

## AN IDEAL SYSTEM FOR NEW PATHOGENS

Every day in the United States, roughly 200,000 people are sickened by a foodborne disease, 900 are hospitalised, and fourteen die. According to the Centers for Disease Control and Prevention (CDC), more than a quarter of the American population suffers a bout of food poisoning each year. Most of these cases are never reported to authorities or properly diagnosed. The widespread outbreaks that are detected and identified represent a small fraction of the number that actually occurs. And there is strong evidence not only that the incidence of food-related illness has risen in the past few decades, but also that the lasting health consequences of such illnesses are far more serious than was previously believed. The acute phase of a food poisoning — the initial few days of diarrhea and gastrointestinal upset — in many cases may simply be the most obvious manifestation of an infectious disease. Recent studies have found that many foodborne pathogens can precipitate long-term ailments, such as heart disease, inflammatory bowel disease, neurological problems, autoimmune disorders, and kidney damage.

... A generation ago, the typical outbreak of food poisoning involved a church supper, a family picnic, a wedding reception. Improper food handling or storage would cause a small group of people in one local area to get sick. Such traditional outbreaks still take place. But the nation's industrialized and centralized system of food processing has created a whole new sort of outbreak, one that can potentially sicken millions of people. Today a cluster of illnesses in one small town may stem from bad potato salad at a school barbecue — or it may be the first sign of an outbreak that extends statewide, nationwide, or even overseas.

Much like the human immunodeficiency virus (HIV) responsible for causing AIDS, the *Escherichia coli* 0157:H7 bacterium is a newly emerged pathogen whose spread has been facilitated by recent social and technological changes. *E. coli* 0157:H7 was first isolated in 1982; HIV was discovered the following year. People who are infected with HIV can appear healthy for years, while cattle infected with *E. coli* 0157:H7 show few signs of illness. Although cases of AIDS date back at least to the late 1950s, the disease did not reach epidemic proportions in the United States until increased air travel and sexual promiscuity helped transmit the virus far and wide. *E. coli* 0157:H7 was most likely responsible for some human illnesses thirty or forty years ago. But the rise of huge feedlots, slaughterhouses, and hamburger grinders seems to have provided the means for this pathogen to become widely dispersed in the nation's food supply. American meat production has never before been so centralized: thirteen large packinghouses now slaughter most of the beef consumed in the United States. The meatpacking system that arose to supply the nation's fast food chains — an industry molded to serve their needs, to provide massive amounts of uniform ground beef so that all of McDonald's hamburgers would taste the same — has proved to be an extremely efficient system for spreading disease.

Although *E. coli* 0157:H7 has received a good deal of public attention, over the past two decades scientists have discovered more than a dozen other new foodborne pathogens, including *Campylobacter jejuni*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, *Listeria mono-cytogenes*, and Norwalk-like viruses. The CDC estimates that more than three-quarters of the food-related illnesses and deaths in the United States are caused by infectious agents that have not yet been identified. While medical researchers have gained important insights into the links between modern food processing and the spread of dangerous diseases, the nation's leading agribusiness firms have resolutely opposed any further regulation of their food safety practices. For years the large meatpacking companies have managed to avoid the sort of liability routinely imposed on the manufacturers of most consumer products. Today the U.S. government can demand the nationwide recall of defective softball bats, sneakers, stuffed animals, and foam-rubber toy cows. But it cannot order a meatpacking company to remove contaminated, potentially lethal ground beef from fast food kitchens and supermarket shelves. The unusual power of the large meatpacking firms has been sustained by their close ties and sizable donations to Republican members of Congress. It has also been made possible by a widespread lack of awareness about how many Americans suffer from food poisoning every year and how these illnesses actually spread.

The newly recognized foodborne pathogens tend to be carried and shed by apparently healthy animals. Food tainted by these organisms has most likely come in contact with an infected animal's stomach contents or manure, during slaughter or subsequent processing. A nationwide study published by the USDA in 1996 found that 7.5 percent of the ground beef samples taken at processing plants were contaminated with *Salmonella*, 11.7 percent were contaminated with *Listeria monocytogenes*, 30 percent were contaminated with *Staphylococcus aureus*, and 53.3 percent were contaminated with *Clostridium perfringens*. All of these pathogens can make people sick; food poisoning caused by *Listeria* generally requires hospitalization and proves fatal in about one out of every five cases. In the USDA study 78.6 percent of the ground beef contained microbes that are spread primarily by fecal material. The medical literature on the causes of food poisoning is full of euphemisms and dry scientific terms: coliform levels, aerobic plate counts, sorbitol, MacConkey agar, and so on. Behind them lies a simple explanation for why eating a hamburger can now make you seriously ill: There is shit in the meat...

...Antibiotics have proven ineffective in treating illnesses caused by *E. coli* 0157:H7. Indeed the use of antibiotics may make such illnesses worse by killing off the pathogen and prompting a sudden release of its Shiga toxins. At the moment, little can be done for people with life-threatening *E. coli* 0157:H7 infections, aside from giving them fluids, blood transfusions, and dialysis.

Efforts to eradicate *E. coli* 0157:H7 have been complicated by the fact that it is an extraordinarily hearty microbe that is easy to transmit. *E. coli* 0157:H7 is resistant to acid, salt, and chlorine. It can live in fresh water or seawater. It can live on kitchen countertops for days and in moist environments for weeks. It can withstand freezing. It can survive heat up to 160 degrees Fahrenheit. To be infected by most food-borne pathogens, such as *Salmonella*, you have to consume a fairly large dose — at least a million organisms. An infection with *E. coli* 0157:H7 can be caused by as few as five organisms. A tiny uncooked particle of hamburger meat can contain enough of the pathogen to kill you.

The heartiness and minute infectious dose of *E. coli* 0157:H7 allow the pathogen to be spread in many ways. People have been infected by drinking contaminated water, by swimming in a contaminated lake, by playing at a contaminated water park, by crawling on a contaminated carpet. The most common cause of foodborne outbreaks has been the consumption of undercooked ground beef. But *E. coli* 0157:H7 outbreaks have also been caused by contaminated bean sprouts, salad greens, cantaloupe, salami, raw milk, and unpasteurized apple cider. All of those foods most likely had come in contact with cattle manure, though the pathogen may also be spread by the feces of deer, dogs, horses, and flies.

Person-to-person transmission has been responsible for a significant proportion of *E. coli* 0157:H7 illnesses. Roughly 10 percent of the people sickened during the Jack in the Box outbreak did not eat a contaminated burger, but were infected by someone who did. *E. coli* 0157:H7 is shed in the stool, and people infected with the bug, even those showing no outward sign of illness, can easily spread it through poor hygiene. Person-to-person transmission is most likely to occur among family members, at day care centers, and at senior citizen homes. On average, an infected person remains contagious for about two weeks, though in some cases *E. coli* 0157:H7 has been found in stool samples two to four months after an initial illness.

Some herds of American cattle may have been infected with *E. coli* 0157:H7 decades ago. But the recent changes in how cattle are raised, slaughtered, and processed have created an ideal means for the pathogen to spread. The problem begins in today's vast feedlots. A government health official, who prefers not to be named, compared the sanitary conditions in a modern feedlot to those in a crowded European city during the Middle Ages, when people dumped their chamber pots out the window, raw sewage ran in the streets, and epidemics raged. The cattle now packed into feedlots get little exercise and live amid pools of manure. "You shouldn't eat dirty food and dirty water," the official told me. "But we still think we can give animals dirty food and dirty water." Feedlots have become an extremely efficient mechanism for "recirculating the manure," which is unfortunate, since *E. coli* 0157:H7 can replicate in cattle troughs and survive in manure for up to ninety days.

Far from their natural habitat, the cattle in feedlots become more prone to all sorts of illnesses. And what they are being fed often contributes to the spread of disease. The rise in grain prices has encouraged the feeding of less expensive materials to cattle, especially substances with a high protein content that accelerate growth. About 75 percent of the cattle in the United States were routinely fed livestock wastes — the rendered remains of dead sheep and dead cattle — until August of 1997. They were also fed millions of dead cats and dead dogs every year, purchased from animal shelters. The FDA banned such practices after evidence from Great Britain suggested that they were responsible for a widespread outbreak of bovine spongiform encephalopathy (BSE), also known as "mad cow disease." Nevertheless, current FDA regulations allow dead pigs and dead horses to be rendered into cattle feed, along with dead poultry. The regulations not only allow cattle to be fed dead poultry, they allow poultry to be fed dead cattle. Americans who spent more than six months in the United Kingdom during the 1980s are now forbidden to donate blood, in order to prevent the spread of BSE's human variant, Creutzfeldt-Jakob disease. But cattle blood is still put into the feed given to American cattle...

The pathogens from infected cattle are spread not only in feedlots, but also at slaughterhouses and hamburger grinders. The slaughterhouse tasks most likely to contaminate meat are the removal of an animal's hide and the removal of its digestive system. The hides are now pulled off by machine; if a hide has been inadequately cleaned, chunks of dirt and manure may fall from it onto the meat. Stomachs and intestines are still pulled out of cattle by hand; if the job is not performed carefully, the contents of the digestive system may spill everywhere. The increased speed of today's production lines makes the task much more difficult. A single worker at a "gut table" may eviscerate sixty cattle an hour. Performing the job properly takes a fair amount of skill. A former IBP "gutter" told me that it took him six months to learn how to pull out the stomach and tie off the intestines without spillage. At best, he could gut two hundred consecutive cattle without spilling anything. Inexperienced gutters spill manure far more often. At the IBP slaughterhouse in Lexington, Nebraska, the hourly spillage rate at the gut table has run as high as 20 percent, with stomach contents splattering one out of five carcasses.

The consequences of a single error are quickly multiplied as hundreds of carcasses quickly move down the line. Knives are supposed to be cleaned and disinfected every few minutes, something that workers in a hurry tend to forget. A contaminated knife spreads germs to everything it touches. The overworked, often illiterate workers in the nation's slaughterhouses do not always understand the importance of good hygiene. They sometimes forget that this meat will eventually be eaten. They drop meat on the floor and then place it right back on the conveyor belt. They cook bite-sized pieces of meat in their sterilizers, as snacks, thereby rendering the sterilizers ineffective. They are directly exposed to a wide variety of pathogens in the meat, become infected, and inadvertently spread disease.

A recent USDA study found that during the winter about 1 percent of the cattle at feedlots carry *E. coli* 0157:H7 in their gut. The proportion rises to as much as 50 percent during the summer. Even if you assume that only 1 percent are infected, that means three or four cattle bearing the microbe are eviscerated at a large slaughterhouse every hour. The odds of widespread contamination are raised exponentially when the meat is processed into ground beef. A generation ago, local butchers and wholesalers made hamburger meat out of leftover scraps. Ground beef was distributed locally, and was often made from cattle slaughtered locally. Today large slaughterhouses and grinders dominate the nationwide production of ground beef. A modern processing plant can produce 800,000 pounds of hamburger a day, meat that will be shipped throughout the United States. A single animal infected with *E. coli* 0157:H7 can contaminate 32,000 pounds of that ground beef.

To make matters worse, the animals used to make about one-quarter of the nation's ground beef— worn-out dairy cattle — are the animals most likely to be diseased and riddled with antibiotic residues. The stresses of industrial milk production make them even more unhealthy than cattle in a large feedlot. Dairy cattle can live as long as forty years, but are often slaughtered at the age of four, when their milk output starts to decline. McDonald's relies heavily on dairy cattle for its hamburger supplies, since the animals are relatively inexpensive, yield low-fat meat, and enable the chain to boast that all its beef is raised in the United States. The days when hamburger meat was ground in the back of a butcher shop, out of scraps from one or two sides of beef, are long gone. Like the multiple sex partners that helped spread the AIDS epidemic, the huge admixture of animals in most American ground beef plants has played a crucial role in spreading *E. coli* 0157:H7. A single fast food hamburger now contains meat from dozens or even hundreds of different cattle.