

YOUNG READERS EDITION

The  
Omnivore's  
Dilemma

THE SECRETS BEHIND WHAT YOU EAT

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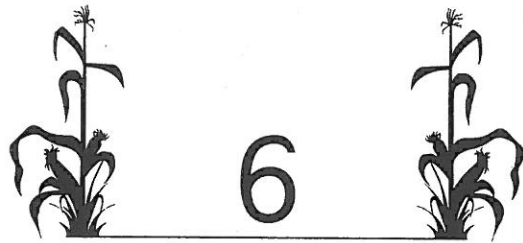
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DIAL BOOKS

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## Processed Food

### SPLITTING THE KERNEL

Do you eat a lot of corn? Looking at it one way, each American eats only about a bushel of corn per year. But that number only includes the corn that *looks* like corn—corn on the cob, or corn out of a can, or corn chips.

But if you count *all* the corn we eat, directly and indirectly the average American eats a *ton of corn* every year. We don't recognize it as corn, though, because it's been turned into something else. Almost half is eaten by animals and turned into beef, chicken, fish, or pork. One-tenth of the U.S. corn crop is turned into processed food.

To make processed food, corn is first broken down into different parts. Those parts are put back together in new ways to make the sweetener in your soft drink or the starch in your hamburger roll. All of this happens in a factory called a "wet mill." (The old sort of mill, which simply grinds grain into flour, or meal, is a "dry" mill.) To follow the industrial

## THE INDUSTRIAL MEAL

food chain, I had to follow the river of corn through a wet mill.

There are twenty-five major wet mills in the United States, most of them owned by two corporations, Cargill and Archer Daniels Midland. George Naylor's corn probably went to Cargill's mill in Iowa City. ADM runs a giant plant in Decatur, Illinois. Both of those companies refused to let me to tour their plants.

Luckily, I was allowed to visit a smaller mill at Iowa State University in Ames, Iowa. Iowa State really should be called the University of Corn. Corn is the hero of many of the sculptures and murals on campus. (The soybean, Iowa's second-largest crop, gets its share of attention too.) The school's wet mill is part of something called the Center for Crops Utilization Research. Larry Johnson, the center's director, was more than happy to show me around.

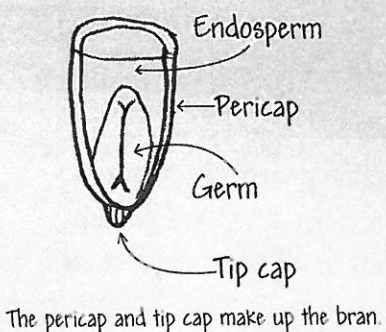
### INDUSTRIAL DIGESTION

Johnson described the wet mill as kind of an industrial digestive system. The mill itself is a maze of stainless steel pipes, valves, filters, and tanks. Corn travels through the maze and is broken down through a series of steps including grinding (like the teeth) and soaking in acid (like the stomach). By the time it reaches the end, the corn is reduced to simple molecules, mostly sugars. Soybeans go through a similar process.

The first step in the "digestion" of corn is to split the kernel into its different parts:

- The yellow skin.
- The germ, the tiny dark part nearest the cob. That's

DIAGRAM OF A CORN KERNEL



the part that holds a tiny embryo of a corn plant.

- The endosperm. The biggest part of the kernel, filled with carbohydrates.

When a shipment of corn arrives at the mill, it is soaked for thirty-six hours in a slightly acid bath. This swells the kernels and loosens the skin. After the soak,

the swollen kernels are ground in a mill. “By now the germ is rubbery and it pops right off,” Johnson explained.

The germ is then squeezed for corn oil. Corn oil can be used as a cooking or salad oil. Some of it is hydrogenated. That means hydrogen is forced into the oil molecules. This makes the oil stay solid at room temperature and so it can be used for margarine. Doctors used to think margarine was healthier for you than butter and would not cause heart disease. Now researchers think these hydrogenated trans fats in margarine are actually worse for our hearts than butter. Trans fats are also used in processed snacks, baked goods, and many other processed foods.

Once the germ has been removed for oil, the kernels are crushed. That makes a white mush of protein and starch called “mill starch.” The mill starch can be used in animal feed.

## STARCH INTO SUGAR

What’s left after that is a white liquid that’s poured out onto a stainless steel table. It dries to a fine, superwhite powder—cornstarch. Cornstarch was wet milling’s first product back in the

1840s. At first the starch was mainly used for laundry—to make shirts stiff. Then cooks and food companies began adding cornstarch to as many recipes as they could. The starch was cheap and had a nice white color that people thought was “pure.”

By 1866, the mill owners had learned how to break down cornstarch into a kind of sugar called glucose. The glucose corn syrup wasn’t as sweet as sugar, but it was cheap. Ever since, corn sweeteners have been the industry’s most important product.

The big breakthrough came in the 1960s. That’s when Japanese chemists discovered an enzyme that could transform glucose into the much sweeter sugar molecule called fructose. High-fructose corn syrup was born. It’s a blend of 55 percent fructose and 45 percent glucose that tastes exactly as sweet as table sugar. Today it is the most valuable food product refined from corn.

High-fructose corn syrup, or HFCS, is by far the biggest food output of the country’s wet mills. But there are hundreds of other food ingredients created from the remaining cornstarch. Some is made into other sugars like maltodextrin, which can be used to make instant pudding or gravy. Some is fermented to become ethanol. Some of the fermented starch is used to make plastic. At the end there’s almost nothing left. Even the dirty water from the process is used to make animal feed.

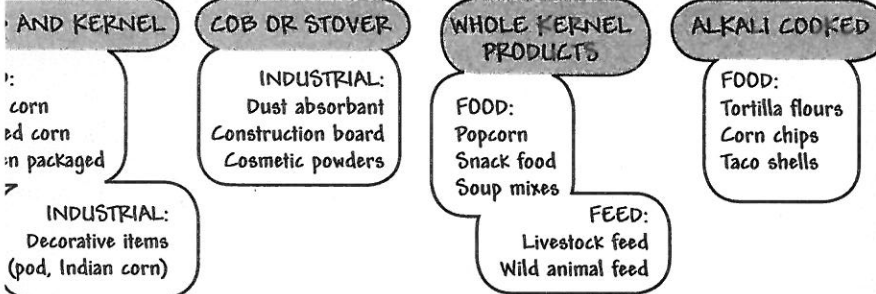
The wet mill is like a giant steel beast, with a maze of pipes and machines inside. At one end it eats millions of bushels of corn fed to it every day by the trainload. At the other end of the beast are hundreds of spigots, large and small. Out of each spigot flows a different product made from corn, called “fractions” by the food industry. Many of these fractions, the sugars and starches, the alcohols and acids, the emulsifiers and stabi-

# Made from CORN

FROM THE CENTER FOR CROPS UTILIZATION RESEARCH, IOWA STATE UNIVERSITY

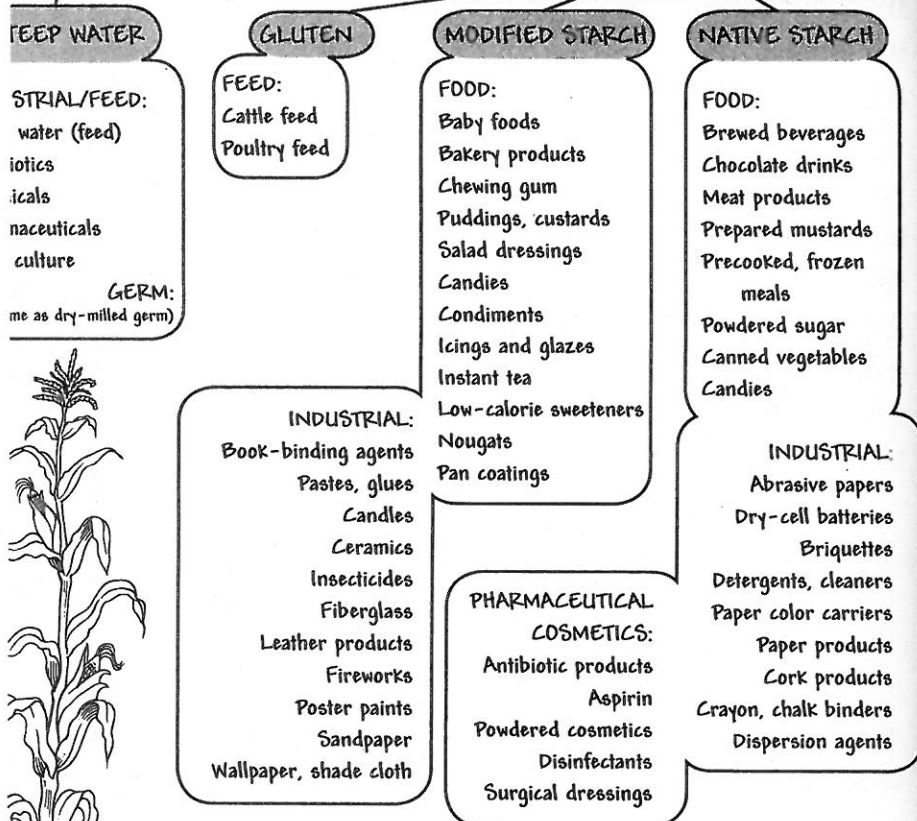


## WHOLE CORN PRODUCTS



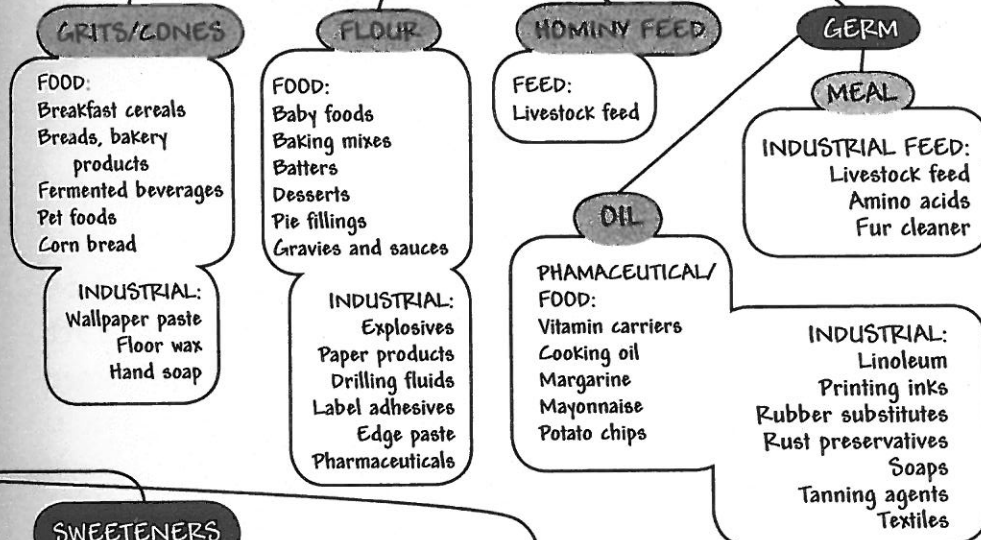
## WET-MILLED CORN

## STARCH PRODUCTS

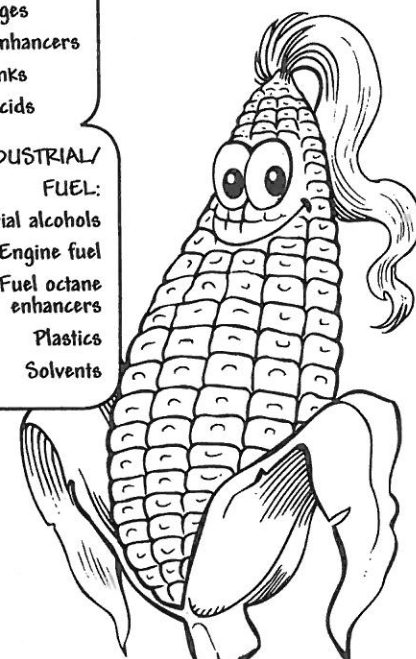
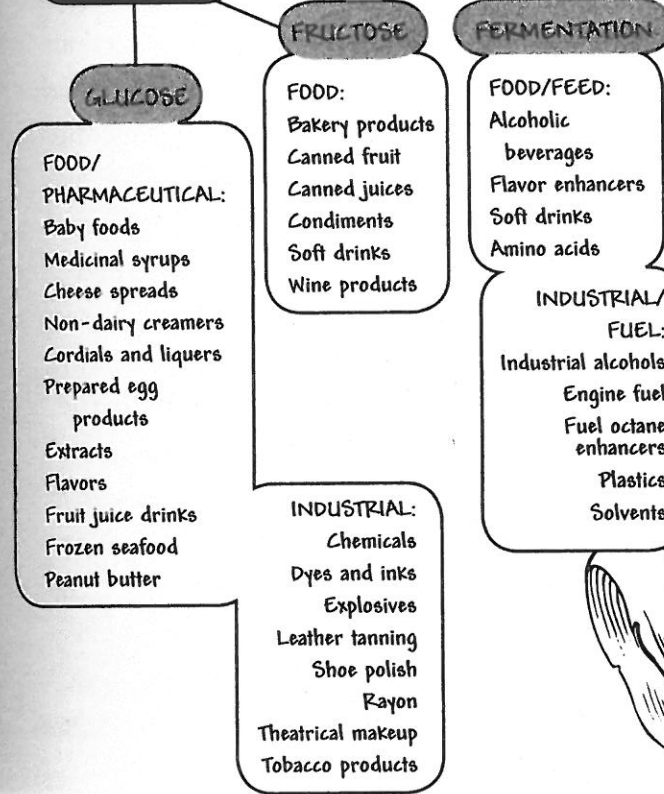


## FRACTIONED PRODUCTS

## DRY-MILLED CORN



## SWEETENERS



lizers with the strange names, will be made into food. They are put together to make cereal or snack food or chicken nuggets or TV dinners or just about anything else you can imagine and ingest. In fact, you would be hard-pressed to find a processed food today that isn't made from corn or soybeans.

## CEREAL SECRETS

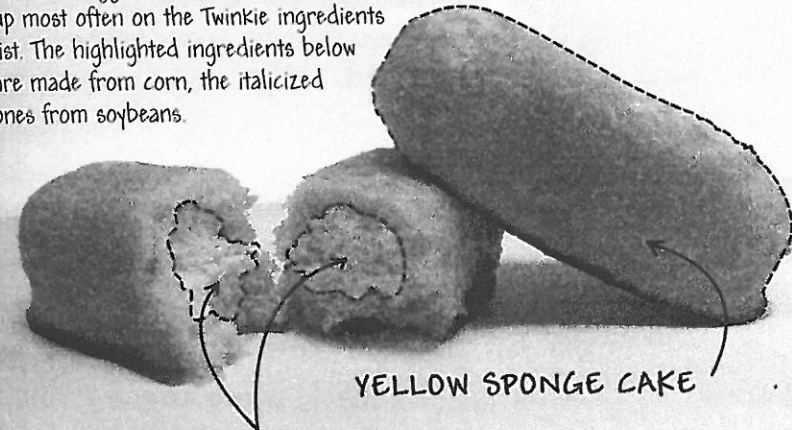
A few years ago I had the chance to visit one of the places where new foods are invented. I was given a tour of the research and development laboratory for General Mills, the sixth-largest food company in the world. The lab is called the Bell Institute and it is housed in a group of buildings on the outskirts of Minneapolis. Here nine hundred food scientists spend their days designing the future of food.

Much of their work is top secret, but nowhere more so than in the cereals area. Deep in the heart of the Bell Institute is a maze of windowless rooms called, rather grandly, the Institute of Cereal Technology. The secrecy surrounding cereals like Lucky Charms seemed silly, and I said so. But an executive explained to me that recipes can't be patented or copyrighted—which means that once you introduce a new cereal, anyone can put out another one just like it. All you can hope for is to have the market to yourself for a few months to establish your brand. That's why companies keep their new cereals top secret.

In the interests of secrecy, the food scientists would not talk to me about current projects. But they would talk about past failures, like the cereal in the shape of little bowling pins and balls. "The kids loved it," the product's inventor told me, "but the mothers didn't like the idea of kids bowling their breakfast across the table." Which is why bowling pins never showed up in your cereal bowl.

### WHAT'S IN A TWINKIE?

Hostess bakes 500 million Twinkies each year, a task requiring 8 million pounds of sugar, 7 million pounds of flour and 1 million eggs. Even with all that sugar, flour and eggs, corn is still the raw material that shows up most often on the Twinkie ingredients list. The highlighted ingredients below are made from corn, the italicized ones from soybeans.



CREAM FILLING

YELLOW SPONGE CAKE



**INGREDIENTS:** ENRICHED BLEACHED WHEAT FLOUR [FLOUR, REDUCED IRON, "B" VITAMINS (NIACIN, THIAMINE MONONITRATE (B1), RIBOFLAVIN (B2), FOLIC ACID)], **CORN SYRUP**, **HIGH FRUCTOSE CORN SYRUP**, WATER, **PARTIALLY HYDROGENATED VEGETABLE AND/OR ANIMAL SHORTENING** (*SOYBEAN*, COTTONSEED AND/OR CANOLA OIL, BEEF FAT), WHOLE EGGS, **DEXTROSE**. CONTAINS 2% OR LESS OF: **MODIFIED CORN STARCH**, **GLUCOSE**, LEAVENINGS (SODIUM ACID PYROPHOSPHATE, BAKING SODA, MONOCALCIUM PHOSPHATE), SWEET DAIRY WHEY, *SOY PROTEIN ISOLATE*, CALCIUM AND SODIUM CASEINATE, SALT, MONO AND DIGLYCERIDES, **POLYSORBATE 60**, *SOY LECITHIN*, *SOY FLOUR*, **CORNSTARCH**, CELLULOSE GUM, *SODIUM STEAROYL LACTYLATE*, NATURAL AND ARTIFICIAL FLAVORS, SORBIC ACID (TO RETAIN FRESHNESS), YELLOW 5, RED 40. CONTAINS WHEAT, EGG, MILK AND *SOYBEANS*. MAY CONTAIN PEANUTS.

Breakfast cereal is a great example of why companies love to make processed foods. A box of cereal contains four cents worth of corn (or some other grain). Yet that box will sell for close to four dollars. Cereals generate higher profits for General Mills than any other food. In the same way, McDonald's makes much more by selling you a chicken nugget than a piece of recognizable chicken.

The farmer, on the other hand, makes more money from whole foods than processed foods. For example, for every dollar a consumer spends to buy eggs, forty cents finds its way back to the farmer. But for every dollar a consumer spends on HFCS, say in a soft drink, farmers get only four cents. Companies like ADM and Coca-Cola and General Mills capture most of the rest. That's why George Naylor told me more than once: "There's money to be made in food, unless you're trying to grow it."

CAN YOU EAT MORE, PLEASE?

It seems that food corporations have got it made. The U.S. government helps pay for their raw materials. They make more money from selling food than farmers. But they have one big problem that limits their sales: the size of the human stomach.

Unlike many other products—CDs, say, or books—there's a natural limit to how much food we each can consume without exploding. Try as we might, the average person can eat only about fifteen hundred pounds of food a year. The demand for food rises only as fast as the population grows. In the U.S., that's around 1 percent per year.

This leaves food companies like General Mills with two choices. They can figure out how to get people to spend more money for the same amount of food. Or they can get us to eat more food than we need. Which do they choose? Why both, of course.

Processing food allows companies to charge more for it. Consumers will only pay so much for an ear of corn. But they can be convinced to pay a lot more for the same corn if it has been turned into a funny shape, sweetened, and brightly colored. The industry calls this "adding value."

Added value can be anything. It might be the convenience of a dinner you just pop in the microwave. Or it might be a feeling like "this food product is good for me." Or it might be that a food is fun to eat—like ridged potato chips or cereal bars. That's why food companies spend so much on advertising—to convince us they really have added value to the corn and soybeans.

They also try to convince us that their corn or chickens

WHERE DOES A DOLLAR SPENT ON PROCESSED FOOD GO?



Only 20 percent goes to the farmer. The rest goes to pick, package, transport, and advertise that food.

or apples are better (and worth more) than those of another company. They don't want us to buy just any old chicken, but Tyson chicken or Perdue. They don't want us to buy any old oat cereal—they want us to buy Cheerios.

Companies can also try to convince us that their food is healthier, even a sort of medicine. We're used to having vitamins and minerals added to our food. (Of course, manufacturers wouldn't need to add them if they hadn't been *removed* during processing.) And some manufacturers are going even further than adding vitamins. One company, called Tree Top, has developed a "low-moisture, naturally sweetened apple piece infused with a red-wine extract." Natural chemicals in red wine called flavonoids are thought to fight cancer. So Tree Top has added value to an apple by injecting it with flavonoids from red wine.

It seems that an old-fashioned apple just isn't enough anymore. We need an apple that fights cancer! We need orange juice with calcium that builds strong bones. We need cereal that keeps us from having a heart attack.

### FOOD THAT DOESN'T FEED

The latest invention to come from the wet mill and the lab is something called resistant starch. This new corn "fraction" has food makers very excited because—it can't be digested! That's right, it's a food that your body can't use. Since the body can't break down resistant starch, it slips through the digestive track. It's the ultimate diet food—food with no calories. It's food that isn't really food.

You would think this would be a bad thing. Imagine the advertisement: "Our food doesn't feed you!" But for food com-

panies, it's an excellent invention. They have finally overcome the natural limit of what the human body will eat. You could eat this stuff twenty-four hours a day, like a human-size corn processing plant!

Maybe this fake food is corn's final victory. It has succeeded up until now by being useful to humans. Now it is about to succeed by being of no use at all.

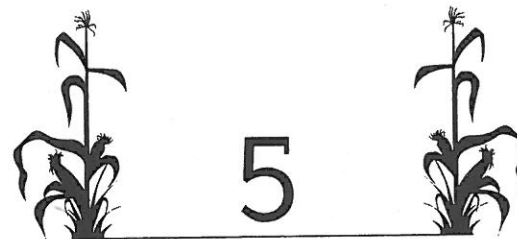
### EAT UP!

Resistant starch can be added to many common manufactured foods, including bread, pizza crust, pastries, salad dressing, ice cream, and pasta.

great eating camps, where they consume the mounting pile of surplus corn.

One of the strangest parts of the industrial food chain is the way it forces some animals to eat corn. And the saddest example of this might be what it means for cows. The cow is by nature not a corn eater. Getting cows to eat a corn diet takes a heroic effort on the part of the factory farm. But the river of surplus corn is waiting and so the cows must be forced to consume it and turn it into beef you and I can buy.

Enter the corn-fed American steer.



## The Feedlot— Turning Corn into Meat

### CITY OF COWS

I was speeding down a ramrod-straight road in Finney County, Kansas, when the empty, dull tan prairie suddenly turned black. The gently rolling sea of grass became a grid of steel fences as far as the eye could see. (In Kansas, that is *really* far.) I had made it to my destination—Poky Feeders, a feedlot and home to thirty-seven thousand head of cattle.

The feedlot appeared suddenly, but the stench of the place had been rising for more than a mile. I soon learned why. At first I thought the cattle were standing or lying in a grayish mud. Then it dawned on me—that wasn't mud at all. It was manure.

An endless series of cattle pens stretched to the horizon, each one home to a hundred or so animals. The cattle pens, filled with animals and their waste, are built around a corn mill. Twelve hours a day, seven days a week, the mill noisily turns America's river of corn into cattle feed.