The Director-General of the World Health Organization was blunt. The world is facing “an end to modern medicine as we know it,” Margaret Chan warned last year. Strep throats could once again kill people, and hip replacements, organ transplants, and cancer chemotherapy “would become far more difficult or even too dangerous to undertake.”

That’s because we’re losing our first-line antimicrobial drugs to antibiotic resistance, Chan noted. As for new antibiotics to replace them, Chan wasn’t optimistic: “The pipeline is virtually dry. The cupboard is nearly bare.”

### HAPPY HALLOWEEN

On the evening before Halloween in 2011, Danielle Wadsworth, a healthy 31-year-old insurance agent, shared a dinner of beef tacos with friends at her home in Lewiston, Maine.

“Then, seemingly out of nowhere, I started feeling like I had the flu,” she told the Web site keepantibioticsworking.com. By the next day, “I just wanted to be left alone.”

But Wadsworth got worse. When her persistent bloody diarrhea wouldn’t stop, she went to the emergency room, where intravenous fluids brought temporary relief. But when the bloody diarrhea returned, she ended up back in the hospital. For the next four days, as she suffered intense pain and alternating pangs of hunger and thirst, Wadsworth was treated with morphine every few hours while her doctors tried to figure out what was wrong.

“I love life, but was beginning to wonder if fighting was worth it,” she recalled. “It never crossed my mind that it could be something I’d eaten.”

Nor did that occur to the hospital staff until the stool cultures came back positive for Salmonella typhimurium, one of the leading causes of food poisoning in the United States.

Wadsworth was one of 20 known victims infected with a new strain of S. typhimurium, one that was resistant to at least eight antibiotics, including streptomycin and tetracycline. The Centers for Disease Control and Prevention (CDC) eventually traced the resistant S. typhimurium to contaminated ground beef sold by a supermarket chain, but the CDC couldn’t identify the meat supplier because the chain hadn’t kept good records.

Fortunately, the bug was still susceptible to the antibiotic ciprofloxacin. Cipro helped cure Wadsworth’s infection, but it couldn’t heal the anxiety that she says she still feels about what can happen from eating tainted food.

Or what could happen to her loved ones. “I am the legal guardian for my grandfather. Considering that I cook for him, I hate to even think about the outcome had he eaten the same meat that made me sick.”

### COURSE OF MOST RESISTANCE

“There’s this huge population of antibiotic resistance genes in bacteria in nature and nobody quite knows where they’re there,” says microbiologist Julian Davies of the University of British Columbia in Vancouver. “You can even find them in caves where no human has ever been.”

“What we do know,” explains Lance Price, an environmental health scientist at George Washington University in Washington, D.C., “is that when you use antibiotics, it’s very clear and undisputable that you promote the development of drug-resistant bacteria. It’s one of the strongest evolutionary forces in nature.”

### Handle with Care

If you cook meat, poultry, and fish thoroughly, you’ll kill any harmful bacteria they may contain. Beyond that, here’s some good advice about how to help prevent the spread of antibiotic-resistant bacteria:

- **Don’t expect antibiotics to treat** colds, flu, most coughs, bronchitis, sore throats not caused by strep, or runny noses. They’re caused by viruses, which antibiotics don’t kill.
- **Don’t stop taking prescribed antibiotics** early because you start feeling better.
- **Alcohol-based hand sanitizers** like Purell don’t increase antibiotic resistance. The jury is still out on whether antibacterial soaps and dish detergents that contain triclosan do.

Sources: CDC, CSPI.
Simply Irresistible

When antibiotics are routinely given to animals to speed up their growth, there are many ways for the antibiotic-resistant bacteria that survive to spread through the environment and end up in humans.

Antibiotics stop bacteria by killing them or halting their growth. Resistant bacteria have genes that enable them to survive certain antibiotics by neutralizing the drugs, by pumping the drugs out of their cells, or by altering the cell structure that the antibiotic attacks so that it’s no longer vulnerable.

To make matters worse, bacteria can swap their resistance genes with each other, so that the instructions for resistance are passed on to other bacteria that have yet to be exposed to the antibiotic.

Every time an antibiotic is used, susceptible bacteria are killed, paving the way for resistant bugs to grow and multiply.

The consequences can be deadly. “People sickened by antibiotic-resistant bacteria are more likely to have longer and more expensive hospital stays, and may be more likely to die as a result of the infection,” Price notes. And these aren’t obscure bacteria, he adds. “They’re the same kind of E. coli, for instance, that cause urinary tract infections and sepsis, or blood infections.”

When the first-choice antibiotics are useless, physicians have to resort to drugs that may be less effective, more toxic, and more expensive, according to the CDC.

Unfortunately, much of the damage to the effectiveness of antibiotics has already occurred.

“There’s no doubt that antibiotic resistance is now widespread throughout the world,” says Davies.

A major cause: the chronic misuse of antibiotics in hospitals, physicians’ offices, and homes. Some doctors, for example, still prescribe—and some patients still demand—antibiotics to treat colds or the flu, even though both are caused by viruses, not bacteria. (Antibiotics don’t attack viruses.)

“Humans are to blame in large part for creating this huge problem,” says George Zhanel, a microbiologist at the University of Manitoba and director of the Canadian Antimicrobial Resistance Alliance.

But reducing the inappropriate use of antibiotics in human medicine alone won’t be enough, concluded a 2003 report from the National Academy of Sciences. “Substantial efforts must be made to decrease inappropriate overuse of antimicrobials in animals and agriculture as well.”

That’s because three-quarters of the antibiotics that are used in the United States are given to animals, not people.

**ANTIBIOTICS TO GROW ON**

Most meat and poultry farms rely on antibiotics to treat sick animals and to prevent healthy animals from becoming sick. Modern facilities crowd many animals together, which makes it easier for disease to spread throughout the herds or flocks. (Antibiotics are also widely used in fish farming.)

“The antibiotics approved by the FDA for use in animals represent nearly every class of antibiotic important for treating humans,” says Price.

Much of the antibiotics that are given to animals, however, are not to treat or prevent disease, but to stimulate growth. In the 1950s, scientists discovered that animals fed small, “sub-therapeutic” doses of antibiotics grew more quickly on the same amount of food. And farmers need no prescription for those low doses.

“It’s a big economic advantage because the animals are larger and healthier, and their time to slaughter is shorter,” explains Zhanel. “The drawback is that this use of antibiotics selects out antibiotic-resistant bacteria for survival.”

For example, fluoroquinolone antibiotics (which include the Cipro that helped Danielle Wadsworth) can kill a wide range of disease-causing bacteria. After the FDA approved their use in poultry in 1995, resistance to fluoroquinolones among Campylobacter bacteria on chicken tested at slaughter houses and supermarkets rose so sharply that in 2000, the FDA reversed its decision and tried to ban the use of fluoroquinolones in poultry. (The ban was delayed for five years while Bayer, which manufactures fluoroquinolones, fought it unsuccessfully in court.)

**RESISTANT BACTERIA SPREAD**

Antibiotic-resistant bacteria usually reside in an animal’s intestines and are excreted in its waste. From there, they can be spread by polluted water, farm workers, the wind, birds, and even flies.

In North Carolina, for example, swine waste is commonly stored in open pits before being sprayed onto nearby fields. “Many of these waste pits are located in flood plains and can overflow, while the fields sprayed with waste can contaminate groundwater,” says epidemiologist Steve Wing of the University of North Carolina.

“This clearly is a potential source for human exposure to antibiotic-resistant bacteria.”

**BUGS ON FOOD**

Some antibiotic-resistant bacteria wind up on the meat and poultry in the refrigerator case at the supermarket. “Our food supply is tainted with disease-causing bacteria that are often resistant to many different antibiotics,” says George Washington University’s Lance Price, who serves on a U.S. Department of Agriculture advisory panel on food safety.
How to Decode the Claims

Want to find meat and poultry grown without antibiotics? It’s tricky.

➤ What these terms on food labels mean:

**Antibiotic free**: Term not permitted by the U.S. Department of Agriculture because all foods should be free of antibiotic residues.

**No antibiotics administered or Raised without antibiotics**: Animal never received antibiotics. Not independently verified, so claim depends on the honesty of the company making it.

**USDA Certified Organic or American Grassfed Certified**: Use of antibiotics prohibited. Verified by independent audits.

**Certified Humane or Animal Welfare Approved**: Antibiotics permitted only to treat sick animals. Verified by independent audits.

➤ Companies that told us that they use or sell meat from animals that were never treated with antibiotics:

**Supermarkets**: Whole Foods

**Restaurants**: Chipotle Mexican Grill

**Brands**: Applegate, Bell & Evans, Coleman Natural Foods, Murray’s Chicken, Niman Ranch, Heritage Acres, Laura’s Lean Beef, Harvestland

➤ Companies that told us that they use or sell meat from animals that were treated with antibiotics only if they were sick:

**Restaurants**: Burger King, In-N-Out Burger, Panera (only items marked on the menu)

**Brands**: Perdue

To find stores, farmers’ markets, farms, and restaurants near you that sell meat and poultry raised without the routine use of antibiotics, go to realtimefarms.com/fixantibiotics. The information is “crowd sourced,” which means that anyone can add to it. So be sure to verify with the company before you buy.


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**ENDING DRUG ABUSE**

How practical would it be to end the routine use of antibiotics to promote growth in animals that are raised for food? Very practical, says Price, because it’s already been done.

In the late 1990s, Denmark, the world’s largest exporter of pork, banned the use of antibiotics on farms except to treat sick animals.

“Nothing bad happened as a result,” Price notes. Ending the use of antibiotics for growth promotion caused no sustained harm to animal survival, production rates, or feed efficiency, a World Health Organization expert panel found.4

“And these are industrial farms,” adds Price. “They’re cleaner, the density of animals is lower, and the quality of life is a little better than in the U.S., but these are still highly efficient industrial farms.”

Most importantly, ending the routine use of antibiotics helped slash rates of resistance.

According to the Danish Veterinary and Food Administration, the percentage of *Campylobacter* bacteria in pigs that was resistant to antibiotics like erythromycin dropped from 80 percent before the ban to less than 20 percent. And the percentage of vancomycin-resistant *E. coli* in broiler chickens plummeted from 75 percent to less than 5 percent.5

The ban also led to a decline in resistant bacteria isolated from the intestines of healthy Danes.

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**WHAT TO DO**

How can you lower your odds of getting food poisoning from resistant bacteria?

It may help to buy meat or poultry that comes from animals that were never given antibiotics (see “How to Decode the Claims”). According to a 2012 Stanford University meta-analysis, conventionally produced chicken and pork were 33 percent more likely than organic chicken and pork to be contaminated with bacteria that were resistant to at least three antibiotics.6

But that won’t guarantee that you—or your child or parent—won’t get a bout of antibiotic-resistant food poisoning like the one that hit Danielle Wadsworth.

“As a society, we have to say that antibiotics are too valuable for treating sick people and that we cannot afford to squander them as production tools for raising animals,” says Price.

“We’re talking about the future of medicine. We don’t have new drugs coming up through the pipeline. And even if we did, if we abuse them the same way, they’re going to be useless again very quickly.”

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1. www.cspinet.org/foodsafety.
2. www.nap.edu/openbook.php?isbn=030908864X.