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January 4, 1998

Deadly Bacteria a New Threat to Fruit and Produce in U.S.

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**By CHRISTOPHER DREW and PAM BELLUCK**

Annna Grace Gimmestad, 16 months old, was just beginning to put her infant stamp on the world. She would parrot the whir of a helicopter, pause on each stair step to kiss her parents through the banister.

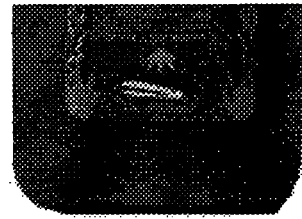
And every time her mother wheeled her past the grocery-store cooler, she would point excitedly to her favorite: the colorful, fruity juices made by a California company, Odwalla, that promoted its products as some of the nation's freshest and healthiest.

To Christy and Chad Gimmestad, who live in Evans, Colo., these fresh-squeezed juices seemed natural and nutritious. But in late 1996, Anna became so ill after drinking Odwalla apple juice that, within two weeks, her kidneys gave out, part of her brain became clogged with dead blood cells, her heart faltered and she died.

Health authorities say Anna's body collapsed so fast because the juice had been contaminated with an increasingly troublesome hazard in America's food system: a strain of bacteria known as E. coli



system: a strain of bacteria known as E. coli O157:H7. The authorities say that while Odwalla was marketing its products as premium sources of nourishment, the fast-growing company had significant flaws in its safety practices -- weaknesses that may have allowed tainted apples to contaminate some of its juice and caused 70 people to become sick.



After its apple juice caused 70 people to become sick, Odwalla became a convert to pasteurization.

Interviews with former Odwalla managers and company documents show that in the weeks before the outbreak, Odwalla began relaxing its standards on accepting blemished fruit and reining in the authority of its own safety officials, culminating in tense, dramatic moments on the morning of Oct. 7, 1996, the day the contaminated juice was pressed.

By these accounts, production managers brushed aside warnings from a young company inspector that a batch of apples was too rotten to use -- some were highly decayed, one she picked out had a worm in it -- without taking special precautions against contaminants. These issues are being examined by a federal grand jury in Fresno, Calif., that could bring criminal charges.

Odwalla officials acknowledge that their safety systems failed to keep out the E. coli, but they deny that the company took any undue risks and insist no laws were broken. Top company executives say that, like many others in their industry, they simply did not realize that E. coli O157:H7 could live in something as acidic as apple juice, and they still are not sure how it got in. Since the outbreak, Odwalla has begun pasteurizing many of its products, a sure-fire method of killing bacteria with heat.

What happened at Odwalla (pronounced ode-WALL-a) is more than just a tale of one company and a one-time breakdown in safety precautions. This case and similar outbreaks across the country illustrate one of the least understood new currents in food safety: This dangerous strain of E. coli has begun to infiltrate fresh fruit juices and vegetables, the very foods that Americans are buying more of to be healthy.

Since 1993, when hundreds of people got sick from undercooked hamburgers, the public has associated the biggest hazards with ground beef. Yet a small but growing portion of food-poisoning cases -- some stunning in their severity -- now arise from E. coli, salmonella and other pathogens in fresh juice and produce.

The nation's food supply remains one of the world's safest. But the emphasis on freshness and nutrition is placing a greater burden on companies to insure that their products are as free of harmful bacteria as other foods that have undergone processes like pasteurization. And while the food industry responds to the changing American palate with a jazzy array of new products, from exotic juices to convenient packs of fancy premixed salads, the Odwalla case shows how some growers and processors are failing to meet the rigorous safety standards needed to keep out dangerous pathogens.

needed to keep out dangerous pathogens.

It has also become clear that as more companies expand distribution of their products, unsanitary conditions in even the smallest corners of the industry can cause widespread harm. In another striking example, federal and state health authorities say they believe a small lettuce producer -- operating under conditions cited as blatantly unsanitary -- was responsible for an outbreak of *E. coli* O157:H7 that sickened at least 61 people in Illinois, Connecticut and New York.

After the outbreak, a team of investigators found that the lettuce had been washed and packaged less than 100 feet from a cattle pen. Although *E. coli* O157:H7 originates in animals and cattle (feces is the most common source), there were virtually no measures to protect the lettuce.

Until recently, the government had shown little leadership in dealing with the problems, and there are deep flaws in the system that regulates much of the nation's food industry. It is a patchwork of weak state agencies and a lumbering federal bureaucracy, centered at the Food and Drug Administration, that has focused more on reacting to outbreaks than on preventing them.

The FDA is responsible for the safety of all foods except meat, poultry and eggs. But for an agency that must also regulate pharmaceutical drugs and medical devices, food has never been a high priority, and the FDA has given little guidance to the industry.

In fact, the agency inspected Odwalla's plant just three months before the *E. coli* outbreak. But government reports show its inspector focused on minor issues and missed signs that the company had failed to build the kind of safeguards that the FDA now contends it should have had.

The emergence of this mysterious strain of *E. coli* points up how the food chain is becoming more vulnerable to microscopic threats. Millions of Americans suffer some sort of illness each year from something they eat. But government officials say that less than 5 percent of food illnesses are ever reported to authorities, so they rely heavily on estimates.

All told, the Centers for Disease Control and Prevention estimates that *E. coli* O157:H7 infects as many as 20,000 Americans a year through meat, produce and other means and kills up to 500. It first began to appear in food in 1980, and the outbreaks have gotten more frequent. Since mid-1995, the CDC has confirmed that more than 300 people had severe diarrhea and other illnesses in nine outbreaks of the *E. coli* in lettuce, alfalfa sprouts and fresh apple juice or cider.

But what alarms food experts is how devastating the *E. coli* can be, especially for children. In the Odwalla case, 14 children were hospitalized with a severe blood and kidney disorder, hemolytic uremic syndrome. Anna Gimmestad was the only one who died, but doctors say some of the others are likely to have permanent kidney damage and other lasting problems.

"The biggest problem in the food system right now is the new hazards like *E.*

"The biggest problem in the food system right now is the new hazards like E. coli O157:H7," said Caroline Smith DeWaal, a consumer advocate in Washington. "And the most surprising thing is the number of outbreaks linked to fresh fruits and vegetables." Food contamination, she added, "isn't just a stomach ache anymore."

Dr. Michael A. Friedman, the acting commissioner of the Food and Drug Administration, agreed that the hazards are growing. Regulators need "to be more vigilant and to be, honestly, more aggressive," he said.

Many food companies, especially the largest ones, have taken steps to improve safety, and the Clinton administration recently unveiled several safety initiatives. The FDA has begun to draft new rules for juice production, though it faces opposition from some juice and cider makers who maintain that unpasteurized products taste better and can still be made safely.

Odwalla now says it would never have sold unpasteurized apple juice if it had understood the dangers. "The bottom line is that you would have to say we failed," said Stephen Williamson, Odwalla's chief executive. "And those are hard words." Odwalla also criticized the roughly 1,500 companies, mostly farms and roadside operations that make fresh apple juice and cider, as failing to heed this lesson.

A close look at the Odwalla case shows there is little margin for error in dealing with fresh products. While Odwalla had told growers it wanted only tree-picked apples, the authorities suspect the bacteria got into its plant on decayed apples that had fallen on the ground and come into contact with feces, possibly from deer.

But former Odwalla managers see another lesson as well: The company, they say, was growing so rapidly that it did not pay enough attention to safety.

"In terms of safety, it could have been improved greatly if we had spent a little more time on it instead of just focusing on production," said Douglas Dobbs, a former company planning official.

The Backdrop: Quality Standards Vs. Production

early all the giant juice companies, like Tropicana, and some mid-sized upstarts, like Nantucket Nectars, rely on pasteurization. Analysts estimate that 98 percent of the nation's juice goes through this process.

But when Odwalla's chairman, Greg Steltenpohl, started the company in 1980, he saw absolute freshness as his entree into a highly competitive business. Inspired by his father's habit of squeezing his own orange juice, Steltenpohl borrowed \$200 from a girlfriend, started making juice at home and delivered it to restaurants in Volkswagen vans. He took the name Odwalla from a character in a jazz song who guided the

from a character in a jazz song who guided the lost "people of the sun" out of the "gray haze."

Over the years, Odwalla worked hard to build up its brand name, and it now markets more than 20 flavors of juice, smoothies and vitamin-packed drinks in the West and Southwest. Steltenpohl kept the folksy philosophy, even as Odwalla became a public company in 1993 and its sales soared, to \$59 million in its 1996 fiscal year from \$9 million in 1991. It studded its labels with whimsical sunbursts, gave its products names like Mo' Beta and Femme Vitale and threaded its mission statements with phrases like "Nourishing the Body Whole."

This approach created an enthusiastic following, particularly among professionals. It also turned Odwalla into one of the nation's largest fresh-juice companies, along with a few other regional outfits. And before the E. coli outbreak, Odwalla officials never considered pasteurization, fearing that it would kill nutrients and make their juices taste bland.

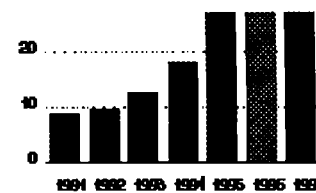
"If it's not fresh-squeezed, then it's not part of Odwalla -- and that's truly the way we thought," Steltenpohl said at the company's headquarters in Half Moon Bay, a seaside town south of San Francisco.

But if a juice company does not pasteurize, it is placing a huge strain on the rest of its safety processes. Even the least harmful bacteria, like food-spoilage organisms, multiply so fast that they can render fresh juices undrinkable within a couple of weeks.

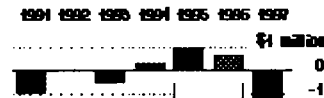
This means that the companies have to rely on several lines of defense, from sorting out bad fruit to washing the usable pieces with sanitizing chemicals.

Company documents reviewed by The New York Times show that Odwalla had been grappling with these problems since it opened a \$3 million plant in Dinuba, Calif., in 1993. Tests on samples of its juices then found high readings of general bacteria, yeast and mold that could cause them to spoil. A contractor later warned in a memorandum that Odwalla's citrus-processing equipment was so poorly maintained it was breeding bacteria in "black rotten crud" and "inoculating every drop of juice you make."

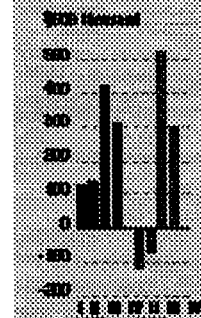
After customers complained of illnesses in early 1995, tests found low levels of *listeria monocytogenes*, a pathogen that can harm pregnant women, in samples of Odwalla's apple and orange juice. Federal law bans the sale of any food or drink with this strain of *listeria*. But Odwalla officials say the levels in the juice



... BUT IN 1996 ANNUAL PROFITS STARTED TO SLIDE PARTLY BECAUSE OF HIGH COMPANY COSTS ...



... PROMPTING A COST-CUTTING DRIVE THAT ALSO REDUCED QUALITY CONTROL. PROFITS GREW TEMPORARILY ...



... BUT PLUNGED IN THE FIRST QUARTER OF THE '97 FISCAL YEAR WHEN ODWALLA PRODUCED A BATCH OF APPLE JUICE TAINTED WITH E. COLI.

drink with this strain of listeria. But Odwalla officials say the levels in the juice were far too low to cause any health risk.

Steltenpohl and Williamson said the company spent several million dollars over the last several years to upgrade plant equipment and install new safety devices, and it reduced the general bacterial counts to relatively low levels. "We thought we were doing a good job," Williamson said.

But in mid-1995, juice makers in Florida were hit by an outbreak of salmonella in orange juice served at Walt Disney World, which sickened more than 60 children and adults.

The cause was odd: Authorities believe the disease came from a toad that crawled onto a juice plant's processing equipment. But this was the first time that a toxic bacteria had been discovered in orange juice, and it shook much of the industry with the realization that pathogens could survive in highly acidic products.

Before this, there had been two small outbreaks of *E. coli* O157:H7 in fresh apple juice and cider made on farms, in Canada in 1980 and Massachusetts in 1991. But the incidents had received little attention at Odwalla or in the industry, and even the CDC suggested that such contamination was likely to occur at only the crudest operations.

After the Disney World outbreak, the state of Florida drafted new rules, which took effect in early 1996, that required larger fresh-juice companies to add more protections. The regulations prohibit using split or decayed fruit. They also require a two-step fruit-cleaning process, including both an acid-based detergent and chlorine.

As a California company, Odwalla was under no obligation to follow these rules, and few juice companies outside of Florida did.

But Odwalla had just hired two managers from the Florida juice industry. One of them, Dave Stevenson, who oversaw quality assurance as Odwalla's technical services director, contended that Odwalla should add a chlorine rinse as a crucial backstop against bad fruit, company documents show. But Chip Bettel, a former Tropicana executive who became Odwalla's senior vice president, feared chlorine would leave an aftertaste and decided that only an acid wash was needed.

By the summer of 1996, as Odwalla's plant pushed hard to keep up with rapidly rising sales, some former company officials say production demands began to overshadow safety concerns.

At the end of August, Steve Kock, Odwalla's quality assurance manager, sent an e-mail to Bettel saying he planned to start testing for listeria again.

But on Sept. 2, Bettel wrote back: "why are we doing it, why now, what do we

want to PROVE ... If the data is bad, what do we do about it. Once you create a body of data, it is subpoenaable."

Bettel declined to be interviewed. He said in a statement that he was mainly concerned that any testing be based on "a sound plan" to identify corrective measures.

Kock dropped the testing plan. And by mid-September, he asked to be relieved of his management duties, demoting himself, in effect, to a quality technician. Kock, who still works at Odwalla, did not return calls for comment.

But former associates said he had grown tired of battling with production officials over safety issues, like how often to sanitize the juice tanks. He was also concerned that Stevenson was leaving at the end of September to take a sales job with Odwalla in New Mexico.

In a company report on Oct. 4, Kock described this change. "Philosophically," he wrote, "the department is moving towards an audit function as compared to one of controlling or policing."

The Crucial Day: A Plant Breaks A Basic Tenet

Interviews and documents suggest that the tensions reached a climax three days later at Odwalla's plant, located about 200 miles from the company's headquarters in the main agricultural belt of Central California.

No one disputes that Oct. 7, 1996, was when the contaminated apple juice was made: The genetic markings on the E. coli in the victims matched bacteria found in a product bottled that day. On that day, according to a new account provided to federal investigators, production workers used decayed fruit over the objections of a quality-control inspector and resisted taking extra steps to weed out the rotten pieces.

So in the end, health authorities say, the E. coli outbreak may have occurred simply because the plant violated one of the most fundamental tenets of fresh juice production: Do not use rotten fruit.

The new account comes from Stevenson, who told investigators last month about the face-off between the quality inspector, Anita Velasquez, and production officials. According to people familiar with his account, Ms. Velasquez described this to Stevenson in early November 1996, shortly after health authorities had traced the first E. coli illnesses to Odwalla.

Stevenson had returned to the plant to help, and he asked Ms. Velasquez if anything unusual had happened. She responded, he told investigators, by relating the trouble she had run into on Oct. 7.

Ms. Velasquez then repeated that account, without citing that date, in a two-page handwritten note on Nov. 4, 1996.

In the note, Ms. Velasquez said that the disagreement with the production officials began on a Friday, when she saw "a couple of apple bins that had high decay." She added that she cut open one apple and found a worm in it.

Around this time, Odwalla had received several loads with poor-quality apples because of a seasonal switch from prized Washington fruit to less expensive California varieties. Company documents show that its policy was to stretch its standards for fruit quality at such times -- and add extra sorters to pick out bad pieces.

While Odwalla often had accepted only loads in which no more than 5 percent of the fruit was defective, it had lifted that to 10 to 15 percent. In the three weeks before the bad juice was made, the documents show, some loads of apples came in with 25 to 30 percent defective fruit.

Ms. Velasquez wrote that on that Friday, she "didn't want to accept the rest of the bins" in the load. But her objection was overruled by an official who told her "we had to use them since we had the load here."

Ms. Velasquez wrote that the production staff used half of that load on Friday and decided to use the other half on Monday. That meant the apples would sit in a cooler for two days, and she was worried that bacteria would spread among them.

So she got the leader of the apple press line to agree to assign three or four people on Monday to sort out bad apples, instead of the usual one or two.

When Ms. Velasquez came in on Monday morning, she saw only one sorter picking out rotten apples as they rolled by to be pressed into juice. She also spotted 10 to 15 decayed apples that the sorter had missed.

She suggested slowing the line and was told a second sorter would be added. But when she checked 10 minutes later, there was still only one sorter, and she asked again to slow down the line. "At this point, everyone was upset at me," she wrote. She added that the tensions had risen this high "only because I wanted to reject it but couldn't due to higher power."

In her note, Ms. Velasquez did not indicate that she or the production officials took further action.

In a brief telephone interview, she said, "What I wrote is true." She said that she did not know if these problems were connected to the illnesses, but added, "It was an incident that happened at that time."

But Ms. Velasquez, who is being represented by a lawyer for Odwalla, declined to comment further. Chris Gallagher, an Odwalla spokesman, said Ms. Velasquez had told company lawyers that she could not recall the dates when the incidents occurred.

"Obviously, the 'Friday' and the 'Monday' could well be dates other than October 4 and 7," Gallagher wrote in a statement. "Indeed, there are a number of inconsistencies suggesting that the incident referred to in the memo may not have occurred over that precise weekend."

Gallagher said one inconsistency was that Odwalla's records indicate that the company used three sorters on the morning of Oct. 7. He also said that Ms. Velasquez had told company lawyers that on the day she described, she ended up halting the production line until extra sorters were added.

"This is an indication of good quality management, not a failure," Gallagher wrote.

But federal and state inspection reports confirm that the company used apples from two loads with relatively high defect levels on the day the tainted juice was made. Moreover, Warren Hayes, a former Odwalla production supervisor, said there may have been a similar incident that day. Hayes said a production team leader told him that he had objected to using rotten fruit but others had "made the decision to run it."

Hayes added: "Generally if it's that bad, you shouldn't be running it."

The Reaction: A Broad Debate Over Safety Rules

Right after the outbreak, new regulatory inspections also found other flaws in Odwalla's safety programs. And the problems at Odwalla have since sparked a broad debate over what rules are needed to insure the safety of fresh juices and cider.

The FDA cited Odwalla for having an "inadequate" program to test for food-poisoning bacteria. Odwalla's chemical supplier said the brand of acid wash Odwalla was using had killed all the E. coli O157:H7 in only 8 percent of lab tests and should not have been used without chlorine.

And while Odwalla now has one of the most extensive bacteria-testing programs in the industry and has expanded its fruit-washing, it also has become one of the most vigorous champions of a solution it once disdained: pasteurization.

The company hired safety consultants, then identified every point where bacteria could slip in and devised measures to kill them. This systematic approach, known as a Hazard Analysis Critical Control Point plan, is what federal regulators are starting to require as the best answer to the new threats in other types of foods, from seafood to meat. The FDA said it would draft a similar rule for juices.

With apples, where the skin gets mashed right into the juice, Odwalla says this has inevitably meant a shift to pasteurization. But given that orange juice can be extracted without touching the rind, Odwalla's tests show it is still safe to sell it without pasteurizing.

But a bitter debate is shaping up. Many doctors now caution against giving children fresh apple juice or cider, and small cider makers fear that more regulations could put them out of business. Other companies think the FDA's move will lead to pressure to pasteurize all fresh juices. And they say this is too sweeping a conclusion to draw from Odwalla's failure.

"The perception I've got is that it was just a breakdown in good manufacturing practices," said Marc Isaacs, co-chairman of the American Fresh Juice Council.

But Williamson, Odwalla's chief executive, said his company has "a more sensitive perspective on safety" than it used to. He added: "Having Anna die was unquestionably an horrifically awful, terrible thing to go through. You can't imagine worse."

Next to Anna Gimmestad, 4-year-old Amanda Berman was perhaps the child most severely injured by Odwalla's apple juice. She drank it at a Starbucks in Seattle and was catapulted into a maze of medical tubes and machines -- 17 days of kidney dialysis, vomiting and blood transfusions. After her illness, she had trouble sleeping for months.

The Bermans are suing Odwalla, which has paid an undisclosed sum to the Gimmestads and settled five of 10 lawsuits by other victims.

For most of these families, the big worry is that their children will experience problems as they grow older. Of the children who got hemolytic uremic syndrome in the 1993 E. coli outbreak involving hamburgers, some developed diabetes, and one has needed a kidney transplant.

"You just got to wait and see," said Amanda's father, Adam.

NEXT: Tracing a three-state food poisoning outbreak to one small lettuce producer.

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January 5, 1998

FRESH HAZARDS / Second of three articles

From Farm in California to Outbreak of Food Poisoning in the East**In This Article**

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- [Deadly Bacteria a New Threat to Fruit and Produce in U.S. \(Jan. 4\)](#)

By **PAM BELLUCK** and **CHRISTOPHER DREW**

HOLLISTER, Calif. -- At the dusty elbow of a ragged road named Lovers Lane sits a corrugated tin barn, dull gray and green against the dun-colored hills of central California.

Inside the barn is a big stainless steel tub where lettuce greens like radicchio, frisee and arugula, plucked from the nearby fields, are rinsed before being blended into fancy, premixed salads -- a hot item among health-minded consumers these days.

But in 1996 a team of federal and state authorities descended on the farm here. After weeks of detective work, they concluded that lettuce processed at this one barn had almost certainly led to an outbreak of food poisoning that May and June that sickened 61 people in Illinois, Connecticut and New York. At least 21 people were hospitalized, including three children who were severely harmed.



Haylee Bernstein, who ate contaminated lettuce, and her parents, Larry and Rita, at home in Wilton, Conn., last fall. Credit: Susan Harris for The New York Times

people were hospitalized, including three children who were severely harmed. One was a 3-year-old Connecticut girl, Haylee Bernstein, who spent 11 weeks in intensive care, needed surgery to remove a huge pool of blood in her brain and was left with damaged vision.

The investigators said they were troubled to find that the lettuce company operating at the barn, Fancy Cutt Farms Inc., had taken virtually no measures to protect its salad mixes from contamination. The prime suspect, they believed, was obvious: Next to the barn is a small pen for cattle, whose feces are a leading source of the E. coli O157:H7 bacteria that experts say is a growing threat to the nation's food supply.

The state cited Fancy Cutt for a number of safety violations in July 1996. Yet today, more than 17 months later, the company still has not corrected all the problems, state officials say.

Indeed, Fancy Cutt denies responsibility for the outbreak, questions the strength of the evidence against it and argues the contamination could have come from elsewhere in the distribution chain. It defends its safety practices and continues to sell its lettuce.

The fact that the investigation led to a small California farm -- thousands of miles from the victims -- illustrates how vulnerable the nation's far-flung food distribution system is to the new contaminants that are puzzling scientists and causing thousands of illnesses each year. What happened with Fancy Cutt, an organic farm that used no chemicals to wash lettuce, also shows how federal and state regulators have failed to keep up as the fresh-food industry undergoes sweeping changes.

An E. coli outbreak in apple juice produced by Odwalla Inc. showed that even fairly sophisticated processors could have flawed safety practices. And some farms and processors, eager to satisfy America's taste for ever-fresher products, are venturing into new areas with the barest understanding of risks and what few rules there are. While many producers, especially big ones like Dole and Fresh Express, have developed advanced safety systems, some small farmers and processors are going into business with jury-rigged equipment and scant quality control.

These kinds of unreliable practices can create particular risks for fresh produce and today's bountiful array of prepackaged salads, the foods most likely to be consumed raw, without high-heat cooking that destroys bacteria. Some salads are labeled "all natural" or "triple-washed," implying they are safer and cleaner than other produce.

Thousands of Americans have reported illnesses in recent years in outbreaks of salmonella on cantaloupes and tomatoes, cyclospora on imported raspberries, the hepatitis virus on strawberries and E. coli in fresh fruit juice, salads and, just this summer, alfalfa sprouts.

Despite growing concerns, industry officials say nearly all fruits and vegetables sold are safe. Federal and state health officials say Americans should not back away from eating such nutritional fare, though they recommend washing even

away from eating such nutritional fare, though they recommend washing even premixed salads.

Still, as more food is distributed nationally, unsafe practices at even a small company can affect significant numbers of consumers over a wide area. Federal officials acknowledge they have paid little attention to farms and many small-scale processors because they have been overwhelmed by their responsibilities. The Food and Drug Administration has only 700 inspectors for 53,000 processors of everything from canned soup to frozen seafood, meaning, on average, only one inspection every 10 years.

Until the outbreak, state and federal health regulators did not even know Fancy Cutt existed, because the company, formed in early 1996, had not registered as a processor with the state, as required. But even once they found problems at Fancy Cutt, the regulators did not act forcefully.

The federal government left it up to the state, and the state did not try to fine or temporarily shut down Fancy Cutt, even as repeated inspections showed a failure to comply with state food safety regulations.

"That's mind-boggling," said Rita Bernstein, Haylee's mother. "How are they still operating? What does it take to close down a place?"

Jim Waddell, acting chief of food safety for the California Department of Health Services, said his department's approach has been to work with the industry. But acknowledging the lack of results, he criticized Fancy Cutt, saying, "They have flat not done what we've asked them in a timely manner."

After The New York Times raised questions about the case, state health authorities did begin pressing for action against the company. In response, the county prosecutor says he will file criminal charges and the state attorney general's office says a civil suit is planned -- in both cases, not in connection to the outbreak, but for failing to correct safety violations.

Fancy Cutt's president, Robert Chavez, insisted that his operation had always been safe. But standing outside the processing barn, his brother, Leonard, who helps run the company, acknowledged recently that "this is not a facility, in my mind, that is up to standards." He also said the state had been "pretty lenient with us."

The Chavezes also said there are a dozen or more lettuce processors with more hazardous operations than theirs here in California's "salad bowl," one of the nation's prime agricultural belts.

State and county officials said they were planning civil and criminal cases against another lettuce producer, down the road from Fancy Cutt, where state inspectors say they found even more blatant safety problems soon after they learned about conditions at Fancy Cutt. And, Waddell said, "there's a lot out there we haven't seen."

The Outbreak: From Far Away, Crippling Sickness

The first illnesses from the tainted lettuce, marked by bloody diarrhea and cramps, were in Illinois.

Some, like Tammy Aardema, seemed unlikely victims of food poisoning. Ms. Aardema, 43, who lives in the Chicago suburb of St. Charles, swears by fruits and vegetables and always washes them before eating. Her husband runs a beef processing plant that takes strict precautions to keep out *E. coli* O157:H7. Yet she was bedridden for days.

A few days after the first Illinois cases in late May 1996, the same pattern cropped up a thousand miles away in Connecticut.

In affluent Wilton, Haylee Bernstein had terrible diarrhea and became so weak she fell asleep on the dining room floor. Ultimately, she spent 14 weeks in the hospital with hemolytic uremic syndrome, the most serious consequence of *E. coli* O157:H7, which, especially in children, can destroy blood vessels and ravage the kidneys and other organs, sometimes causing death.

Haylee was hooked up to so many tubes -- for food, oxygen, kidney dialysis -- that doctors at times gave her paralyzing drugs to keep her from wriggling. She had several surgeries, including the removal of a tennis ball-sized pool of blood that had pushed part of her brain out of position.

Haylee's medical bills, mostly covered by insurance, came to more than \$500,000, including nearly \$100,000 for drugs alone. After the brain surgery, she went blind for weeks, and still has partial vision loss.

Federal and state health officials had reports that at least 52 other people who either lived in or visited Illinois or Connecticut were sickened.

By examining the genetic makeup of the bacteria in stool and blood samples of the victims, the health officials concluded that they had the exact same strain of *E. coli* O157:H7. They painstakingly interviewed victims about what they had eaten and where, canvassed supermarket aisles and questioned restaurant chefs.

Finally, they zeroed in on the cause: mixed baby lettuce, sometimes called mesclun, those blends of colorful greens like baby spinach or red mustard sold in plastic containers or supermarket bins, or served in restaurants with goat cheese or balsamic vinaigrette.

Premixed salads have become so popular that one trade group estimates sales soared to \$1 billion nationally last year from \$82.6 million in 1989. Some of these products are marked "certified organic," a promise that no pesticides or chemical fertilizers were used. But the organic certification, currently or under regulations proposed recently by the Department of Agriculture, does not guarantee safe processing practices or absence of harmful bacteria.

Investigators were not altogether surprised that their attention turned to lettuce.

Investigators were not altogether surprised that their attention turned to lettuce. In the previous five years, there were five outbreaks of *E. coli* O157:H7 in lettuce, including iceberg lettuce and other greens. Some of those cases might have been linked to food handlers, but this 1996 outbreak affected more people and had spread much farther than the others.

Those sickened by the lettuce had gotten it from at least 11 different restaurants and stores in Connecticut and Illinois, said Dr. Jonathan Mermin, a medical epidemiologist for the Centers for Disease Control and Prevention. Those businesses received the lettuce from two different wholesale distributors, in New York and Illinois.

Those two distributors, in turn, had a half-dozen or so suppliers, Mermin said. One name in common was Fancy Cutt Farms, a small California company that was just getting into the organic business. Invoices showed that at the time of the outbreak, the lettuce supplied to virtually all the Connecticut restaurants came only from Fancy Cutt, Mermin said.

Investigators later tested bacteria samples from people who had been sick in the same time period in New York, another state where Fancy Cutt had sent its lettuce. They found that seven people had the same strain of *E. coli*, bringing the total number of cases to 61. The team concluded that the data were "good enough to implicate Fancy Cutt Farms," Mermin said. He added: "It was the weight of the evidence. Fancy Cutt could account for most of the cases."

In mid-July, more than six weeks after the first reports of illness, Mermin and investigators from the FDA and the California and Connecticut health departments went to inspect Fancy Cutt Farms. With the outbreak over and lettuce highly perishable, investigators knew they would be unlikely to find contaminated greens or *E. coli* O157:H7, Mermin said. And they did not.

But what the investigators did find, they said, was profoundly disturbing.

The barn that was Fancy Cutt's processing shed was completely open on one side, exposing the large, stainless steel tub where the leaves of lettuce were washed before being mixed and shipped in three-pound boxes. Less than 100 feet away were some cattle. Three cows, owned by Fancy Cutt's landlord, sat in a pen just across a small dirt parking area; at least two dozen more were in the next pasture, brought in regularly for water.

"Routes of contamination" were all around, wrote an FDA inspector, Mary C.B. Acton. Cow feces could be blown into the shed by wind, washed in by rain and tracked in on workers' boots, by animals or by the birds investigators saw flying into the barn. Ms. Acton noted that "dust from the trucks and cars driving in and out of the parking area and debris from the field is blown into the wash tank and wash area."

Some of the lettuce was grown in a field where cows had grazed in the winter, the report said, raising a possibility of contamination through manure. Greens were carted to the washing area in reused, "dirt encrusted" boxes that "may carry contamination into the processing area." In the wash tank, lettuce was

carry contamination into the processing area." In the wash tank, lettuce was swished around by employees, some of whom did not wear gloves, and who had no acceptable place to sanitize their hands. Ms. Acton also wrote that the company had "no quality control procedures."

Then there was the water. The inspectors found generic types of *E. coli* in the wash water and on lettuce -- bacteria that are harmless but which can indicate the possibility of toxic contamination.

The report said the well that supplied the washing water was 20 feet from the cattle pen and the mouth of a second well that supplied some irrigation water was in a cattle pasture. It said no chlorine, which can be used on organic foods to kill bacteria, was added to the wash water, and no bacterial testing was done.

Investigators said that in the weeks just before people got sick, the wash water at Fancy Cutt was not changed often because the farm appeared to be relying on a jerry-built filter system. The system was clogged and not working properly, they said, and Mermin believes the filter may have been a perfect environment for bacteria to multiply. The FDA report said that Chavez, Fancy Cutt's president, told investigators that on May 25, three weeks after it was hooked up, the filter was disconnected.

The period the filter was being used on recirculated water, Mermin said, matched the timing when contaminated lettuce was produced.

"The implicated lettuce stopped being shipped on a particular day," Mermin said. "That day was the day they stopped the filter and started changing the water."

The Response: Farm Is Allowed To Keep Operating

With all their findings pointing to Fancy Cutt, the investigators from the CDC, Connecticut and California health departments issued a report that said the contaminated greens had been traced to a single producer that processed its lettuce near cattle and had the generic form of *E. coli* in its wash water.

Still, they did not formally -- or publicly -- cite the company as the source of the outbreak. That was because, in their visit six weeks after the outbreak, the suspected lettuce was gone and they did not find the same strain of *E. coli* that had sickened people anywhere on the farm. They did not have the kind of scientific proof they normally like to have to reach such a conclusion, several investigators said.

"There was no evidence of continued contamination of lettuce, otherwise we would have" cited the company for the outbreak, Mermin said. "We believe we have good data."

As is customary with small-farm operations, the FDA let the state address the problems investigators documented. California cited Fancy Cutt for violations of its food-safety laws that July, telling it to fix the most urgent threats first: the open shed, the unchlorinated wash water, the unsanitary employee practices.

open shed, the unchlorinated wash water, the unsanitary employee practices. But it did not fine the company or try to close it, even temporarily. State officials now say that they thought Fancy Cutt would correct the problems.

The company president, Robert Chavez, said he took the authorities' low-key response -- and their failure to find the harmful *E. coli* -- to mean that Fancy Cutt was cleared of responsibility for the outbreak. He suggested that contamination might have occurred when some distributors and stores added ingredients to his lettuce mix and divided it into small plastic bags and containers for retail.

"Why haven't I been closed down?" he asked. "Why haven't I been sued? It's very simple. We were cleared of it."

Since the citations, Fancy Cutt has made some improvements. It has better trained its workers, supplied them with gloves and hairnets and replaced some equipment.

But state officials say Fancy Cutt took months to correct some of the most serious violations. And they say there are still problems that could leave its lettuce vulnerable to bacteria.

For example, while the company eventually began using chlorine to kill bacteria in its wash water, the state is still not confident about "the overall cleanliness of the water, how often it's changed out, the monitoring of the chlorine," Waddell said.

And several months after the first inspection, the barn was still wide open, said Alex Mamaril, a former operations manager at Fancy Cutt. "You had cows right there and the rain would come right in there while we were processing, and that lettuce goes right to somebody's table," he said.

When a corrugated metal wall was put up, two large openings were left in it, shielded only by plastic strips that can still allow in dust, dirt and animals.

In follow-up inspections last year, the state repeatedly pointed out these and other problems, documents show. In May, the inspectors reported that Fancy Cutt still had no acceptable hand-washing facilities. The water in the wash tank had "a brown soil coloration," the inspectors said, and the shed ceiling had "numerous cobwebs with numerous trapped insects directly over exposed salads." Also, they said, "Live birds and a bird nest were observed inside the shed ceiling rafters." In both July and September, they found washing equipment "encrusted with grime" or containing "a crust of rust."

Standing outside the shed on a recent afternoon, Leonard Chavez acknowledged: "It has to be absolutely spotless, I know that. It has to be completely enclosed so that there's no way any unwanted creature can get in. What you see here may look bad. You should have seen it before."

Showing visitors fields striped with greens like lolla rossa and tat soi, Leonard Chavez said that Fancy Cutt was beginning to shift from selling lettuce mixtures

Chavez said that Fancy Cutt was beginning to shift from selling lettuce mixtures to supplying other companies that would be responsible for washing and mixing. He believes state-of-the-art safety improvements would cost over \$100,000, and said Fancy Cutt, with sales of about \$1 million a year, could not afford it.

Waddell defended the state's approach, saying regulators had focused on learning about and working with the burgeoning industry -- and creating voluntary safety guidelines with an industry group, the Western Growers Association.

"Rather than seeking out individual bad actors," he said, "we try to get as much industry cooperation as possible.

"Initially, Fancy Cutt was making some effort to work with us, but as time went on they were not progressing as quickly as we had hoped."

At the health department's request, Harry Damkar, the San Benito County district attorney, recently reviewed the case and said he expects to file criminal misdemeanor charges against Fancy Cutt soon for violating state food-safety laws. Asher Rubin, a deputy state attorney general, said his office was also preparing a civil suit against the company.

Fancy Cutt, meanwhile, has just completed another growing season. And even its landlord, Anthony Betancourt, said it had taken much too long for the state to act. Betancourt, who said he has never been asked to move his cows, was visibly distressed that so many people had gotten sick. "I wish," he said, "they had shut it down."

The Aftermath: Vows In The Capital, Fear In The Kitchen

The lettuce outbreak and others have spurred efforts in Washington to overhaul a safety system dating to the turn of the century.

Just over a week ago, the Clinton administration said it would seek an additional \$71 million for food safety programs in the 1999 fiscal year, including some money for up to 100 new inspectors. The administration is also asking Congress to give the FDA authority to block imports of produce from countries that do not have inspection systems as strong as the one here. But at the same time, cases like Fancy Cutt show that the inspection network in this country has more holes than people realize.

To overcome these weaknesses, cooperation between state and federal regulators "must work better," said Dr. Michael A. Friedman, the acting FDA commissioner.

The FDA also wants the food industry to take more responsibility. It is working on voluntary guidelines to encourage safer handling of fruits and vegetables, and Friedman said he would like to see fruit and vegetable companies develop hazard-control plans to insure the destruction of contaminants.

Some produce companies, however, say more research is needed to identify the best safeguards.

"Our industry can't afford to lose consumer confidence in these products," said John Aguirre, a lobbyist for the United Fresh Fruit and Vegetable Association. "On the other hand, we can't afford to blindly change the way we operate because many of our guys aren't that wealthy. We have to make reasonable changes where we know they have practical effect."

But consumer advocates, and families hit by E. coli, have little patience with such pleas.

In Connecticut, Haylee Bernstein is in nursery school and her curly brown hair has grown back since her brain surgery. But a loss of certain brain cells has limited how much she can see to her right. And the family does not know if there will be other medical problems.

Everything the Bernsteins eat is scrutinized, sanitized. When a restaurant served Haylee a piece of chocolate cake, Mrs. Bernstein plucked off the strawberry on top.

At home, Mrs. Bernstein sprays all produce with an anti-bacterial wash, even though it is not certified as effective by the FDA. Only recently, because her daughter begged her, has Mrs. Bernstein bought lettuce. She spends 40 minutes washing it, going over and over every leaf.

After Haylee got sick, Mrs. Bernstein said, "I went through a kind of guilt thing because I fed it to them. But then I realized, I was really just sitting in the house and an A-bomb fell on me."

She added, "The reaction I get from people is, 'Lettuce. You mean lettuce?'"

NEXT: How scientists discovered that an innocuous bacteria had turned into a killer.



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Looking for One of the World's Most Dangerous Toxin Bacteria

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By GINA KOLATA

People in the United States are sickened by their food once a year, on average. But the food poisoning that suddenly appeared in White City, Ore., in December 1981 was something else.

It was terrifying, and dramatic, and it seemed to have no cause. In the end, however, that mini-epidemic turned out to be the first show of force by a new strain of bacteria that is now infesting the food supply, infecting as many as 20,000 Americans a year and killing 500.

This is a scientific detective story about those bacteria, known as E. coli O157:H7. It is a story that is continuing and that, in the end, may lead to sweeping changes in the way food is regulated in the United States.

The bacteria that puzzled scientists 16 years ago have turned up in some of the most notorious food poisoning episodes in recent history, including one



poisoning episodes in recent history, including one involving Jack in the Box restaurants in the Northwest in 1993 where four children died after eating hamburgers and hundreds of people became ill.



Dr. Alison O'Brien, a researcher of lethal E. coli, in her Maryland laboratory.

Credit: Carol T. Powers for The New York Times

The bacteria surfaced in 1996 in cases traced to contaminated apple juice and lettuce, then dominated headlines last August when 17 people in Colorado got sick after eating hamburgers from beef processed by a Hudson Foods plant in Nebraska. Hudson, based in Rogers, Ark., recalled 25 million pounds of its ground beef, the largest meat recall in history, and the plant closed its doors.

Normally, *Escherichia coli* bacteria live innocuously in the intestines of people and animals. But the new E. coli strain can cause diseases from standard diarrhea to kidney failure and death. The bacteria still befuddle medical doctors, who have misdiagnosed their infections as everything from appendicitis to blocked blood vessels of the colon.

Once someone is infected, there is no effective medical treatment to combat the disease, and all doctors can do is prevent dehydration, wait for the disease to run its course, and hope for the best.

"I say the 'E' in E. coli stands for evil," said Nancy Donley, a Chicago mother whose son, Alexander, died in 1993 from an E. coli O157:H7 infection.

In just four days, it "destroyed all of Alex's internal organs and liquefied parts of his brain," Mrs. Donley said. It is, she added, "a terrible, terrible bug."

The Hunt: At a Meat Plant, The Smoking Gun

The search for the killer strain of E. coli began when about a dozen people showed up one week in December 1981 in the emergency rooms of White City, a working-class city near the California border. The patients described terrifying symptoms: diarrhea attacks occurring several times an hour accompanied by abdominal cramps that women said were worse than labor pains and men said felt like a hot sheet of metal had been placed on their abdomen. At first, the patients said, they had watery stools, but within hours, their diarrhea turned into what looked like pure, bright red blood. And it lasted for days.

White City doctors tested patients' stools for a long list of bacteria and parasites, but could not find a culprit. It was not even clear whether the disease was caused by an infectious organism, like a bacterium or a virus, or whether it was due to a toxic chemical. Finally, on a cold damp day in February 1982, frustrated officials of the Oregon public health department called in Dr. Lee Riley, who had recently begun work as a medical detective for the Centers for Disease Control and Prevention in Atlanta, and who is now a professor of infectious disease and epidemiology at the University of California at Berkeley.

Riley immediately flew to White City. "We figured that whatever we were dealing with had to be completely new," he said.

dealing with had to be completely new," he said.

The first question Riley tackled was, What did the patients have in common that their friends, family members and neighbors did not? One clue was that they had eaten at a local McDonald's restaurant.

Still, the association might have been purely coincidental. And if the source was McDonald's food, it was not certain what item was causing the illness. The hamburgers? Unlikely, Riley reasoned. The meat patties were cooked at such a high temperature, he said, that "we couldn't believe that that kind of cooking would allow a microorganism to survive."

While Riley dissected the Oregon cases, the disease struck again, this time in Michigan in May 1982. Once again, the patients had just eaten at a McDonald's restaurant.

At the same time, working on the mystery disease at the disease control centers, Dr. Joy Wells, a microbiologist, noticed something suspicious. Nine of the 12 patients whose stools were obtained at the start of the illness contained a type of *E. coli* designated O157:H7, a label based on the proteins found on the surface of that strain. When the stool of healthy people was tested for comparison, the strain was absent. But the medical investigators were leery.

"We just didn't think *E. coli* could do something like that," Riley said. It was possible that *E. coli* O157:H7 was a perfectly harmless bacterium that just happened, by chance, to be in those patients' stools.

Finally, in July 1982, the investigators found what they needed. A plant in Ohio that had supplied meat to the McDonald's in Traverse City, Mich., had happened, as part of its quality-control program, to have saved ground beef from the suspected lot. Lurking in that meat was the same strain, *E. coli* O157:H7.

It turned out, Riley said, to be the smoking gun.

But if it was a common strain, it could well have been a coincidence that the *E. coli* were in the patients' stools and in the hamburger. So Dr. Wells began searching a database of more than 3,000 *E. coli* samples that had been stored for years at the disease control centers. Only one was *E. coli* O157:H7. It had been isolated in 1975 from the stool of a 50-year-old California woman who was a naval officer in Oakland at the time.

"We tried to track down this patient," Riley said, "but we couldn't find her."

He did, however, get her medical records from the Navy. They showed that the woman had had a bloody diarrhea that was identical to the diarrhea that struck the patients in Oregon and Michigan.

Until then, said Dr. Patricia Griffin, who is a director of epidemiology research at the disease control centers, the case was shaky. "You could say, 'Maybe that's just a nice bacteria that happens to be in food,'" she said. But, she added,

just a nice bacteria that happens to be in food," she said. But, she added, "finding that woman in 1975 who had had bloody diarrhea, and who had the same E. coli strain in her stool, that's when you start to get chills." The researchers now knew that there was a new strain of E. coli that could get into food and make people seriously ill.

The Bacteria: A Virulent Strain Never Seen Before

Yet a fundamental question remained. How, or why, did these bacteria make people sick?

A crucial clue came from a seemingly unrelated investigation that was going on at the same time. Dr. Mohamed Karmali, who is the head of microbiology at the Hospital for Sick Children in Toronto, had been tormented over a mysterious illness. In 1980, in the space of 10 days, 14 children were admitted to his hospital, all with the same symptoms. Their illness began with diarrhea. About a week later, their kidneys failed. Two children died and others were left with severe, permanent damage to their kidneys and bowels.

Like Riley, Karmali and his colleagues asked what these children had in common. "There weren't too many leads," Karmali said. "We were looking at all sorts of poisons and chemicals." One hint, significant mainly in retrospect, was that the children had visited a farm market on the outskirts of Toronto and had drunk unpasteurized apple juice.

"I was working day and night," looking for infectious organisms that could have caused the strange illness, Karmali recalled. "Then we had sort of a break," he said. An 18-month-old boy died, and the autopsy showed that the boy had E. coli bacteria in his bowel that were making a potent, unidentified toxin.

Karmali began looking for the bacteria in the feces of children admitted later with the kidney disease, called hemolytic uremic syndrome, but could not find them, probably because the children's active diarrhea had already ended.

So Karmali searched for the toxin instead. "To our surprise, we found the toxin in the stool," he said.

Laboratory tests showed that the toxin killed monkey kidney cells and a type of human cell grown for research. That sounded familiar to Dr. Alison O'Brien, a microbiologist at the Uniformed Services University of the Health Sciences in Bethesda, Md., who heard about the research at a scientific meeting. She worked with a different bacterium, Shigella, that exudes a toxin with exactly the same properties. It could be, she reasoned, that the E. coli had picked up the gene that causes bacteria to make Shigella toxin. If so, the new E. coli was armed with "a nasty little toxin," Dr. O'Brien said -- indeed, probably the third most dangerous bacterial toxin known, coming right after tetanus and botulism.

Dr. O'Brien examined the rogue E. coli, and sure enough, discovered that it had somehow taken on the Shigella toxin gene. Moreover, in many of the E. coli, that gene was slightly altered in a way that made the bacterium produce toxin even more deadly than the original toxin made by Shigella.

even more deadly than the original toxin made by *Shigella*.

No one knows exactly how the *Shigella* toxin genes jumped to *E. coli*, but Dr. O'Brien has an educated guess. Viruses that infect bacteria can sometimes pick up a gene from one bacterium and carry it to another.

But if that was the seminal event, Dr. O'Brien said, it probably did not occur in the United States, where *Shigella* bacteria do not have the dangerous toxin gene. *Shigella* in Central America do have that gene, however, and in the 1970s, that area was hit with a pandemic of *Shigella* dysentery. As the *Shigella* mixed with harmless *E. coli* in people's intestines, or as it mixed with harmless *E. coli* that inhabited animal manure, a virus may have carried *Shigella* toxin genes to *E. coli*. The result would have been a strain that had never been seen before: the toxin-armed *E. coli* O157:H7.

However the toxin does its work -- and scientists still do not know for sure -- the result is that it can injure cells that line blood vessels, plugging them with blood clots. When this happens, the first symptom is bloody diarrhea. But a small proportion of people, especially young children and the elderly, develop hemolytic uremic syndrome, the actual destruction of the kidneys that occurs when blood vessels in these organs are destroyed. The syndrome can lead to kidney failure or can be fatal. Infections with *E. coli* O157:H7 are now the leading cause of kidney failure in children, the CDC says, with at least 1,000 children a year developing kidney failure from these infections, and 3 to 5 percent dying.

Older people also tend to develop another complication, thrombotic thrombocytopenic purpura, a sort of leakage of the blood vessels that feed nerve cells. The result is an encephalitis-like disease, with psychosis, comas or seizures.

The bacteria are surprisingly tough and virulent. For example, said Dr. Marguerite Neill, chief of the division of infectious diseases at Brown University School of Medicine, most bacteria do not produce disease unless a person is exposed to millions of them. But as few as 10 or so *E. coli* O157:H7 can produce illness -- far too few to see or smell.

While most bacteria, including botulism bacteria, cannot live in acidic environments, *E. coli* O157:H7 is undaunted, able to grow in foods like unpasteurized apple cider and commercial mayonnaise.

The Epidemics: From Dairy Cows to Food Supply

As researchers studied the organism and its effects, *E. coli* O157:H7 epidemics kept ticking away, usually going unreported because they were sporadic and few doctors thought to test for *E. coli*. But some outbreaks were hard to miss. In September 1984, 34 out of 101 people living in a Nebraska nursing home became ill with *E. coli* infections. They had eaten contaminated hamburgers.

In October 1988, 32 junior high school students from a school in Minneapolis

In October 1988, 32 junior high school students from a school in Minneapolis developed bloody diarrhea from eating contaminated hamburgers in the school cafeteria.

Nonetheless, said Dr. James Marsden, a professor of meat science at Kansas State University, "other than among scientists, I don't think it really sank in what a serious issue this was until the Jack in the Box outbreak," in 1993, when four children died and hundreds of people became ill.

Ridding meat of the new E. coli strain became "the biggest challenge ever to face the industry," Marsden said.

Public health officials also changed their tack. The Centers for Disease Control made a video about E. coli O157:H7 and sent it to public laboratories, suggesting they look for the bacteria. Suddenly, the E. coli were everywhere.

"We used to recognize outbreaks every couple of years," said Dr. Griffin, the epidemiologist for the Center for Disease Control. "Now we see 25 to 30 a year." And the list of foods that caused outbreaks keeps growing. "We look at that list and say, 'Wow,'" Dr. Griffin said.

But how, scientists asked, were the E. coli entering the food chain? Because the first outbreaks seemed to be associated with ground beef, scientists looked into cattle and other farm animals.

Initially, the scientists came up empty handed. In 1982, the Department of Agriculture could not find E. coli O157:H7 in any animals in the country, indicating that the infected cows that contaminated the McDonald's hamburgers must have been rarities. But now, said Dr. Michael Doyle, the director of the University of Georgia's Center for Food Safety and Quality Enhancement in Griffin, Ga., as many as 1.5 to 5 percent of dairy cows carry the organism. Dairy cows and other cattle seem to be the Typhoid Marys of the epidemics, carrying the bacteria harmlessly in their feces. From there, the bacteria enter the food supply. In modern meat plants, a single contaminated carcass can be ground up with scores of other cows to produce hamburgers.

E. coli O157:H7 has also gotten into apple cider, possibly because farmers fertilized their crops with cow manure, Doyle said. It has also gotten into lettuce and alfalfa sprouts.

Other animals can carry E. coli as well. Doyle said he helped investigate a case in Oregon where 11 family members got sick after eating venison jerky. The deer had been infected and the E. coli, he said, "survived the brine process."

He added, "There are reports of kids who went to petting zoos on farms and got sick from petting goats."

The outbreaks have pushed the government into revamping regulation of the food industry. Meat plants are starting to replace the decades-old "sniff and poke" system of inspection with high-tech microbial tests. The Clinton administration is seeking greater power to levy fines and order recalls.

The Food and Drug Administration recently approved irradiation for meat, a method that can kill E. coli. Non-irradiated hamburger, safety experts say, should be cooked until the inside reaches 155 degrees. They also advise thoroughly washing produce and avoiding raw milk and unpasteurized apple juice.

"I really credit the USDA and the FDA for new initiatives," said Dr. Michael Osterholm, an epidemiologist at the Department of Public Health in Minnesota who in summer 1996 traced an outbreak that sickened scores of children in a Twin Cities day-care center to a cow carcass one child's family had in their freezer. "But if you gave me all the money in the world, I'm not sure I could keep these bacteria out of the food supply."

That, however, is no excuse for complacency from regulators or the food industry, Dr. Griffin said.

"The bottom line should be, is it reasonable that if a consumer undercooks a hamburger that their 3-year-old child dies?" she asked. "Even if only a small number of children die each year, 50 or 100, I think it galls consumers and that's understandable. They are asking, Can't we have better control of how our food is produced?"



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