FIGHT INVISIBLE KILLERS

SCIENCE SOURCE (GERMS); COURTESY OF THE INFECTIOUS DISEASES SOCIETY OF AMERICA (ADDI)
Deadly bacteria are lurking in hospitals, playgrounds, malls, and parks, infecting millions of people. Can we stop them before it’s too late?

BY KRISTIN LEWIS

In May 2011, 11-year-old Addie Rerecich was attacked by a monster. No, this monster was not a ferocious animal. In fact, it was invisible to the naked eye. But it was one of the most dangerous killers in the world today.

Addie was attacked by a kind of bacteria that for years has given doctors nightmares. It’s called methicillin-resistant Staphylococcus aureus, or MRSA.

And it was slowly poisoning her from the inside out.
The Nightmare

Addie’s nightmare started when she developed an ache in her hip. At first, she and her mom, Tonya, chalked it up to a strain from softball practice. But then Addie’s temperature spiked to 103 degrees. Doctors concluded that she had a virus. They said she should rest and follow up in a few days.

But Addie didn’t get better. She got worse—a lot worse.

Two days later, Addie’s pain had become so unbearable that she couldn’t sleep. Tonya rushed her to a hospital in their hometown of Tucson, Arizona, that specializes in treating children. There, doctors tested Addie’s blood and discovered that she was infected with MRSA. They suspected that it had entered her body through her hip, though no outside injury was visible. Now the brutal infection was coursing through her bloodstream.

Addie was rushed into the intensive care unit, where doctors and nurses scrambled to help her. MRSA can be one of the most dangerous and contagious infections. Some people can fight it off, but for others, particularly the elderly and sick, MRSA can be lethal.

MRSA is called a superbug because many medicines used to treat infections don’t work on it. In the U.S., more than 2 million people get some kind of superbug every year, according to a new report by the Centers for Disease Control and Prevention. Superbugs threaten everyone—young and old, healthy and sick—and kill at least 23,000 people every year.

Addie was in for a terrifying fight against MRSA—and it was just beginning.

Age-Old Problem

Bacteria are microscopic organisms that are too small to see or feel. There are 5 million trillion bacteria on Earth, and they are literally everywhere, from the top of Mount Everest to the deepest trench in the Pacific Ocean. You are surrounded by them right now, and your body is filled with them. The majority of bacteria are harmless. Many are actually crucial to our survival, like the bacteria that line our intestines and help us digest our food.

Some types of bacteria, though, make us sick. Until the 20th century, bacterial infections were a leading cause of death around the world. That’s because there were few medicines to treat them. People routinely died of strep throat or even mild cuts that became infected. By the 1900s, for example, the Black Death, caused by the bacterium *yersinia pestis*, had killed more than 200 million people.

**BLACK DEATH**

*(Yersinia pestis)*

**SYMPTOMS:** fever, vomiting, coughing, swollen lymph nodes, tissue that blackens and dies

**HOW IT SPREADS:** bites from fleas living on infected rats and through the air

**HOW WE FIGHT IT:** antibiotics

At the height of the Black Death in the 14th century, at least a third of Europe’s population was wiped out. Today, the disease is easily treated with antibiotics, and infections are extremely rare.
An Accidental Medicine

Human history changed on the morning of September 3, 1928—and it happened by accident.

A Scottish scientist named Alexander Fleming was cleaning his laboratory. For years, he had been searching—unsuccessfully—for a cure to infection. While organizing some glass plates he had coated with *Staphylococcus*, he noticed something odd. Some mold had grown on one of the plates (he was notoriously messy), and there were no bacteria on or near the mold.

*Was there something in that mold that was killing bacteria?* Fleming wondered.

It turned out that the mold was producing an incredible substance called penicillin. It would be the world’s first antibiotic.

Suddenly, the world had become a much safer place. Antibiotics—medicines that destroy or slow down the growth of bacteria—were called wonder drugs. This was not an exaggeration.

During World War II, penicillin saved hundreds of thousands of injured troops. Killer diseases were now survivable. Surgeries to fix everything from broken bones to failing kidneys became more common, because antibiotics prevented the fatal infections that would have likely followed.

For the next 50 years, antibiotics continued to open doors to incredible life-saving procedures. Organ transplants, chemotherapy for cancer patients, heart surgery—none of these would be as safe without antibiotics.

By the 1950s, doctors were handing out antibiotics like candy. The drugs were being prescribed to treat all kinds of sickness, whether caused by bacteria or not. Over time, even better antibiotics were developed, and their uses continued to expand. Farmers began giving them to cows, pigs, and other livestock to prevent, rather than treat, illness, and to make the animals grow larger.

What few people realized was that there was a consequence to the overuse of antibiotics. Some bacteria were fighting back, and they were getting stronger.

Preparing for the Worst

Within 24 hours of being admitted to the hospital, Addie’s condition had *deteriorated*. Tiny infected boils erupted on her skin. Fluid filled her lungs. She was put on a machine that breathed for her, giving her lungs time to heal.

But in a horrifying turn of events, hiding inside that machine was another kind of superbug. It is called *Stenotrophomonas maltophilia*, and it is even worse than MRSA.

Immediately, doctors administered another antibiotic, and Addie started to get better. Then the antibiotic stopped working and the infection came back. So doctors started Addie on a different drug. Then that one stopped working too.

This went on for several agonizing weeks until finally there were no antibiotics left to try. Doctors told Tonya to prepare for the worst.

The War on Superbugs

How could the bacteria inside Addie resist the medicines that once killed them? Bacteria, it turns out, are smart—and resilient. Every time they encounter an antibiotic, they “learn” a little bit more about how to beat it. Over time, bacteria come up with ways to defend themselves. They build thick armor around their cells. They develop scissorlike arms that can stop medicines in their tracks. They can even pass on their
drug resistance, teaching other, weaker bacteria how to be strong too.

Does this mean the superbugs are going to win? Not if scientists like Dr. Helen Boucher can help it.

Dr. Boucher is an infectious disease specialist at Tufts Medical Center in Boston and one of a growing number of doctors and scientists who are working hard to stop the spread of superbugs.

Boucher warns that as antibiotics stop working, our world could start to look like it did before Alexander Fleming discovered penicillin, when a minor cut could kill within days. Common medical procedures could again be too risky to perform. Millions could die of infections that were once easily treated.

The good news is that we can stop this from happening—if we act now. According to Boucher, the best way to fight superbugs is to prevent infection in the first place. Because superbugs can travel around on your skin (they usually won’t make you sick unless they get inside your body), you can pass them to other people without ever knowing. Regularly washing your hands for at least 30 seconds with soap and water can help prevent that.

Just as important? Take antibiotics only when you really need them. And when you do take them, make sure you take the entire prescription. Don’t stop after you start feeling better. (Even if your symptoms are gone, you may still have bacteria inside you that can grow and multiply.) The CDC estimates that half of all antibiotics taken in the U.S. are unnecessary or used inappropriately. And the more antibiotics we take, the more resistant bacteria become. That’s why in places where antibiotics are used most—such as hospitals—bacteria seem to be the strongest.

The bacteria inside Addie were some of the strongest in the world.

The Last Resort

Addie’s condition continued to worsen. She developed more infections from drug-resistant superbugs that tend to flourish in hospitals. Doctors said her lungs were damaged beyond repair. Yet her mom refused to give up. What Addie needed, Tonya realized, was a new set of lungs. “I went on the Internet at 3 a.m. and started researching transplants,” Tonya said. She found a doctor she thought could do the surgery, Dr. Michael J. Moulton, the surgical director of lung transplantation at the University of Arizona’s Medical School.

Over the centuries, tens of millions of people have died in cholera outbreaks. Today, it is easily treated, but there are still up to 5 million cases a year. Cholera is also a concern after natural disasters. Thousands got sick in Haiti (below) after the 2011 earthquake because food and drinking water got contaminated by sewage in the refugee camps.
Center-University Campus. “I knew I had to get to him somehow. I felt like if he could come and meet her, he’d see the life in this child. She’d come through a war covered in scars but intact.”

Moulton agreed to see Addie, and Tonya tried not to get her hopes up. But to her relief, Moulton said he thought he could help Addie. First, though, doctors needed to deal with all the resistant bacteria inside Addie. Otherwise there was little chance she could survive a procedure as traumatic as a lung transplant.

Turns out, there was one more antibiotic they could try after all. It is rarely used because it can seriously harm organs. It’s a last-resort antibiotic, basically poison. Tonya believed that if there was even a glimmer of hope that Addie’s life could be saved, the risk was worth it.

After doctors administered the antibiotic, Tonya and Addie received the best news they’d had in months: The bacteria were being obliterated.

On September 8, 2011, Addie received a pair of lungs.

**Time to Act**

It’s been two years since the lung transplant, and Addie, for now, is out of danger. Her new lungs are fragile, and she is still recovering her strength. But she is moving forward with her life, and eager for her mom to share her story.

Tonya has become a crusader against superbugs, working with the Infectious Diseases Society of America to get the word out. She is especially passionate about the importance of developing new antibiotics capable of killing superbugs. One challenge is that most big drug companies have stopped working on new antibiotics because they are so costly and time consuming to develop. It can take as much as a billion dollars to get a new drug to patients.

But the situation is not hopeless. Last October, the CDC sounded the alarm. They are working on ways to make it easier for companies to develop new antibiotics and get them to patients who need them most. They are ranking superbugs by threat level. They also want to better track where infections occur, so scientists can develop treatments more quickly.

And that is good news. “We need to take steps now to ensure we are able to more effectively battle these infections in the future,” Tonya urges. “My family and I pray every day that no one else will have to experience what Addie has gone through.”

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**Writing Contest**

Doctors and scientists are working hard to stop superbugs. But they aren’t the only ones who can help. Write an essay explaining three ways you can help in the fight against superbugs. Use text evidence in your response. Send your essay to SUPERBUGS CONTEST. Five winners will each receive a copy of Invincible Microbe by Jim Murphy.