheeseburgers); and for adults it is 0.8 gram per kilogram. This would be 46 grams per day for a 125-pound woman and 56 grams per day for a 154-pound man.

If you want to know how this works out for ordinary foods, 3 ounces of lean meat or poultry contain about 25 grams of pure protein, whereas 3 ounces of fish supply a bit less, about 20 grams. A cup of milk or yogurt has 8 grams of protein, and one egg or one ounce of cheese offers 6 grams. Soybeans provide about 20 grams per cup, with most other types of bean (legumes) supplying about 15 grams of protein per one-cup serving. Cereals, grains, nuts, and vegetables contain about 2 grams of protein per serving.

Too many numbers? You're right! You don't actually need to start reading the Nutrition Facts Labels, putting your children (or your dinner) on the bathroom scale, or otherwise calculating weights and proportions to determine healthy protein balances for your family. First, the recommended intake is deliberately set well above the average daily requirement, which is about 0.6 gram per kilogram. Second, the range in protein requirements from person to person is extraordinary—from 0.4 to 1.7 grams/kilogram—a more than fourfold difference.

3
Too Much of a Good Food Might Be a Bad Food

*W*HAT MAKES HEALTH FOODS HEALTHY? Ironically, it is the fact that they are poor sources of the calories needed to sustain life. They are bulky foods that contain more micronutrients (vitamins, minerals) per calorie than foods that are rich in fat, protein or sugar. Population studies consistently indicate that a high-fiber, plant-based diet offers a modest degree of protection against chronic diseases such as diabetes, heart disease and some forms of cancer. But, we still know relatively little about what makes these foods good or whether some might be much better than others. We look to laboratory studies for answers, but these are inadequate to tell us how the thousands of potentially beneficial compounds in an eggplant, a bell pepper or a ratatouille might interact. These interactions might often be crucial to whether a given substance ultimately has beneficial or negative properties.

Most health-conscious Americans have heard about studies linking specific foods with health benefits—for example, suggesting that raw garlic protects against heart disease and some cancers, or that folic acid protects against birth defects and perhaps colon cancer. Rather than eat large quantities of the real thing, many people buy supplements or fortified foods to give them a hefty dose of the latest disease-fighter.

But often there is little research to say how much is enough and how much might be too much.

Remember, there are at least one million distinct, chemically active substances naturally present in our food. They interact with each other. They interact with our bodies. As it turns out, there are dose effects with some of the more potent ones: a little is good, a lot is bad.

Almost any substance can be toxic if consumed in excessive quantities, even pure water, which can bring on severe electrolyte imbalances. We are told that salt is bad and water is good. But the kidneys need sodium, potassium and other electrolytes to function normally. Distance runners, hikers and other endurance athletes have collapsed and even died because they followed the common but wrong advice to drink as much fluid as one can tolerate while exercising. There are also case reports of people on crash diets or low-protein vegetarian diets who became quite ill by drinking more water than their kidneys could process. Drink only when you are thirsty, or in anticipation of thirst without easy access to water.

Many otherwise wholesome foods can be unhealthy if they form a major portion of the diet. For example, chickpeas (the main ingredient in hummus, a popular Middle Eastern dip) contain minute quantities of nerve toxins (lathyrogens) that can cause partial paralysis if they are consumed in large quantities daily for a period of weeks to months.

Potatoes are a staple of the American diet and are a good source for vitamin C, thiamin, iron, magnesium and phosphorus. *Potato poisoning* can result from excessive consumption of solanine, a toxic substance found at high levels in greened or sprouting potatoes. The American Association of Poison Control Centers reported 1,166 cases of potato poisoning in 2005. Milder cases could easily be mistaken for a bad stomachache. Although solanine content is highest in greened or sprouting portions of potatoes, all potatoes contain some amount. The average large order of fries contains about one-tenth of the dose of solanine capable of producing symptoms, so one or two bad potatoes in a batch could tip the balance. The next time a fast food meal leaves you with a queasy stomach, suspect the fries as well as the cheeseburger!

Most types of dried beans or legumes contain substances called lectins that interfere with digestion. Fortunately, lectins are destroyed by heating, so properly cooked beans are safe and nutritious. During the original fad for crockpot cooking in the 1970s, many people were sickened by eating kidney beans that were cooked at too low a temperature. If you have one of the original crockpots (the updated slow cookers have higher minimum temperatures), make sure any dishes containing kidney beans are started or finished at higher temperatures.

Celery offers a modest assortment of vitamins and almost no calories, only two or three for a small stalk, so it might seem like a healthy food to fill up on when you want to look good in a swimsuit. But, don't eat a lot of celery before a day in a sun, because it also contains chemicals called psoralins that greatly increase sensitivity to ultraviolet light. The amount of psoralin present in the plant varies with growing conditions, but these chemicals are so potent that agricultural workers can suffer burns on their hands simply from handling celery.

An apple a day is said to keep the doctor away, but a few dozen apple seeds might bring the doctor to your bedside. The seeds or pits of apples, apricots, cherries and peaches contain variable amounts of a substance called amygdalin, which is converted to cyanide in the body. A few accidentally swallowed apple seeds contain trivial amounts that the body can detoxify, but apricot and peach pits have substantial quantities. The American Association of Poison Control Centers reported 2,617 cases of amygdalin poisoning in 2005, two-thirds of them involving children under age six who either had been given unpitted fruit to eat or else found the pits and swallowed them.

"DON'T EAT ME—OR ELSE"

We have long been told that junk food, pesticides and bacterial contamination are hazardous to our health, but it is hard to understand how there could be anything wrong with the healthy alternatives. Why would all-natural foods like potatoes, beans and celery have any ill effects at all?

It's simple, really. Plants don't want to be eaten. They have evolved substances such as solanine, psoralen, lathyrogens and lectins as a way to "bite back" at hungry animals that might otherwise threaten their survival. The natural pesticides that plants produce to protect themselves are technically known as *phytoalexins*. A more general term, *antinutrient*, refers to any plant substance that can cause illness or interfere with the absorption of nutrients. Solanine in potatoes, psoralen in celery, lectins in beans, amygdalin in apple seeds and the lathyrogens in chickpeas are all antinutrients.

Antinutrients are generally present in quantities that might be fatal to a caterpillar or an aphid but offer little danger to huge lumbering mammals such as humans who are consuming whole foods in a balanced diet. For example, very high doses of oxalic acid can produce muscle cramps and even cardiovascular collapse and kidney failure from severe calcium deficiency, but you would have to eat five or six pounds of tomatoes or over a pound of raw spinach to produce symptoms. Except for fad dieters, most people would be bored or sated long before they ate themselves sick on whole foods such as these. But, people who take supplements or consume the new "wellness foods" that are fortified with antioxidants and other plant chemicals may be putting themselves at risk.

The list of known antinutrients and carcinogens (cancer promoters) includes substances that are also considered to be good-for-you antioxidants and cancer fighters. Caffeic acid, found in apples, lettuce and many other fruits and vegetables, is classified as both a carcinogen and an antioxidant. Quercetin, one of the flavonoids credited with having antioxidant and anticancer effects, can also promote cancer growth.

The same high-dose animal studies that implicate chemicals such as pesticides as cancer causers have also shown that high doses of some antioxidants can promote the growth of cancer, even though low doses are protective against cancer.

As summarized in a 1996 report of the National Research Council of the National Academy of Sciences, about seventy naturally occurring chemicals in common foods are reported to have both carcinogenic and anticarcinogenic effects, including the heavily hyped flavonoids. The National Research Council report concluded that people consuming a normal diet were unlikely to be harmed by antinutrients present in common foods. However, the report said, unhealthy doses could be reached by people who consume excessive amounts of antioxidants in supplement form.

Unwholesome antinutrients in common whole foods

Oxalic acid in spinach, rhubarb, tomato, tea and cocoa (binds calcium, lowering its availability)

Phytic acid (phytate) in soy beans, wheat, peanuts, corn, rice and navy beans (binds calcium, zinc and iron, lowering their availability)

Allyl isothiocyanate and thiocyanate in cabbage, broccoli, Brussels sprouts and cauliflower (cause goiter)

Tannins in tea, coffee, green bananas and millet (interfere with protein absorption)

Agaritine in mushrooms (a carcinogen or cancer-causing agent)

Safrole in black pepper and nutmeg (a carcinogen)

Caffeic acid in apples, lettuce and other fruits and vegetables (a carcinogen)

Tomatine in green tomatoes (toxic to animals in high doses)

d-Limonene in citrus (a carcinogen, used as an insecticide in flea collars)

Sources: See reference list for works by Ross Beier, Ronald Estabrook and Bruce Ames; see also EXTOXNET database on phytonutrients, ace.orst.edu/info/extoxnet/faqs

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4

Why We Eat What We Eat

I HATE LIMA BEANS. You can't stand cilantro. He turns up his nose at anchovies. She won't eat fish, period. There is nothing more subjective or more personal than taste. My mother fought me over the lima bean issue for years. She could make me, gagging, eat three or four. She could not make me like them. Refusing one food and demanding another is a child's earliest expression of autonomy and perhaps the most frustrating for nutrition-conscious parents. I am Sam. Sam I am. I like what I like because I am who I am. You can't change me (nah, nah, nah!).

Objectively, I realize now that I wrong the lima bean, that properly prepared fresh beans are possibly excellent. But I am Carol. Carol I am. I don't like lima beans and (probably) never will.

Or so we naively believe. In fact, flavor and food preferences are almost entirely learned, meaning they are not innate expressions of our individuality. We don't learn food preferences the way we learn our multiplication tables, by being instructed. (Or I would be happily eating lima beans to this day.) We learn food preferences both from our own experiences and by watching others eat and observing their reactions. This makes good evolutionary sense: who wants to be the first person to try a strange berry or root? My mother's professed liking for lima beans, based entirely on their nutritional excellence, was obviously lacking in gustatory passion. The Saturday morning commercials never showed happy children joyously gobbling lima beans and clamoring for more. Nor did cute cartoon characters sing catchy jingles about yummy yum lima beans. Lima beans never stood a chance against the favored foods of my youth, Fruit Loops, animal crackers, Hostess Cupcakes and Fritos.

Parents can be forgiven for snorting in disbelief at the idea that their finicky toddler somehow, somewhere, *learned* to reject broccoli and spinach so vehemently. Taste preferences seem innate and individual because the learning process begins extremely early—in the womb and at the mother's breast. Some food flavors are known to pass into the amniotic fluid, where they are both swallowed and inhaled by the developing fetus. Flavors also pass very readily into breast milk. A number of studies have shown, first, that breastfed babies are aware and interested when their mother has partaken of a strong flavor, such as garlic or vanilla; and, second, that children who were formula-fed during their infancy are less adventuresome eaters compared to those who were breastfed and thereby enjoyed a more stimulating variety of flavors. So, if you really want your children to like broccoli and spinach—or just a richly varied diet—you have to start very young, well before birth. If, on the other hand, you subsisted on pizza, takeout and vitamin pills during pregnancy and breastfeeding, it is too late to pretend to adore the mushy peas (or lima beans) you are trying to shovel into your toddler. Your child knows you better than that.

A SPOONFUL OF SUGAR HELPS THE BROCCOLI GO DOWN

While most of our food likes and dislikes are learned, two of the most basic preferences are undeniably innate. We come into the world liking sweet tastes and disliking bitter ones. This also makes good evolutionary sense: a sweet taste indicates that a food supplies energy, the most essential nutrient of all, while many poisons (cyanide, for example) are identifiable by a bitter taste. But so are many of the vegetables that nutritionists and mothers urge us to eat, such as broccoli and (ahem!) lima beans, which both have a marked bitterness in taste, particularly to the tender and inexperienced palate of a child. The same nutritionists have taught us to view sugar as poison, so few parents use it, as their grandparents or great-grandparents would have done, adding a pinch or two in nearly every vegetable dish, to cut the bitterness and accentuate the flavors.

These grandparents and great-grandparents ate their vegetables because they liked them, not because they were told to eat them. No nutritionist had instructed them to serve their vegetables raw, or barely cooked, or sauced only with a squeeze of lemon juice. They made rich, satisfying dishes from green beans, broccoli, cauliflower, kale and other vegetables by cooking them long and slow with flavorings (including sugar and fat) carefully selected to complement the dish. Prudish cookbooks often dismiss the traditional methods of cooking vegetables until meltingly tender as motivated by hygiene (prolonged cooking to kill germs) or barbaric ignorance (prolonged cooking reduces the vitamin content). But the obvious conclusion to be drawn by anyone who has tried the traditional recipes is that our forebears cooked vegetables this way because they tasted good. It is true that the water-soluble vitamins (mostly vitamin C), are diminished with long cooking. But if the resulting dish is so appealing that it goes around the table a second and third time, then surely there is a net gain in both health and pleasure. You may recall from chapter 1 that Wilbur O. Atwater, the granddaddy of American nutritionists, objected to fresh fruits and vegetables as an unnecessary indulgence. So, once upon a time, people ate broccoli, and presumably even lima beans, for pleasure and not as penance.

Many adults have an acquired liking for the palate-stimulating effects of bitter flavors like black coffee, horseradish, dandelion greens or raw broccoli. But it is unreasonable to expect a child to delight in these harsh-tasting foods. In *Why We Eat What We Eat*, Elizabeth Capaldi explains the adaptation process by commenting that most people first drink coffee with cream and sugar, and only later come to like it black. She describes several experiments by her research group to show that the spoonful-of-sugar principle will predispose people to like bitter vegetables as well as bitter black coffee. In one such experiment, college students were fed broccoli and cauliflower, one sweetened and the other unsweetened, three times. When they were later given both vegetables unsweetened, they expressed a preference for the one that had previously been sweetened.

MONKEY SEE, MONKEY EAT

In virtually every species studied—from monkeys to meerkats, baboons to blackbirds—offspring learn what is safe and good to eat by observing their mothers and other adults. What's more, the mothers often actively teach their young about good food. Mother hens make a special cluck to call their chicks and will sometimes toss the food in the air to get their attention.

I say "virtually every species studied" because humans (or at least contemporary Americans) are the notable exception. Studies have found remarkably little concordance between the parents' food preferences and those of their children. One reason might be that many new parents only reform their own diets when it comes time to set an example to their toddler, whose food preferences were already at least partly formed by mother's eating habits during pregnancy and breastfeeding.

Another possibility is that human efforts to teach their young what to eat are less natural and less sincere than those of mother hens and rats. Studies, for example, have repeatedly shown that cake-or-stick strategies to get a child to eat a healthy food simply reinforce a dislike for the food. Either "Finish your lima beans and then you can have dessert" or "You can't leave the table until you eat your lima beans" will effectively teach a child that lima beans are yucky.

5
Flavor, Freshness and Health

Nutritionists in the Atwater tradition take a Calvinist view of eating: we are all sinners, incapable of making a virtuous food choice without continual applications of will power and self-discipline. Weak and foolish as we are, we are unhealthily drawn to those "toothsome" foods (Atwater's word) that are bad for us. In the eternal struggle to be slim, beautiful and cancer-free, our only hope of salvation rests in diligently reading labels and fighting the wicked temptations of taste, aroma and flavor.

Emerging evidence suggests that nutritionists are wrong and that nature is right: flavor is in fact a reliable guide to the nutritional quality of fruits and vegetables.

SOME FRESH SCIENTIFIC FINDINGS

Flavor is the interaction of taste and smell, as anyone knows who has ever failed to appreciate a nice dinner while suffering from a bad cold and a stuffed-up nose. The enticing aroma and flavor of a perfectly ripe strawberry or a garden-fresh tomato turn out to be complex bouquets of many distinct compounds—at least seventeen for the tomato. Some seven thousand flavor compounds have been identified to date in common foods. Most of this research has been performed by the food industry in its quest to synthesize more persuasive fake flavors or, in the case of the tomato, to develop a picked-green shipped-in variety that will taste sort of like a real tomato. Seventeen unique compounds, present in distinctive proportions, are hard to fake.

Of course, in the Atwater tradition, taste is not important as a guide to nutritional quality or is in fact deceptive. We should choose food that is good for us, even if we don't like the taste. But is a pallid, nearly tasteless winter tomato nutritionally equivalent to a garden-fresh summer tomato? Despite its obvious deficiencies in those seventeen flavor compounds, does it provide the same vitamins and other nutrients?

For generations, nutritionists have been answering that question with a "yes," with or without qualification, maintaining that the industry version and the homegrown vine-ripe tomato are fundamentally the same. The USDA National Nutrient Database has over thirty entries for various canned tomato products, but for "tomatoes, red, ripe, raw" the database provides only a single list of year-round average values. For government regulators and nutritionists, "fresh" simply means uncooked and never frozen, no matter how stale or deficient in flavor the food might be. Using this degraded definition of fresh, the food industry can legitimately claim that canned and frozen produce are just as nutritious as their picked-green, shipped-in "fresh" counterparts.

But a recent review of the subject in *Science* gives a more thoughtful and carefully reasoned response to the question of nutrition and taste. In this article, molecular biologists Stephen Goff and Harry Klee present the evidence to suggest that flavor is a reliable guide to nutrition for both humans and animals. Taking the tomato as their primary example—since more is known about its flavor profile than any other fruit or vegetable—they show that the odors and flavors that signal "fresh, ripe tomato!" to our senses are also signals of nutritional quality.

You may remember from chapter 3 that plants produce fruit in order to attract hungry animals that will transport and fertilize their seeds for them. When ripe, tomatoes and other fruits release volatile (airborne) "come hither" aroma molecules, which collectively form what we identify as the fruit's distinctive fragrance and contribute greatly to its flavor. These volatile compounds, it turns out, are all linked to vital nutrients in the tomato: essential amino acids (those that humans cannot synthesize for themselves), essential fatty acids (like omega-3 fatty acids) and antioxidants. What you taste in a good tomato is good nutrition. Conversely, what you fail to taste in an out-of-season tomato is a relative shortage of these nutrients.

Although the flavor profiles of other fruits and foods are not as thoroughly researched, Goff and Klee give other examples to suggest this linkage between good flavor and good nutrition holds generally true. Some of the characteristic flavor components of apple, sweet cherry, olive, bay leaf, pear, banana, peaches, apricots and coconuts also signal the presence of essential fatty acids. The flavor of tomatoes, strawberries and apples—and also of breads, cheeses, wines and beer—are partly due to volatile compounds derived from three essential amino acids: leucine, isoleucine and phenylalanine. Tomatoes, berries, apples and grapes all owe some of their flavor to volatiles derived from carotenoids, and so signal the presence of high levels of antioxidants in the ripe, fresh fruit.

This all makes perfect evolutionary sense. Our senses, including taste, exist to help us stay alive. Only for the last century have a small group of scientists and educators had the hubris to tell us not to trust our senses, insisting that a paper label listing weights and measures for a few crudely defined chemical compounds is somehow more informative than the evidence of sight, smell, touch and taste that kept untold generations before us healthy and well-fed. By training us to judge food by its chemical composition rather than its sensory appeal, a century of authoritarian nutritional advice, coupled with government policies that support international rather than local food sourcing, has compromised both our access to fresh, flavorful food and our ability to appreciate it.

Very little real research has been done on the link between taste and nutrition in traditional unprocessed foods. The food science topics that get funding are those that support or improve the products of large-scale agriculture and food processors. Improving food preservation techniques is a more active research field than investigating what might be lost with prolonged storage, which is the primary topic of this chapter.

WORLD-WEARY FOODS

If fruits, vegetables, fish and meats earned frequent flyer miles, over the course of a month your dinner plate would entitle you to a business class ticket to Tokyo. According to the Leopold Center for Sustainable Agriculture, produce trucked to the Chicago Terminal Market has traveled an average of just over 1,500 miles, and that reaching the Maryland Terminal Market typically travels nearly 1,700 miles. Rich Perog and colleagues at the Leopold Center compared the mileage for meals produced at several institutions participating in local food projects to the mileage those same foods would have traveled if purchased through the usual national distribution network: 45 miles versus 1,546 miles. So purchasing the same foods from a supermarket would have tacked 1,500 miles onto their travel. At least. The study focused on local versus national food sources, excluding foreign sources. In fact, most of our fish and shellfish (78%) are imported, along with 40% of lamb and nearly 40% of fruit.

With global sourcing and shipping and advanced packaging and processing techniques, the time it takes our food to travel from faraway farm to table is ever longer. California alone ships nearly a half million truckloads of produce per year, which travel anywhere from 100 to 3,100 miles to reach consumers. These well-traveled foods are not just avocados and citrus, or other produce for which California's climate (ditto Florida and parts of the Southwest) might be superior, but hardy crops like carrots that can be grown anywhere as well as fragile ones like leaf lettuce that deteriorate rapidly. If you live in a big East Coast or Midwest city, you probably accept the fact that your food comes from somewhere else—but why does it have to come from somewhere so very far away?

From all those eighteen wheelers roaring past on the interstate, one might suppose they shoot across the country in three days or so. In fact, it takes about a week to get a load all the way from California to the East Coast, where it will likely spend several more days in the supermarket chain's warehouses. (The mid-country averages are 1,315 miles and 3.3 days, according a 1998 industry survey.) If the trucker has to unload at different locations, then the last few pallets full of produce will spend extra hours or full days without consistent climate control, which may matter very little in cool weather but make a substantial difference on a hot day.

Quite aside from the waste and inefficiency of an irrational distribution network, long-distance shipping is a problem simply because fresh foods are not inert. Whatever the labels may say, they are not stable mixtures of protein, carbohydrates, fatty acids, minerals and vitamins. From the moment they are plucked from the tree, the vine, the earth or the sea, they begin to change. Any extended delays or lapses in temperature control in the lengthy chain of producers, shippers, brokers, distributors and retailers will accelerate the decay process. Even jarring from potholes takes a toll, as well as repeated loading and unloading as foods are shuttled from one distribution point to another in a centralized network.

GARDEN FRESH, FARM FRESH AND SUPERMARKET FRESH

Consider vitamin C as the canary in the coal mine for freshness. Vitamin-rich kale can lose about one-third of its vitamin C in twenty-four hours at room temperature. Green beans held for twenty-four hours at room temperature lose about one-quarter of their vitamin C, while spinach loses a whopping 40% in just fourteen hours. Broccoli loses 50% in twenty-four hours and 80% over four days.

6

Organic vs. Conventional
Shades of Green, Shades of Gray

A LARGE SUPERMARKET WILL GIVE YOU your choice of dozens upon dozens of fruits and vegetables, many familiar, some quite exotic. But it will usually offer only two forms of agriculture to choose from: conventional or organic.

Ask people what "organic" means, and they will most likely say "no chemical pesticides" and perhaps "no chemical fertilizers." Close enough, as far as it goes—and today most organic agriculture goes no further. But for many long-time practitioners, organic implies a great deal more: a stewardship of the land; long-term concern with maintaining and enhancing soil quality; restoration of environmental balance with habitat provided for beneficial species; careful planning and ingenious recycling to minimize dependence on external inputs such as fertilizers and feeds; and, often, a relationship with the local community that receives its food from the farm.

USDA ORGANIC

These traditional goals and attributes are not easy to quantify. When the USDA entered its ten-year process of formulating definitions and regulations for the National Organic Standard, they were largely left out. The USDA organic standards (implemented in October 2002) encourage but do not require practices such as:

- *Intercropping or mosaic cropping*—planting in small patches, with different crops interspersed, a practice that provides habitat for beneficial insects and reduces the severity of infestations. Companion planting is mixed plantings of crops that interact in a positive way. Corn, beans and squash all do better together, in the "three sisters" companion planting practice that the Iroquois taught the early European settlers (and that they failed, in the long term, to appreciate).
- *Livestock integration*—letting livestock feed on (and manure) fields that will be planted at some later date, or letting livestock loose to help themselves to corn or crop residues as a free-range cafeteria approach to feeding animals.
- *Farmscaping*—letting a few carefully selected areas go wild to provide habitat for beneficial species.
- *Cover crops*—improving soil quality and preventing erosion by planting legumes or other ground covers during the winter months.
- *Composting*—recycling farm wastes into soil nutrients.

Traditional organic farming strove to minimize the need for off-farm inputs (fertilizers, pesticides and other treatments) and instead aimed to develop the viability of the farm as a self-sustaining ecosystem. In contrast, the USDA organic standards focus on specifying what types of inputs organic farmers may or may not use, as set out in a "National List of Allowed and Prohibited Substances." Tellingly, the 1997 draft standards allowed the use of genetically modified organisms, sewage sludge and irradiation, until over 200,000 objecting comments convinced the USDA to prohibit these practices. In the final 2002 standards, organic farmers are prohibited from using most synthetic pesticides, synthetic fertilizers, sewage sludge, genetic engineering products and irradiation. They may use approved fertilizers and pesticides that are biological or natural substances or nonhazardous synthetic materials (for example, alcohol disinfectant, chlorinated water, and newspaper or plastic mulches). The National Organic Standards state that the producer should only use the allowed biological pesticides when ecological and mechanical means of controlling pests fail, but there are no requirements stipulating that, for example, a farmer must employ four of the ten suggested ecological pest control strategies before resorting to pesticides.

These may seem niceties. Sure, we all want to protect the environment, but we also want our food to be plentiful and cheap. However, there is some evidence, discussed below, to say that differences in horticultural practices—not just organic versus conventional—can have a complex but substantial impact on the quality of food, affecting both taste and nutrition.

7
The Brave New World of Animal Farms

*M*ANY PEOPLE SAY THEY WOULD probably become vegetarians if they had to watch a cow, pig or chicken being slaughtered. But what if you had to see how they *live*? The conditions on the worst factory farms are unappetizing to contemplate, with animals confined for their brief, unnatural lives to surreally overcrowded pens and cages, often barely able to move about. It is inhumane, yes, but easy and convenient to forget when inspecting the safe, sanitary-seeming, shrink-wrapped packages of boneless skinless end product in the supermarket—or the even more unreal (and thereby guiltless) packages of heat-and-eat entrées.

Queasiness about the process of meat production doesn't, for most people, extend to the end product. Aside from some legitimate worries about high rates of contamination—*E coli* in ground beef, salmonella in poultry—people generally assume that meat is meat, consisting of water, protein and fat, along with various vitamins, especially B12 and riboflavin, and some minerals like iron. It is healthier to select lean cuts with less fat, but otherwise meat is all the same. Similarly, skim milk is believed to be healthier than whole milk but aside from differences in fat content, milk is all the same: water, protein, B vitamins, vitamin A, synthesized vitamin D and calcium.

That is, after all, the way Wilbur O. Atwater and his disciples have taught us to think about our food. The delicious-or-nutritious dichotomy prevents us from questioning whether meat has more to offer. Even Atwater, who viewed protein as the only essential nutrient and greatly overestimated the need for it, disapproved of meat eating. Because we see meat as either a slab of protein or a naughty indulgence, we don't ask whether it might, after all, be a complex food, whether some of those unknown one million substances naturally present in our food might have important roles in animal foods. As we saw in previous chapters, cultivation and handling can make profound differences in the taste and nutritional quality of fruits and vegetables. Does anyone really believe that a cauliflower is more complicated than a cow?

Animal foods are obviously more than just a protein delivery device and a saturated fat hazard. Chicken, pork, beef, scallops and salmon are all varying blends of protein, water and fat, yet no one could possibly mistake the taste of one for the other. The distinctive tastes can be partly, but only partly, attributed to differing types and proportions of fatty acids. A turkey may be a leaner bird than a chicken, but the proportions of the known chemical compounds—the specific amino acids, fatty acids, minerals and vitamins—are extremely similar, and yet the difference in flavor is substantial. Cows' milk is clearly not equivalent to human milk as a food for babies, and cows' milk plus formula is still not the real thing. Studies continue to report subtle developmental differences between breast-fed and formula-fed children.

Food industry scientists are far ahead of nutritionists in studying the mysterious chemistry of meats, mostly with the aim of perfecting their own mystery meats. Flavor has been intensively investigated with the goal of enhancing it in warmed-over prepared foods and mimicking it in meat substitutes or cheap cuts. This research has shown, for example, that over one thousand distinct chemical compounds have a role in making roast beef taste and smell like roast beef. Meat, poultry and dairy scientists have been equally dedicated to investigating how fortified feed concentrates can be manipulated to produced more marketable meat quicker and cheaper—or how they can be further adjusted to make specific health claims.

This is remarkably easy to do: animals are what they eat. If, by a logical extension, we are what our food eats, then it behooves us to pay attention to how our food animals are bred, fed and reared down on the new, improved and vastly more efficient factory farm.

Concentrated animal feeding operations—CAFOs, the official term for factory farming—aim to maximize and standardize animal protein production by controlling every aspect of the animals' environment and feeding. The fundamental principle is to transform lean, active animals into sedentary cage and pen potatoes that, out of a combination of boredom and stress, will gobble up supersized portions of fortified high-protein concentrate. By the time they are ready for slaughter, their unexercised legs can barely support their massive weight. It suggests, all too obviously, a parody version of "you are what you eat"—weak, obese, flabby humans feeding on weak, obese, flabby animals.

There are many unappetizing exposés of the factory farming system already in print. This chapter will cover the basics of how large-scale animal production operates, not to stir up guilt and squeamishness, but to raise concerns about the nutritional and food quality implications of the switch from family to factory farming. Quite aside from ethical issues of how we should treat living, sentient beings, is this really how you want to treat your food?

CHICKEN—THE NEW AMERICAN TOFU

Chickens have learned to keep pace with the times. We want fast food and they provide it. In the 1930s, a broiler chicken took a leisurely sixteen weeks of casual pecking and scratching around the barnyard to reach a relatively svelte market weight of 3 pounds, compared to the mere six weeks it takes today's zaftig chickens to hit 4.5 pounds. A chicken for Sunday dinner was once considered a marker of prosperity. Now chicken is a fast and processed food staple with a bland, watery flavor that makes it adaptable to many uses—rendering it, in effect, the American tofu.

Thanks to "scientifically formulated feeds," contemporary birds use their brief time on earth very efficiently—needing only 2 pounds of feed to produce one pound of chicken, compared to nearly 4.5 pounds of feed for the outmoded, inefficient 1930s model. They put on weight because they have been bred to be big, heavy-muscled birds that lie around apathetically whenever they are not eating. Maximum calories in, minimum calories out.

When humans follow a similar lifestyle, they put on fat and lose muscle, yet the typical factory chicken (despite a lot of abdominal fat) is a muscular heavyweight. If you ever tried one of those Eight-Minute Abs programs and failed put on muscle, you might feel a little jealous. How did the chicken succeed where so many humans have failed?

The unsavory answer is that the factory chicken's muscle is abnormal and barely functional. They lie around because the leg muscles and tendons are weak and prone to give way. Normal muscle growth in any animal involves two opposing processes: anabolism (protein buildup) and catabolism (protein breakdown). The balance between these two processes allows muscle tissue to be continuously remodeled in response to the stress and strain of use. The fast-growing factory chickens are deficient in the enzymes needed for catabolism—so they keep growing more and bigger muscle fibers despite their inactivity.

Biochemically and physiologically, their muscle tissues are markedly different from the more traditional and more active barnyard bird. The fibers are much larger; they have a far greater proportion of the less efficient "fast twitch" muscle (the white meat); often there are visible areas of diseased or dysfunctional muscle; *rigor mortis* (discussed later in this chpater) occurs much more rapidly post-slaughter; and the acid-base balance of the tissue is shifted to be more acidic. These differences—which are true as well for the factory farm breeds of quick-growing hogs and turkeys—have an overall negative effect on taste, resulting in watery, flavorless and tough meat.

8
The Tyranny of Hygiene

*T*HERE ARE FOOD CONSERVATIVES who like their meals well-cooked, mildly seasoned and (as the most important ingredient of all) familiar. And then there are food adventurers, the dinner table world travelers, who will eat anything at least once. Watching how one diner picks cautiously at a veal cutlet while another wolfs down the head cheese, you can speculate that these traits represent divergent survival strategies among our remote ancestors. When threatened with famine, some ventured to find out whether a berry, a root or a weird-looking fungus might actually be edible—making a lucky discovery with chanterelles or fiddlehead ferns, an unpleasant one with false morels or pokeberries. The food conservatives waited to observe the end results of these culinary investigations, and hoped there was something left over for them.

Today the food conservatives have made careers for themselves in government, legislating, regulating and inspecting the food supply, imposing techno-fixes on techno-problems. Their remedies punish the food rather than the perpetrators—overcook this, irradiate that, and never ever eat anything raw.

Individual illnesses may be clearly preventable: if only we hadn't gone to that restaurant, if only we had had chicken instead of hamburger, or hamburger instead of chicken. But bacteria and bungling (mishandling and contamination of food) are part of nature and of human nature. There will always be food contamination problems, some of them serious or fatal. The high-profile safety problems in the food supply today—salmonella in chickens; pesticide residues in tuna and other large ocean fish; *Escherichia coli* (*E coli*) in ground beef, green onions and bagged salad; and BSE (mad cow disease)—are problems created and perpetuated by the industrialization, centralization and mass processing of the food supply.

Certain people should be food conservatives: pregnant women, small children, frail elderly and people with impaired immune systems. For these at-risk groups, food poisoning can (though still very rarely) be life threatening or fatal. This chapter is written in defense of the food adventurers and their right to adventure—a right that is threatened by regulations that propose to fix an unsafe processed and industrialized food supply by further processing and industrialization of the food.

"Good food and good eating are about risk. Every once in a while an oyster, for instance, will make you sick to your stomach. Does this mean you should stop eating oysters? No way. The more exotic the food, the more adventurous the serious eater, the higher the likelihood of later discomfort. I'm not going to deny myself the pleasures of morcilla sausage, or sashimi, or even ropa vieja at the local Cuban joint just because sometimes I feel bad a few hours after I've eaten them." ~Anthony Bourdain

RAW EGGS, RAW MILK, AND OTHER FORBIDDEN PLEASURES

Real Caesar salad, eggnog, mayonnaise, a rare steak with Béarnaise sauce—these wonderful classic foods are not only hard to find (unless you make them yourself), but in some states serving them is actually illegal due to outdated or overblown concerns that raw eggs are contaminated with salmonella bacteria. (Of course, in most restaurants ordering a Caesar salad is hopeless: you'll only get chopped romaine with bottled dressing, no eggs, raw or poached, and no anchovies.)

The U.S. Centers for Disease Control released a series of reports in the 1980s and '90s detailing outbreaks of salmonella poisoning traced to undercooked or raw eggs. In many instances, these outbreaks involved dishes that had been mishandled by restaurants or caterers: hollandaise sauce held at lukewarm temperatures (100° F) for nine hours, Caesar salad kept at room temperature for six hours, and custard pies that went unrefrigerated for twenty-one hours. In any event, the largest risk for salmonella poisoning is from mishandling or undercooking of contaminated chicken, not eggs. (If you want to know which came first, it was the salmonella-infected hen.)

Better quality control has reduced the contamination rate, although it is still quite substantial in poultry meats—11% of broilers, 20% of ground turkey, 45% of ground chicken meat. The Centers for Disease Control estimates the incidence of salmonella contamination in eggs as one in twenty thousand. The average person, according to the FDA, consumes undercooked eggs twenty times a year, putting them at a once in a thousand years risk of salmonella from undercooked eggs.

By way of comparison, the risk of being injured in a car accident is one in eighty-two in any given year (for being killed it is one in 7,500), but no one has proposed making automobiles illegal, and the federal government has not issued consumer fact sheets suggesting we limit our use of automobiles. Nonetheless, the FDA has an "Egg Safety Action Plan" with the goal of reducing the incidence of salmonella poisoning from eggs by 50%—to once in two-thousand egg-eating years. The push is now on for widespread pasteurization of eggs, which are described as "very similar in taste" to the authentic egg. Now that unpasteurized eggs are classified as a high-risk food, with a warning label on the carton, they will probably sell.

The sale of raw milk (and of unpasteurized buttermilk, butter, yogurt and cream) is highly restricted or outright illegal in many states, giving rise to amusing subterfuges, such as labeling it as pet food or "not fit for human consumption" or selling shares in the cow (so the milk is simply distributed to its owners rather than sold outright). Raw milk can be sold directly to the consumer in some states (such as New Hampshire, New York and Pennsylvania, if the farmer has a permit), but in most states it is illegal to sell it in stores or restaurants.

Traditional cheesemakers say that pasteurization destroys enzymes that are important to the cheese-making process. Raw milk cheese has a more complex, piquant taste and, in semi-hard or hard cheeses, a far more pleasing, non-gluey texture. That's not comparing Reblochon to Velveeta, but the pasteurized to the raw milk versions of specific cheeses, whether a Farmhouse Cheddar or a Roquefort. (Some cheeses sold as unpasteurized are in fact given a heat treatment, "thermised," as a dubious compromise, promising the safety of pasteurization plus the enzymes of raw milk.)

Slow Food USA and the American Cheese Society are working for the recognition and protection of American farmstead raw milk cheeses. Current FDA regulations require that raw milk cheeses be aged a minimum of sixty days before they can be sold, based on the observation that the increasing acidity and reduced moisture content of aged cheese create an inhospitable environment for bacteria to grow. Traditional brie and camembert are aged only three to four weeks and so are illegal in the United States, whether produced domestically or imported. This regulation is unlikely to change, and in fact the raw milk cheese advocates are mostly anxious about protecting the status quo from further restrictions. The FDA has launched a comprehensive risk assessment and intervention program to reduce the number of cases of *Listeria* food poisoning in the United States, and has identified unpasteurized dairy products as a high-risk food category. Even without actually outlawing raw cheeses and milk, state, federal or world trade authorities can apply so many regulations that artisanal cheesemakers and small dairies will not be able to keep up the paperwork and testing requirements. Food codes that elevate hygiene over quality, that define purity as sterility rather than as authenticity, will always favor mass-produced, chemical-laden products over traditional, minimally processed foods.

The FDA estimates that severe *Listeria* poisoning strikes 3.4 out of every million Americans. The goal of their comprehensive risk assessment and intervention is to lower that incidence to 2.5 people per million. There are probably simpler and more cost-effective ways to save 0.9 people per million from life-threatening illnesses or injuries (like gun control or speed limit enforcement), but when all you have is a hammer, every problem is a nail. Food safety is part of the FDA's mandate and they feel that *Listeria* is important.

The FDA's *Listeria* risk assessment, published in September of 2003, showed that deli meats and un-reheated hot dogs account for the largest number of cases. Deli meats and unpasteurized milk were roughly equivalent in risk of serious contamination, but lunch meats are consumed far more frequently. A major outbreak of *Listeria* poisoning in 2002, which resulted in fifty-four illnesses, eight deaths and three miscarriages, was traced to consumption of contaminated turkey meat that was distributed in nine states. In 1999, thirteen deaths and two miscarriages were linked to contaminated hot dogs and deli meats from a Sara Lee subsidiary. Basically, any ready-to-eat food that does not get reheated can be contaminated with *Listeria*; the longer its supposed shelf life, the greater the likelihood that bacteria will multiply to reach toxic levels. This is a problem of industrial food production, not small farms crafting traditional cheeses from the milk of their own cows, sheep and goats. But, since requiring pasteurization of all milk is simple and cleaning up the manufacture of deli meats is difficult, the FDA may well opt to eliminate raw milk to meet their goal of saving 0.9 people per million from *Listeria* poisoning.

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The Tyranny of Shelf Life

*O*ur food supply has changed enormously over the last 150 years, with the introduction first of canned, then frozen foods, followed by processed foods with extended shelf lives, and finally by meal kits, meal substitutes and highly supplemented "wellness" or "functional" foods. As nutritionists trained us to believe first one food and then another was dangerous to eat, processed food manufacturers cheerfully reformulated their products to suit the current craze—margarine, aspartame, Eggbeaters, turkey franks, low-carb pasta—and to meet an ever-growing appetite for easy answers and quick meals. All along the way, food became more convenient, less fresh and less natural (even when it is "all natural").

One hundred years ago, over 40% of Americans lived or worked on farms. Those not on a farm had a garden if they could, raising about 30% of their vegetables, on average, and buying the rest. Today less than 3% of U.S. workers are involved in agriculture, and less than 3% of vegetables consumed domestically are homegrown. Among the many consequences of our move away from the land to the cities (and to processed foods) is our lack of knowledge about how food is produced and—just as crucial—our lack of standards for how it should taste.

THE TYRANNY OF STANDARDS: IT'S ALL MADE OUT OF TICKY-TACKY AND IT ALL TASTES JUST THE SAME

To protect retailers and consumers against fraud and substandard products, the USDA has long administered a grading standards program that covers a wide range of commodities and crops, from sides of beef to bushels of apples. Since most farmers sell to processors or brokers who pay based on the grade, the farmer's profit is entirely contingent on meeting the standards for the higher quality grades. But the quality grades rarely reflect gustatory or nutritional standards for excellence and, in fact, sometimes work against them. For example, to make U.S. No. 1 grade, 90%–95% of the strawberries in the lot being graded must have a minimum diameter of three-quarters of an inch and must be pink or red on at least three-quarters of their surface (which means they can be picked long before ripeness). They must also be free of dirt and blemishes. So a farmer who produces small, perfectly ripe, luscious red strawberries would be graded U.S. No. 2. Now you know why supermarket strawberries are beautiful in appearance and almost devoid of taste. They are regulated to be that way.

For produce, USDA quality is almost always defined by physical appearance: size, shape, and freedom from blemishes and insect damage, requirements that obviously encourage use of pesticides. The USDA grading standards for apples even set minimum color standards (percentage of surface that is solid or striped red). U.S. Extra Fancy red delicious, red rome, empire, winesaps and staymans must be two-thirds red-colored, or else they sink to a U.S. Fancy grade. The standards include such bureaucratic (and nearly incomprehensible) finickiness as:

> For the striped red varieties, the percentage stated refers to the area of the surface in which the stripes of a good shade of red characteristic of the variety shall predominate over stripes of lighter red, green, or yellow. However, an apple having color of a lighter shade than that considered as a good shade of red characteristic of the variety may be admitted to a grade, provided it

> has sufficient additional area covered so that the apple has as good an appearance as one with the minimum percentage of stripes of a good red characteristic of the variety required for the grade.

It is nice to know that the USDA is so concerned with the color of my apples, but I wish they would do something about their taste and texture.

For the foods under their jurisdiction (dairy, eggs, processed foods), the FDA's Standards of Identity set requirements that are both minimal and rigid. For example, to the FDA, mozzarella cheese is defined simply by its milk fat content (minimum of 45% by weight) and its moisture content (52%–60% by weight). Whether or not the cheese is made following the traditional pasta filata technique (stretching the curds into strings) is optional. The traditional process is briefly described in the FDA regulations, but the cheese can be manufactured "by any other procedure which produces a finished cheese having the same physical and chemical properties" and still label itself "mozzarella" (Code of Federal Regulations, Title 21, Food and Drugs, 21 CFR 133.155). Unless knowledgeable consumers are aware of the distinctions, and willing to pay more, there is little incentive for processors to produce a more traditional or higher quality product.

Here is how the FDA defines pasteurized process cheese food: one or more cheese ingredients with one or more dairy ingredients combined with one or more optional emulsifying, acidifying or mold-inhibiting agents and heated for at least thirty seconds at 150° F or higher to become "a homogeneous plastic mass." This homogeneous plastic cheese-flavored mass must contain at least 51% cheese ingredients by weight, with the fat content comprising at least 23% by weight. The dairy ingredient options are cream, milk, skim milk, buttermilk, cheese whey, anhydrous milkfat, dehydrated cream, and cheese whey albumin. (Pasteurized process cheese spread is similarly defined, only with the qualifier that the homogeneous plastic mass "is spreadable at 70° F" and bulking and wetting agents are allowed.)

This might seem to be about as debased a product as could conceivably claim the word "cheese" as part of its name, but apparently it is too high a standard for the food industry to meet consistently. Late in 2002, the FDA issued a warning letter to Kraft Foods for violating the standard by using dried milk solids (not allowed in the definition) in the manufacture of their most well-known homogenous plastic mass, Velveeta.

The Standards of Identity represent the FDA's lowest-common-denominator approach to protecting consumers from unsafe or fraudulently labeled food. It sets minimum standards, giving no incentive to manufacturers to produce a premium product (75% good quality cheese and 25% fresh cream, for example) that could be clearly distinguished by its labeling. In contrast, the European Union has developed a program for defining food by geographic origins that protects traditional artisanal foods such as Roquefort cheese, Tuscany olive oil and Bordeaux wine to prevent producers outside those geographic regions from calling their cheese, olive oil or wine by those names. (The most commonly used labels are: protected designation of origin or PDO; *appellation d'origine contrôlée* or AOC for French products; and *denominazione di origine controllata e garantita* or DOCG for Italian traditional foods. A food labeled PGI for protected geographical indication is a regional product not associated with a detailed production method. TSG, traditional specialty guaranteed, identifies products made according to traditional methods outside their region of origin.) In trying to extend E.U. designations to apply to all World Trade Organization participants, the European Union is getting a great deal of resistance from food processors in Australia, Argentina, Canada, the United States and other countries who have been marketing their own versions of traditional products like Beaujolais, Prosciutto di Parma, Asiago or Parmigiano-Reggiano (Parmesan) cheese.

How the E.U. and the U.S. FDA say cheese

The Italian production standard for Parmigiano-Reggiano cheese:

It is made with cow's milk from animals whose feeding mainly consists of forage from the area of origin. The milk used is raw and cannot undergo any thermal treatments. The use of additives is strictly forbidden.

The milk from the evening milking and that from the morning milking is delivered to the dairy within two hours from the end of each milking.

The evening milk is partly skimmed by removing the cream naturally risen to the surface in open-top stainless steel basins. The morning milk, immediately after arriving at the dairy, is mixed with the partly skimmed milk from the previous evening.

Starter whey is then added to the milk. This is a natural starter culture of lactic ferments obtained from the spontaneous acidification of the whey remaining after the previous day's cheese processing.

The milk curdling takes place inside copper vats shaped like truncated cones with the exclusive use of calf rennet.

Maturation must last at least 12 months starting from the cheese moulding.

[www.parmigiano-reggiano.it]

From the FDA standard for Parmesan/ Reggiano cheese manufacture

Milk … may be pasteurized or clarified or both, and … may be warmed.

For the purposes of this section, the word ``milk" means cow's milk, which may be adjusted by separating part of the fat therefrom or by adding thereto one or more of the following: Cream, skim milk, concentrated skim milk, nonfat dry milk, water in a quantity sufficient to reconstitute any concentrated skim milk or nonfat dry milk used.

Such milk may be bleached by the use of benzoyl peroxide or a mixture of benzoyl peroxide with potassium alum, calcium sulfate, and magnesium carbonate. [To culture it, the milk] is subjected to the action of harmless lactic-acid-producing bacteria, present in such milk or added thereto.

Sufficient rennet, or other safe and suitable milk-clotting enzyme that produces equivalent curd formation, or both, with or without purified calcium chloride. Harmless artificial coloring may be added.

It is cured for not less than 10 months.

[US CSR Sec. 133.165 Parmesan and reggiano cheese]

(Currently, Kraft Foods is seeking to have the FDA standard for aging of parmesan cheese reduced to six months. They say consumers can't tell the difference.)

THE TYRANNY OF EXTENDED SHELF LIFE: WORST THING SINCE SLICED BREAD

Supermarket chains, not coincidentally, came into existence early in the last century when first canned and then frozen foods began to be widely available. Initially, these early supermarkets specialized in offering low-price canned and packaged goods, not even attempting to compete with the neighborhood greengrocers, bakers and butchers where most food shopping was done, or with the farmers driving their carts through the town to sell directly to the public. In the late 1920s, Safeway began experimenting with "combination stores," adding a meat market to the usual packaged and canned goods. Since then, supermarkets have expanded to offer everything from beach chairs to floral arrangements to prescription drugs.

Then and now, the low prices of the supermarket chains are made possible by applying economies of scale to retailing—pushing down wholesale prices by large-volume buying, then keeping costs down using their own warehouse and distribution networks to supply all the stores in the chain. This centralized system works well with canned tomatoes, light bulbs, frozen fish filets and breakfast cereals—less well for more perishable products like produce, now harvested immature in order to survive shipping, and bread, which Americans once purchased fresh daily. Without the technologies of canning, quick-freezing, preservatives, enzymes, antioxidants and refrigerated trucks, the centralized distribution networks of the major supermarket chains simply could not get the food to the stores before it spoiled.

Shelf life technology and supermarket chains have evolved in tandem. Foods that can be preserved longer can be shipped further. As technologies improved, the supermarket chains could extend their purchasing globally while further centralizing their operations—a consolidation process that is accelerating rapidly today.

The benefit for consumers has been astonishingly low prices. In the 1890s, Wilbur Atwater estimated that the average family spent half its income on food. Today Americans spend only a little over one-tenth their income on food. The loss for consumers is the central issue of this book: the erosion of flavor, freshness and traditional high-quality production standards. We get what we pay for, and—perhaps—we are what we eat.

Seduced by low cost and high convenience, most of us have accepted supermarket and processed foods because we have all been taught that they are nutritionally equivalent to the homemade or homegrown versions. The Wilbur O. Atwater school of nutrition would maintain that protein is protein, fiber is fiber, vitamins are vitamins and minerals are minerals, no matter whether they are naturally present in your food or added back to replace those lost by processing and staling. But there are those one million other, mostly unknown, substances naturally present in our food—some of them artificially absent or altered in proportions in processed and extended shelf life preparations. Both the known and the unknown substances interact with each other, and these interactions are strongly influenced by the matrix in which they occur. As chapter 2 showed, taking fiber out of foods and then putting it back in changes the nutritional properties of both the food and the fiber. The numbers on the Nutrition Facts label might be roughly the same, but the food will be different. It cannot be assumed to be truly equivalent to the traditional, minimally processed or whole food from which it was derived.

Conclusion
Eating without Rules

OVER THE PAST 120 YEARS, we have never been without authorities who claim that entire categories of food are inherently healthy, whereas others are inherently unhealthy or fattening. In the late nineteenth century, Atwater urged Americans to choose protein-rich foods and to avoid useless carbohydrates; in the late twentieth century, so did Atkins. In between, we have been warned of the dangers of eating red meat, butter, eggs, raw whole milk, raw milk cheeses and raw scallions, as well as any food with appreciable (as in enjoyable) levels of fat or sugar in it. In his writings for public consumption, Atwater persistently refers to food as "food-materials" in order to emphasize his point that food is properly viewed as nutrients, to be selected rationally for the optimal benefit to health at the least cost. Repeated by generations of industry-funded nutritionists and by their publicists, the message has hit home. The Nutrition Facts labels—not the evidence of our senses—tell us what and how much to eat.

The sad consequence is that we have done to the pleasures of the table what our Puritanical forebears did to the pleasures of the bed. So many people now are frigid, guilty or perverted eaters, out of touch with their instincts and afraid of their longings. Studies have reported that both adults and children interpret "healthy food" as meaning "doesn't taste good." They are mostly right, since we have lost the art of traditional cooking, in which virtuous fruits and vegetables were served with wicked sauces, and since the nutritionists' healthy foods—fruit, vegetables, fish—are so often dead on arrival at the supermarket.

Yet for all the innocent, happy millennia before people were told they *ought* to eat their vegetables, they ate broccoli, peas, spinach, eggplant, leeks and kale because they liked them. The wonderful, sometimes very elaborate, recipes for vegetable-based dishes that have come down to us from the fine cuisines of Europe and Asia are proof enough that people did a very good job of choosing their foods—and a much better job of preparing them—before the nutritionists trained us to view "food-materials" as chemical compounds.

Although we can follow the recipes, we can rarely source fresh ingredients of the quality available, in season, to our grandparents and great-grandparents. The decline in food quality is only partly due to supermarket supply chains and shelf life–extending technologies. For the past sixty years, agricultural science has been focused on producing hardy hybrids of a uniform size that can withstand mechanical harvesting and long-distance shipping. In the process, taste has been bred out of the majority of our fruits and vegetables. With the important exception of heirloom tomatoes, most small-scale farmers are raising the same fast-growing hybrids as the large corporate farms.

I adore strawberries. In season I greedily tour the local farmers markets via bicycle, always hoping to find the über-berry, the full-flavored strawberry I remember, or think I remember, from the gardens and farmstands of my childhood. The local berries are fresh, ripe all the way through, and markedly better than the huge California fakes, yet the flavor is still a bit watery, weak, unconvincing. I have on my shelves a collection of old (very old) *Farm Journal* articles. The very first issue, March of 1877, included a feature on strawberry growing for beginners that describes some twenty varieties: the Longfellow, beautiful, firm, sweet; the Essex Beauty, large, prolific, with a superior flavor; the Mt. Vernon, large, very handsome, prolific, but not very firm. How I long to sample them! But that was long ago, in the nutritional dark ages, when people cared for the taste of their food, before we learned that the purpose of a strawberry is to provide vitamin C, not pleasure. So long as the burgeoning network of farmers markets (4,385 nationwide as of 2006) position themselves as providing *healthier* food (or more politically correct food), we are unlikely to have real alternatives to the dominant, fast-growing, blandly flavored hybrids and crosses, whether it's a strawberry or a chop, a canteloupe or a chicken. Wilbur O. Atwater casts a long shadow over the "toothsome" quality of our food.

So what have we really learned about nutrition over the last 120 years? Quite a great deal and much of that information is important. We know what happens when people have extreme or prolonged deficiencies of specific vitamins and minerals: vitamin A (night blindness, scarring of the cornea), vitamin B12 (pernicious anemia), vitamin C (scurvy), vitamin D (rickets, osteomalacia), thiamine (beriberi), zinc (impaired growth and immunity). However, we know very little about what happens when people get extreme or prolonged overdoses of specific vitamins and minerals. Yet that is happening to us now—with the nutritionists' and the FDA's blessing—as more and more of our food is overfortified with vitamins, minerals and antioxidants.