

THE  
OMNIVORE'S  
DILEMMA

A NATURAL HISTORY  
OF FOUR MEALS



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FOR JUDITH AND ISAAC

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## FOUR

# THE FEEDLOT

*Making Meat*

(54,000 KERNELS)

### 1. CATTLE METROPOLIS

The landscape that corn has made in the American Middle West is unmistakable: It forms a second great American lawn, unfurling through the summer like an absurdly deep-pile carpet of green across the vast lands drained by the Mississippi River. Corn the plant has colonized some 125,000 square miles of the American continent, an area twice the size of New York State; even from outer space you can't miss it. It takes a bit more looking, however, to see some of the other landscapes that corn-the-commodity has created, in obscure places like Garden City, Kansas. Here in the high plains of western Kansas is where America's first feedlots were built, beginning in the early fifties.

You'll be speeding down one of Finney County's ramrod roads when the empty, dun-colored January prairie suddenly turns black and geometric, an urban grid of steel-fenced rectangles as far as the eye can see—which in Kansas is really far. I say "suddenly" but in fact the swiftly rising odor—an aroma whose Proustian echoes are decidedly

more bus station men's room than cows in the country—has been heralding the feedlot's approach for more than a mile. And then it's upon you: Poky Feeders, population, thirty-seven thousand. A sloping subdivision of cattle pens stretches to the horizon, each one home to a hundred or so animals standing dully or lying around in a grayish mud that, it eventually dawns on you, isn't mud at all. The pens line a network of unpaved roads that loop around vast waste lagoons on their way to the feedyard's thunderously beating heart and dominating landmark: a rhythmically chugging feed mill that rises, soaring and silvery in the early morning light, like an industrial cathedral in the midst of a teeming metropolis of meat. As it does twelve hours a day seven days a week, the mill is noisily converting America's river of corn into cattle feed.

I'd traveled to Poky early one January with the slightly improbable notion of visiting one particular resident, though as I nosed my rental car through the feedlot's rolling black sea of bovinity, I began to wonder if this was realistic. I was looking for a young black steer with three white blazes on his face that I'd met the previous fall on a ranch in Vale, South Dakota, five hundred miles due north of here. In fact, the steer I hoped to find belonged to me: I'd purchased him as an eight-month-old calf from the Blair Ranch for \$598. I was paying Poky Feeders \$1.60 a day for his room and board (all the corn he could eat) and meds.

My interest in this steer was not strictly financial, or even gustatory. No, my primary interest in this animal was educational. I wanted to learn how the industrial food chain transforms bushels of corn into steaks. How do you enlist so unlikely a creature—for the cow is a herbivore by nature—to help dispose of America's corn surplus? By far the biggest portion of a bushel of American commodity corn (about 60 percent of it, or some fifty-four thousand kernels) goes to feeding livestock, and much of that goes to feeding America's 100 million beef cattle—cows and bulls and steers that in times past spent most of their lives grazing on grasses out on the prairie.

America's food animals have undergone a revolution in lifestyle in the years since World War II. At the same time as much of America's hu-

man population found itself leaving the city for the suburbs, our food animals found themselves traveling in the opposite direction, leaving widely dispersed farms in places like Iowa to live in densely populated new animal cities. These places are so different from farms and ranches that a new term was needed to denote them: CAFO—Concentrated Animal Feeding Operation. The new animal and human landscapes were both products of government policy. The postwar suburbs would never have been built if not for the interstate highway system, as well as the G.I. Bill and federally subsidized mortgages. The urbanization of America's animal population would never have taken place if not for the advent of cheap, federally subsidized corn.

Corn itself profited from the urbanization of livestock twice. As the animals left the farm, more of the farm was left for corn, which rapidly colonized the paddocks and pastures and even the barnyards that had once been the animals' territory. The animals left because the farmers simply couldn't compete with the CAFOs. It cost a farmer more to grow feed corn than it cost a CAFO to buy it, for the simple reason that commodity corn now was routinely sold for less than it cost to grow. Corn profited again as the factory farms expanded, absorbing increasing amounts of its surplus. Corn found its way into the diet of animals that never used to eat very much of it (like cattle) or any corn at all, like the farmed salmon now being bred to tolerate grain. All that excess biomass has to go somewhere.

The economic logic of gathering so many animals together to feed them cheap corn in CAFOs is hard to argue with; it has made meat, which used to be a special occasion in most American homes, so cheap and abundant that many of us now eat it three times a day. Not so compelling is the biological logic behind this cheap meat. Already in their short history CAFOs have produced more than their share of environmental and health problems: polluted water and air, toxic wastes, novel and deadly pathogens.

Raising animals on old-fashioned mixed farms such as the Naylor's used to make simple biological sense: You can feed them the waste products of your crops, and you can feed their waste products to your



crops. In fact, when animals live on farms the very idea of waste ceases to exist; what you have instead is a closed ecological loop—what in retrospect you might call a solution. One of the most striking things that animal feedlots do (to paraphrase Wendell Berry) is to take this elegant solution and neatly divide it into two new problems: a fertility problem on the farm (which must be remedied with chemical fertilizers) and a pollution problem on the feedlot (which seldom is remedied at all).

This biological absurdity, characteristic of all CAFOs, is compounded in the cattle feedyard by a second absurdity. Here animals exquisitely adapted by natural selection to live on grass must be adapted by us—at considerable cost to their health, to the health of the land, and ultimately to the health of their eaters—to live on corn, for no other reason than it offers the cheapest calories around and because the great pile must be consumed. This is why I decided to follow the trail of industrial corn through a single steer rather than, say, a chicken or a pig, which can get by just fine on a diet of grain: The short, unhappy life of a corn-fed feedlot steer represents the ultimate triumph of industrial thinking over the logic of evolution.

## 2. PASTORAL: VALE, SOUTH DAKOTA

The Blair Ranch occupies fifty-five hundred acres of rolling short-grass prairie a few miles outside Sturgis, South Dakota, and directly in the shadow of Bear Butte. The Bismarck-Deadwood trail crossed its land just to the north of the butte, which rises dramatically from the plains like a chubby ten-story exclamation mark. You can still make out ruts in the turf dug by stagecoaches and cattle drives the century before last. The turf itself in November, when I visited, forms a luxuriant pelt of grass oscillating yellow and gold in the constant wind and sprinkled with perambulating black dots: Angus cows and calves, grazing.

Ed and Rich Blair run what's called a "cow-calf" operation, the first stage in the production of a hamburger and the stage least changed by

the modern industrialization of meat. While the pork and chicken industries have consolidated the life cycle of those animals under a single roof, beef cattle still get born on hundreds of thousands of independently owned ranches scattered mainly across the West. Although a mere four giant meatpacking companies (Tyson subsidiary IBP, Cargill subsidiary Excel, Swift & Company, and National) now slaughter and market four of every five beef cattle born in this country, that concentration represents the narrow end of a funnel that starts out as wide as the Great Plains. These corporations have concluded that it takes so much land (and therefore capital) to produce a calf ready for the feedlot—ten acres per head at a minimum—that they're better off leaving the ranching (and the risk) to the ranchers.

Steer number 534 spent his first six months in these lush pastures alongside his mother, 9534. The number signifies she was the thirty-fourth cow born in 1995; since none of her male offspring stick around long enough to meet, they're all named 534. His father was a registered Angus by the name of Gar Precision 1680, a bull distinguished by the size and marbling of his offsprings' rib-eye steaks. Gar Precision's only contact with 9534 came by way of a fifteen-dollar mail-order straw of his semen.

Born on March 13, 2001, in the birthing shed across the road, 534 and his mother were turned out on pasture just as soon as the eighty-pound calf stood up and began nursing. Within a few weeks the calf began supplementing his mother's milk by nibbling on a salad bar of mostly native grasses: western wheatgrass, little bluestem, buffalo grass, green needlegrass.

Apart from the trauma of the Saturday in April when he was branded and castrated, one could imagine 534 looking back on those six months as the good old days. It might be foolish for us to presume to know what a cow experiences, yet we can say that a calf grazing on grass is at least doing what he has been supremely well suited by evolution to do. Oddly enough, though, eating grass is something that after October my steer will never have the opportunity to do again.

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THE COEVOLUTIONARY RELATIONSHIP between cows and grass is one of nature's underappreciated wonders; it also happens to be the key to understanding just about everything about modern meat. For the grasses, which have evolved to withstand the grazing of ruminants, the cow maintains and expands their habitat by preventing trees and shrubs from gaining a foothold and hogging the sunlight; the animal also spreads grass seed, plants it with his hooves, and then fertilizes it with his manure. In exchange for these services the grasses offer ruminants a plentiful and exclusive supply of lunch. For cows (like sheep, bison, and other ruminants) have evolved the special ability to convert grass—which single-stomached creatures like us can't digest—into high-quality protein. They can do this because they possess what is surely the most highly evolved digestive organ in nature: the rumen. About the size of a medicine ball, the organ is essentially a forty-five-gallon fermentation tank in which a resident population of bacteria dines on grass. Living their unseen lives at the far end of the food chain that culminates in a hamburger, these bacteria have, like the grasses, coevolved with the cow, whom they feed.

Truly this is an excellent system for all concerned: for the grasses, for the bacteria, for the animals, and for us, the animals' eaters. While it is true that overgrazing can do ecological harm to a grassland, in recent years ranchers have adopted rotational grazing patterns that more closely mimic the patterns of the bison, a ruminant that sustainably grazed these same grasses for thousands of years before the cow displaced it. In fact, a growing number of ecologists now believe the rangelands are healthier with cattle on them, provided they're moved frequently. Today the most serious environmental harm associated with the cattle industry takes place on the feedlot.

In fact, growing meat on grass makes superb ecological sense: It is a sustainable, solar-powered food chain that produces food by transforming sunlight into protein. Row crops could accomplish this trick too, but not around here: In places like western South Dakota the land

is far too arid, thin, and hilly to grow crops without large amounts of irrigation, chemicals, and erosion. “My cattle can take low-quality forage and convert it into a pretty desirable product,” Rich Blair pointed out. “If you didn’t have ruminant animals, all this”—he gestures to the high plains rolling out from his ranch in every direction—“would be the great American desert.”

So then why is it that steer number 534 hasn’t tasted a blade of prairie grass since October? Speed, in a word, or, in the industry’s preferred term, “efficiency.” Cows raised on grass simply take longer to reach slaughter weight than cows raised on a richer diet, and for half a century now the industry has devoted itself to shortening a beef animal’s allotted span on earth. “In my grandfather’s time, cows were four or five years old at slaughter,” Rich explained. “In the fifties, when my father was ranching, it was two or three years old. Now we get there at fourteen to sixteen months.” Fast food, indeed. What gets a steer from 80 to 1,100 pounds in fourteen months is tremendous quantities of corn, protein and fat supplements, and an arsenal of new drugs.

Weaning marks the fateful moment when the natural, evolutionary logic represented by a ruminant grazing on grass bumps up against the industrial logic that will propel the animal on the rest of its swift journey to a wholesale box of beef. This industrial logic is rational and even irresistible—after all, it has succeeded in making beef everyday fare for millions of people for whom it once represented a luxury. And yet the further you follow it, the more likely you are to begin wondering if that rational logic might not also be completely mad.

IN OCTOBER, two weeks before I made his acquaintance, steer number 534 was weaned from his mother. Weaning is perhaps the most traumatic time on a ranch for animals and ranchers alike; cows separated from their calves will mope and bellow for days, and the calves, stressed by the change in circumstance and diet, are prone to getting sick. Calves are weaned for a couple of reasons: to free their mothers to have more calves (9534 had already been inseminated again in June), and to

get the animals, now five or six hundred pounds, ready for life on the feedlot.

The animals are rounded up and herded into a “backgrounding” pen, where they’ll spend a couple of months before boarding the truck for Poky Feeders. Think of backgrounding as prep school for feedlot life: The animals are, for the first time in their lives, confined to a pen, “bunk broken”—taught to eat from a trough—and gradually accustomed to eating what is for them a new and unnatural diet. Here is where the rumen first encounters corn.

It was in the backgrounding pen that I first made the acquaintance of 534. Before coming to Vale I’d told the Blairs I wanted to follow one of their steers through the life cycle; Ed Blair, the older of the brothers, suggested only half in jest that I might as well go whole hog and buy the animal, if I really wanted to appreciate the challenges of ranching. This immediately struck me as a promising idea.

Ed and Rich told me what to look for: a broad straight back and thick shoulders—basically, a sturdy frame on which to hang a lot of meat. I was also looking for a memorable face in this black Angus sea, one that I could pick out of the crowd at the feedlot. Almost as soon as I began surveying the ninety or so animals in the pen, 534 moseyed up to the railing and made eye contact. He had a wide stout frame and was brockle-faced—he had three easy-to-spot white blazes. Here was my boy.

### 3. INDUSTRIAL: GARDEN CITY, KANSAS

Traveling from the ranch to the feedyard, as 534 and I both did (in separate vehicles) the first week of January, feels a lot like going from the country to the big city. A feedlot is very much a premodern city, however, teeming and filthy and stinking, with open sewers, unpaved roads, and choking air rendered visible by dust.

The urbanization of the world’s livestock being a fairly recent historical development, it makes a certain sense that cow towns like Poky

Feeders would recall human cities centuries ago, in the days before modern sanitation. As in fourteenth-century London, say, the workings of the metropolitan digestion remain vividly on display, the foodstuffs coming in, the streams of waste going out. The crowding into tight quarters of recent arrivals from all over, together with the lack of sanitation, has always been a recipe for disease. The only reason contemporary animal cities aren't as plague-ridden or pestilential as their medieval human counterparts is a single historical anomaly: the modern antibiotic.

I spent the better part of a day at Poky Feeders, walking the streets, cattle watching, looking up my steer, and touring local landmarks like the towering feed mill. In any city it's easy to lose track of nature—of the transactions between various species and the land on which everything ultimately depends. Back on the ranch the underlying ecological relationship could not have been more legible: It is a local food chain built upon grass and the ruminants that can digest grass, and it draws its energy from the sun. But what about here?

As the long shadow of the mill suggests, the feedlot is a city built upon America's mountain of surplus corn—or rather, corn plus the various pharmaceuticals a ruminant must have if it is to tolerate corn. Yet, having started out from George Naylor's farm, I understood that the corn on which this place runs is implicated in a whole other set of ecological relationships powered by a very different source of energy—the fossil fuel it takes to grow all that corn. So if the modern CAFO is a city built upon commodity corn, it is a city afloat on an invisible sea of petroleum. How this peculiar state of affairs came to seem sensible is a question I spent my day at Poky trying to answer.

IT WAS ONLY NATURAL that I start my tour at the feed mill, the feedlot's thundering hub, where three meals a day for thirty-seven thousand animals are designed and mixed by computer. A million pounds of feed pass through the mill each day. Every hour of every day a tractor trailer pulls up to the loading dock to deliver another fifty tons of corn. The

driver opens a valve in the belly of the truck and a golden stream of grain—one thin rivulet of the great corn river coursing out of the Middle West—begins to flow, dropping down a chute into the bowels of the mill. Around to the other side of the building, tanker trucks back up to silo-shaped tanks into which they pump thousands of gallons of liquefied fat and protein supplements. In a shed attached to the mill sit vats of liquid vitamins and synthetic estrogen beside pallets stacked with fifty-pound sacks of antibiotics—Rumensin and Tylosin. Along with alfalfa hay and silage (for roughage), all these ingredients will be automatically blended and then piped into the parade of dump trucks that three times a day fan out from here to keep Poky's eight and a half miles of trough filled.

The feed mill's pulsing din is the sound of two giant steel rollers turning against one another twelve hours a day, crushing steamed corn kernels into warm and fragrant flakes. (Flaking the corn makes it easier for cattle to digest it.) This was the only feed ingredient I sampled, and it wasn't half bad; not as crisp as a Kellogg's flake, but with a cornier flavor. I passed on the other ingredients: the liquefied fat (which on today's menu is beef tallow, trucked in from one of the nearby slaughterhouses), and the protein supplement, a sticky brown goop consisting of molasses and urea. The urea is a form of synthetic nitrogen made from natural gas, similar to the fertilizer spread on George Naylor's fields.

Before being put on this highly concentrated diet, new arrivals to the feedyard are treated to a few days of fresh long-stemmed hay. (They don't eat on the long ride and can lose up to one hundred pounds, so their rumens need to be carefully restarted.) Over the next several weeks they'll gradually step up to a daily ration of thirty-two pounds of feed, three-quarters of which is corn—nearly a half bushel a day.

What got corn onto the menu at this and almost every other American feedlot is price, of course, but also USDA policy, which for decades has sought to help move the mountain of surplus corn by passing as much of it as possible through the digestive tracts of food animals, who can convert it into protein.

We've come to think of "corn-fed" as some kind of old-fashioned virtue, which it may well be when you're referring to Midwestern children, but feeding large quantities of corn to cows for the greater part of their lives is a practice neither particularly old nor virtuous. Its chief advantage is that cows fed corn, a compact source of caloric energy, get fat quickly; their flesh also marbles well, giving it a taste and texture American consumers have come to like. Yet this corn-fed meat is demonstrably less healthy for us, since it contains more saturated fat and less omega-3 fatty acids than the meat of animals fed grass. A growing body of research suggests that many of the health problems associated with eating beef are really problems with corn-fed beef. (Modern-day hunter-gatherers who subsist on wild meat don't have our rates of heart disease.) In the same way ruminants are ill adapted to eating corn, humans in turn may be poorly adapted to eating ruminants that eat corn.

Yet the USDA's grading system has been designed to reward marbling (a more appealing term than "intramuscular fat," which is what it is) and thus the feeding of corn to cattle. Indeed, corn has become so deeply ingrained in the whole system of producing beef in America that whenever I raised any questions about it among ranchers or feedlot operators or animal scientists, people looked at me as if I'd just arrived from another planet. (Or perhaps from Argentina, where excellent steaks are produced on nothing but grass.)

The economic logic behind corn is unassailable, and on a factory farm there is no other kind. Calories are calories, and corn is the cheapest, most convenient source of calories on the market. Of course, it was the same industrial logic—protein is protein—that made feeding rendered cow parts back to cows seem like a sensible thing to do, until scientists figured out that this practice was spreading bovine spongiform encephalopathy (BSE), more commonly known as mad cow disease. Rendered bovine meat and bonemeal represented the cheapest, most convenient way of satisfying a cow's protein requirement (never mind these animals were herbivores by evolution) and so appeared on the daily menus of Poky and most other feedyards until the Food and Drug Administration (FDA) banned the practice in 1997.



We now understand that while at a reductive, molecular level protein may indeed be protein, at an ecological or species level, this isn't quite true. As cannibal tribes have discovered, eating the flesh of one's own species carries special risks of infection. Kuru, a disease bearing a striking resemblance to BSE, spread among New Guinea tribesmen who ritually ate the brains of their dead kin. Some evolutionary biologists believe that evolution selected against cannibalism as a way to avoid such infections; animals' aversion to their own feces, and the carcasses of their species, may represent a similar strategy. Through natural selection animals have developed a set of hygiene rules, functioning much like taboos. One of the most troubling things about factory farms is how cavalierly they flout these evolutionary rules, forcing animals to overcome deeply ingrained aversions. We make them trade their instincts for antibiotics.

Though the industrial logic that made feeding cattle to cattle seem like a good idea has been thrown into doubt by mad cow disease, I was surprised to learn it hadn't been discarded. The FDA ban on feeding ruminant protein to ruminants makes an exception for blood products and fat; my steer will probably dine on beef tallow recycled from the very slaughterhouse he's heading to in June. ("Fat is fat," the feedlot manager shrugged, when I raised an eyebrow.) Though Poky doesn't do it, the rules still permit feedlots to feed nonruminant animal protein to ruminants. Feather meal and chicken litter (that is, bedding, feces, and discarded bits of feed) are accepted cattle feeds, as are chicken, fish, and pig meal. Some public health experts worry that since the bovine meat and bonemeal that cows used to eat is now being fed to chickens, pigs, and fish, infectious prions could find their way back into cattle when they're fed the protein of the animals that have been eating them.

Before mad cow disease remarkably few people in the cattle business, let alone the general public, comprehended the strange new semi-circular food chain that industrial agriculture had devised for the beef animal—and so, in turn, for the beef eater. When I mentioned to Rich

Blair how surprised I'd been to learn cattle were eating cattle, he said, "To tell you the truth, it was kind of a shock to me, too."

COMPARED TO ALL the other things we feed cattle these days, corn seems positively wholesome. And yet it too violates the biological or evolutionary logic of bovine digestion. During my day at Poky I spent a few hours with Dr. Mel Metzin, the staff veterinarian, learning more than any beef eater really should know about the gastrointestinal life of the modern cow. Dr. Mel, as he's known at Poky, oversees a team of eight cowboys who spend their days riding the yard's dusty streets, spotting sick animals and bringing them into Poky's three "hospitals" for treatment. Most of the health problems that afflict feedlot cattle can be traced either directly or indirectly to their diet. "They're made to eat forage," Dr. Metzin explained, "and we're making them eat grain."

"It's not that they can't adjust," he continues, "and now we're breeding cattle to do well in a feedyard." One way to look at the breeding work going on at ranches like the Blairs' is that the contemporary beef cow is being selected for the ability to eat large quantities of corn and efficiently convert it to protein without getting too sick. (These, after all, are precisely the genes prized in 534's father, Gar Precision 1680.) The species is evolving, in other words, to help absorb the excess biomass coming off America's cornfields. But the cow's not there quite yet, and a great many feedlot cattle—virtually all of them to one degree or another, according to several animal scientists I talked to—are simply sick.

Bloat is perhaps the most serious thing that can go wrong with a ruminant on corn. The fermentation in the rumen produces copious amounts of gas, which is normally expelled by belching during rumination. But when the diet contains too much starch and too little roughage, rumination all but stops, and a layer of foamy slime forms in the rumen that can trap the gas. The rumen inflates like a balloon until it presses against the animal's lungs. Unless action is taken promptly to

relieve the pressure (usually by forcing a hose down the animal's esophagus), the animal suffocates.

A concentrated diet of corn can also give a cow acidosis. Unlike our own highly acid stomachs, the normal pH of a rumen is neutral. Corn renders it acidic, causing a kind of bovine heartburn that in some cases can kill the animal, but usually just makes him sick. Acidotic animals go off their feed, pant and salivate excessively, paw and scratch their bellies, and eat dirt. The condition can lead to diarrhea, ulcers, bloat, rumenitis, liver disease, and a general weakening of the immune system that leaves the animal vulnerable to the full panoply of feedlot diseases—pneumonia, coccidiosis, enterotoxemia, feedlot polio. Much like modern humans, modern cattle are susceptible to a set of relatively new diseases of civilization—assuming, that is, we're willing to put the modern feedlot under the rubric of civilization.

Cattle rarely live on feedlot diets for more than 150 days, which might be about as much as their systems can tolerate. "I don't know how long you could feed them this ration before you'd see problems," Dr. Metzin said; another vet told me the diet would eventually "blow out their livers" and kill them. Over time the acids eat away at the rumen wall, allowing bacteria to enter the animal's bloodstream. These microbes wind up in the liver, where they form abscesses and impair the liver's function. Between 15 percent and 30 percent of feedlot cows are found at slaughter to have abscessed livers; Dr. Mel told me that in some pens the figure runs as high as 70 percent.

What keeps a feedlot animal healthy—or healthy enough—are antibiotics. Rumensin buffers acidity in the rumen, helping to prevent bloat and acidosis, and Tylosin, a form of erythromycin, lowers the incidence of liver infection. Most of the antibiotics sold in America today end up in animal feed, a practice that, it is now generally acknowledged (except in agriculture), is leading directly to the evolution of new antibiotic-resistant superbugs. In the debate over the use of antibiotics in agriculture, a distinction is usually made between their clinical and nonclinical uses. Public health advocates don't object to treating sick animals with antibiotics; they just don't want to see the drugs lose their

effectiveness because factory farms are feeding them to healthy animals to promote growth. But the use of antibiotics in feedlot cattle confounds this distinction. Here the drugs are plainly being used to treat sick animals, yet the animals probably wouldn't be sick if not for the diet of grain we feed them.

I asked Dr. Mel what would happen if drugs like Rumensin and Tylosin were banned from cattle feed, as some public health experts advocate. "We'd have a high death rate [it's currently about 3 percent, matching the industry average] and poorer performing cattle. We just couldn't feed them as hard." The whole system would have to change—and slow down.

"Hell, if you gave them lots of grass and space, I wouldn't have a job."

MY FIRST IMPRESSION of pen 63, where my steer is spending his last five months, was, *Not a bad little piece of real estate, all considered*. The pen is far enough from the feed mill to be fairly quiet and it has a water view of what I thought was a pond or reservoir until I noticed the brown scum. The body of water is what is known, in the geography of CAFOs, as a manure lagoon. I asked the feedlot manager why they didn't just spray the liquefied manure on neighboring farms. The farmers don't want it, he explained. The nitrogen and phosphorus levels are so high that spraying the crops would kill them. He didn't say that feedlot wastes also contain heavy metals and hormone residues, persistent chemicals that end up in waterways downstream, where scientists have found fish and amphibians exhibiting abnormal sex characteristics. CAFOs like Poky transform what at the proper scale would be a precious source of fertility—cow manure—into toxic waste.

The pen 534 lives in is surprisingly spacious, about the size of a hockey rink, with a concrete feed bunk along the road, and a fresh water trough out back. I climbed over the railing and joined the ninety steers, which, en masse, retreated a few lumbering steps, and then stopped to see what I would do.

I had on the same carrot-colored sweater I'd worn to the ranch in South Dakota, hoping to elicit some glint of recognition from my steer. I couldn't find him at first; all the faces staring at me were either completely black or bore an unfamiliar pattern of white marks. And then I spotted him—the three white blazes—way off in the back. As I gingerly stepped toward him the quietly shuffling mass of black cowhide between us parted, and there stood 534 and I, staring dumbly at one another. Glint of recognition? None, none whatsoever. I told myself not to take it personally; 534 and his pen mates have been bred for their marbling, after all, not their ability to form attachments.

I noticed that 534's eyes looked a little bloodshot. Dr. Metzin had told me that some animals are irritated by feedlot dust. The problem is especially serious in the summer months, when the animals kick up clouds of the stuff and workers have to spray the pens with water to keep it down. I had to remind myself that this is not ordinary dirt dust, inasmuch as the dirt in a feedyard is not ordinary dirt; no, this is fecal dust. But apart from the air quality, how did feedlot life seem to be agreeing with 534? I don't know enough about the emotional life of a steer to say with confidence that 534 was miserable, bored, or indifferent, but I would not say he looked happy.

He's clearly eating well, though. My steer had put on a couple hundred pounds since we'd last met, and he looked it: thicker across the shoulder and round as a barrel through the middle. He carried himself more like a steer now than a calf, even though his first birthday was still two months away. Dr. Metzin complimented me on his size and conformation. "That's a handsome-looking beef you got there." (Shucks.)

If I stared at my steer hard enough, I could imagine the white lines of the butcher's chart dissecting his black hide: rump roast, flank steak, standing rib, tenderloin, brisket. One way of looking at 534—the feedlot way, the industrial way—was as a most impressive machine for turning number 2 field corn into cuts of beef. Every day between now and his slaughter in six months, 534 will convert thirty-two pounds of feed into four pounds of gain—new muscle, fat, and bone. This at least is how 534 appears in the computer program I'd seen at the mill: the

ratio of feed to gain that determines his efficiency. (Compared to other food animals, cattle are terribly inefficient: The ratio of feed to flesh in chicken, the most efficient animal by this measure, is two pounds of corn to one of meat, which is why chicken costs less than beef.) Poky Feeders is indeed a factory, transforming—as fast as bovinely possible—cheap raw materials into a less cheap finished product, through the mechanism of bovine metabolism.

Yet metaphors of the factory and the machine obscure as much as they reveal about the creature standing before me. He has, of course, another, quite different identity—as an animal, I mean, connected as all animals must be to certain other animals and plants and microbes, as well as to the earth and the sun. He's a link in a food chain, a thread in a far-reaching web of ecological relationships. Looked at from this perspective, everything going on in this cattle pen appears quite different, and not nearly as far removed from our world as this manure-encrusted patch of ground here in Nowhere, Kansas, might suggest.

For one thing, the health of these animals is inextricably linked to our own by that web of relationships. The unnaturally rich diet of corn that undermines a steer's health fattens his flesh in a way that undermines the health of the humans who will eat it. The antibiotics these animals consume with their corn at this very moment are selecting, in their gut and wherever else in the environment they end up, for new strains of resistant bacteria that will someday infect us and withstand the drugs we depend on to treat that infection. We inhabit the same microbial ecosystem as the animals we eat, and whatever happens in it also happens to us.

Then there's the deep pile of manure on which I stand, in which 534 sleeps. We don't know much about the hormones in it—where they will end up, or what they might do once they get there—but we do know something about the bacteria, which can find their way from the manure on the ground to his hide and from there into our hamburgers. The speed at which these animals will be slaughtered and processed—four hundred an hour at the plant where 534 will go—means that sooner or later some of the manure caked on these hides

gets into the meat we eat. One of the bacteria that almost certainly resides in the manure I'm standing in is particularly lethal to humans. *Escherichia coli* 0157:H7 is a relatively new strain of the common intestinal bacteria (no one had seen it before 1980) that thrives in feedlot cattle, 40 percent of which carry it in their gut. Ingesting as few as ten of these microbes can cause a fatal infection; they produce a toxin that destroys human kidneys.

Most of the microbes that reside in the gut of a cow and find their way into our food get killed off by the strong acids in our stomachs, since they evolved to live in the neutral pH environment of the rumen. But the rumen of a corn-fed feedlot steer is nearly as acidic as our own stomachs, and in this new, man-made environment new acid-resistant strains of *E. coli*, of which 0157:H7 is one, have evolved—yet another creature recruited by nature to absorb the excess biomass coming off the Farm Belt. The problem with these bugs is that they can shake off the acid bath in our stomachs—and then go on to kill us. By acidifying the rumen with corn we've broken down one of our food chain's most important barriers to infection. Yet another solution turned into a problem.

We've recently discovered that this process of acidification can be reversed, and that doing so can greatly diminish the threat from *E. coli* 0157:H7. Jim Russell, a USDA microbiologist on the faculty at Cornell, has found that switching a cow's diet from corn to grass or hay for a few days prior to slaughter reduces the population of *E. coli* 0157:H7 in the animal's gut by as much as 80 percent. But such a solution (*Grass?!*) is considered wildly impractical by the cattle industry and (therefore) by the USDA. Their preferred solution for dealing with bacterial contamination is irradiation—essentially, to try to sterilize the manure getting into the meat.

So much comes back to corn, this cheap feed that turns out in so many ways to be not cheap at all. While I stood in pen 63 a dump truck pulled up alongside the feed bunk and released a golden stream of feed. The black mass of cowhide moved toward the trough for lunch. The \$1.60 a day I'm paying for three meals a day here is a bargain only by the narrowest of calculations. It doesn't take into account, for example,

the cost to the public health of antibiotic resistance or food poisoning by *E. coli* 0157:H7. It doesn't take into account the cost to taxpayers of the farm subsidies that keep Poky's raw materials cheap. And it certainly doesn't take into account all the many environmental costs incurred by cheap corn.

I stood alongside 534 as he lowered his big head into the stream of fresh grain. How absurd, I thought, the two of us standing hock-deep in manure in this godforsaken place, overlooking a manure lagoon in the middle of nowhere somewhere in Kansas. Godforsaken perhaps, and yet not apart, I realized, as I thought of the other places connected to this place by the river of commodity corn. Follow the corn from this bunk back to the fields where it grows and I'd find myself back in the middle of that 125,000-mile-square monoculture, under a steady rain of pesticide and fertilizer. Keep going, and I could follow the nitrogen runoff from that fertilizer all the way down the Mississippi into the Gulf of Mexico, adding its poison to an eight-thousand-square-mile zone so starved of oxygen nothing but algae can live in it. And then go farther still, follow the fertilizer (and the diesel fuel and the petrochemical pesticides) needed to grow the corn all the way to the oil fields of the Persian Gulf.

I don't have a sufficiently vivid imagination to look at my steer and see a barrel of oil, but petroleum is one of the most important ingredients in the production of modern meat, and the Persian Gulf is surely a link in the food chain that passes through this (or any) feedlot. Steer 534 started his life part of a food chain that derived all of its energy from the sun, which nourished the grasses that nourished him and his mother. When 534 moved from ranch to feedlot, from grass to corn, he joined an industrial food chain powered by fossil fuel—and therefore defended by the U.S. military, another never-counted cost of cheap food. (One-fifth of America's petroleum consumption goes to producing and transporting our food.) After I got home from Kansas, I asked an economist who specializes in agriculture and energy if it might be possible to calculate precisely how much petroleum it will take to grow my steer to slaughter weight. Assuming 534 continues to eat twenty-five pounds of



corn a day and reaches a weight of twelve hundred pounds, he will have consumed in his lifetime the equivalent of thirty-five gallons of oil—nearly a barrel.

So this is what commodity corn can do to a cow: industrialize the miracle of nature that is a ruminant, taking this sunlight- and prairie grass-powered organism and turning it into the last thing we need: another fossil fuel machine. This one, however, is able to suffer.

Standing there in the pen alongside my steer, I couldn't imagine ever wanting to eat the flesh of one of these protein machines. Hungry was the last thing I felt. Yet I'm sure that after enough time goes by, and the stink of this place is gone from my nostrils, I will eat feedlot beef again. Eating industrial meat takes an almost heroic act of not knowing or, now, forgetting. But I left Poky determined to follow this meat to a meal on a table somewhere, to see this food chain at least that far. I was curious to know what feedlot beef would taste like now, if I could taste the corn or even, since taste is as much a matter of what's in the head as it is about molecules dancing on the tongue, some hint of the petroleum. "You are what you eat" is a truism hard to argue with, and yet it is, as a visit to a feedlot suggests, incomplete, for you are what what you eat eats, too. And what we are, or have become, is not just meat but number 2 corn and oil.