Bacterial Warfare

When fighting infections means fighting for life

by Élan Young

Bacteria: A Dirty Word?

Even though bacteria can only be seen with the aid of powerful microscopes, they surround us, swirling through the air and living in soil where they decompose waste matter. Not only do they co-exist with humans, they are essential for survival of all life on earth. Even the human body is host to bacteria - bacteria in the human body outnumbers human cells by about 10 to 1. Humans rely on innumerable bacterial friends or normal flora from hundreds of different species to aid in digestion and fend off harmful microbes trying to enter the body through the skin and mucous membranes.

A healthy immune system will keep pathogens in check, but if the immune system becomes weakened, some of these germs will sense an opportunity to set up housekeeping and out-compete the normal flora, causing illness. When a person carrying pathogenic bacteria shows no symptoms of illness, that means he or she has been colonized by the bacteria. When a weaker host is invaded by bacteria that causes illness, that is infection.

The Rise of Antibiotic Resistance

Eleven years after Alexander Fleming discovered penicillin, scientists found a way to isolate it, enabling production for the masses. While this great success led to effective treatment of many infectious diseases and gave rise to the discovery of more antibiotics, it was only four years later, in 1943, that penicillin-resistant microbes arose.

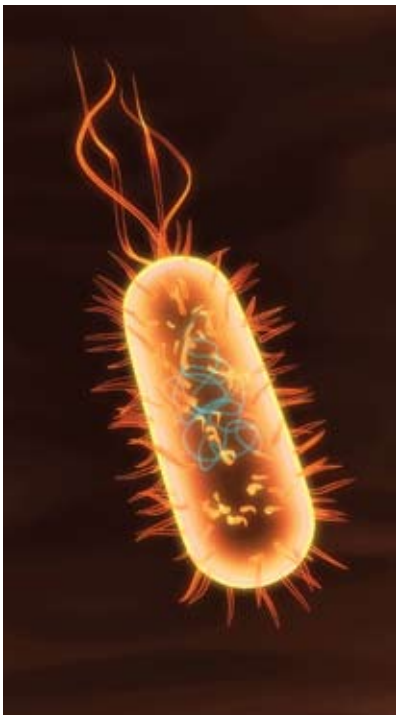
Bacteria are the most primitive and abundant life forms on earth and have a sophisticated way of ensuring their survival even in the antibiotic age. Within colonies of bacteria, many variations or mutations in genetic material may occur among individual members. When antibiotics are present, most of the bacteria in a colony will die very quickly. However, a few mutated bacteria may take longer to die.

If the mutated bacteria are present in small enough quantities, the body's own immune system can finish the job. If an antibiotic treatment is stopped prematurely, and the number of mutated bacteria left over is greater than the body can handle on its own, then infection can begin again. This time, as the colony grows it will reproduce using the genetic material from the surviving, stronger bacteria, creating a slightly more resistant infection. The process then repeats itself. This is perhaps nature's oldest demonstration of survival through evolution.

When people abuse antibiotic prescriptions, it doesn't just make them more susceptible to stronger strains of bacteria - it creates a public health risk for everyone. Healthcare workers are seeing more frequent infections from strains of bacteria that are easier for anyone, including healthy people, to catch and are more difficult to treat.

In the nearly 70 years that humans have used antibiotics, some strains of pathogenic bacteria have evolved into super-strong versions of themselves. Stories about these multi-drug-resistant bacteria, often dubbed "superbug" by the media, have reached a fevered pitch in recent months. However, a bacteria doesn't have to be classified as a "superbug" to cause severe disabilities, such as amputation, or even death. Complications and death can arise from treatable diseases when the bloodstream becomes infected. Hardly a more urgent medical health condition exists than those caused by certain Staphylococcus

aureus infections, necrotizing fasciitis and meningitis, as three survivors who lost limbs from these infections can attest.



Staph and MRSA Infections

Staphylococcus aureus and methicillin-resistant Staphylococcus aureus

According to the Centers for Disease Control and Prevention (CDC), 25 percent to 30 percent of the population is colonized with Staphylococcus aureus. It is naturally found living on some people's hands and in their noses. This is the same bacteria responsible for acne, boils and other minor skin infections. However, as a growing number of people have learned firsthand, when the bacteria enters the body through a wound or as the result of surgery, it can be debilitating.

Ryan Leishman

Ryan Leishman was visiting friends out of state when he came into contact with this nasty microbe. Even though then 19-year-old Leishman was not diabetic, he had what doctors describe as a diabetic foot. A previous car accident had broken his left femur, leaving him with poor circulation and no sensation. Still, Leishman was active despite his condition, and while on this visit with friends, they did a lot of walking. Later, when he took his shoes off, he discovered his left sock was full of blood from a blister the size of a 50 cent piece. Leishman sought medical treatment. At the hospital, doctors debrided the wound in surgery and sent him on his way in a week with antibiotics and crutches.

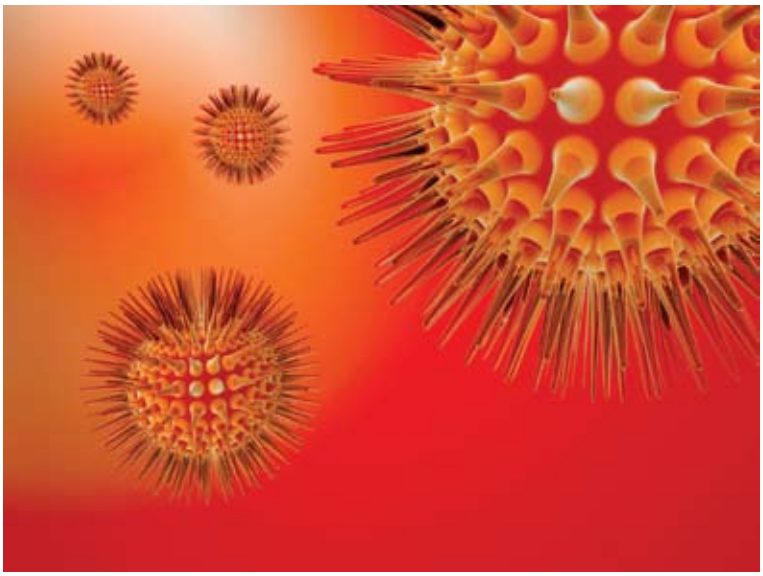
Still out of state, Leishman spent more than a week feeling progressively weaker, forcing him back to the hospital. In all, Leishman would have three hospital stays before the infection specialists urged him to head home. Meanwhile, Leishman was breaking out in hot and cold sweats, couldn't sleep, and could barely move. When his plane landed back home, he was rushed to the hospital. The doctors eventually diagnosed him with a staph infection and gave him his options. Because of the condition of his leg, Leishman had already researched several options, so it was a clear choice for him: below-knee amputation.

Waking from surgery, Leishman's epidural slipped out, and he went for four hours without pain medication. Yet even with the post-surgical pain, he says he felt physically better than he had during the entire time he was infected with staph. As for life as an amputee, he has no regrets about his decision. "I increased my mobility and quality of life," he says. "I'm active in ways I wouldn't have been able to be without amputation." Leishman realizes that he was one of the lucky ones, since staph can sometimes enter the bloodstream and cause fatal illness. He's glad he didn't take any chances.

Not long ago, methicillin was considered a strong and effective antibiotic. Unfortunately, its widespread use in the treatment of staph infections has created a new strain called methicillin-resistant Staphylococcus aureus (MRSA) which is even more difficult to treat, making it the much-feared "superbug" in the headlines.

According to the CDC, approximately 1 percent of the population is colonized with

MRSA. A CDC report in the October 17, 2007 issue of the *Journal of the American Medical Association* suggesting that MRSA infections occur more frequently than previously realized caused a surge in news articles about MRSA. The report cites data that invasive MRSA occurred in 31.8 per 100,000 members of the population. Using this data, researchers estimated that 18,650 people died from MRSA infections in 2005, a startling statistic considering that it surpassed the number of people dying from AIDS.



MRSA has become a major cause of infections both in hospitals and communities. Health-care-associated MRSA (HA-MRSA) infections occur among hospitalized patients. Those who have been hospitalized or had surgery within the past year, or who are receiving treatments such as dialysis, are at greatest risk. Community-associated MRSA (CA-MRSA) infections are acquired by people who have not been hospitalized or had a medical procedure within the past year. MRSA infections in the community are usually manifested as skin infections and can strike otherwise-healthy people.

For years, the antibiotic vancomycin has been a last resort against infections caused by MRSA and other antibiotic-resistant "superbugs," but now the drug is becoming more widely used out of necessity. Hospitals are seeing vancomycin-resistant infections, and there is increasing concern that development of newer and stronger antibiotics is not keeping pace with infection.

Necrotizing Fasciitis

Streptococcus pyogenes, or group A streptococcus

Group A streptococcus, or GAS, is often carried in the throat and on the skin without causing illness. When infection occurs, it is usually minor, such as with strep throat. However, in some rare instances, a virulent strain can cause life-threatening conditions such as necrotizing fasciitis (NF), a severe, but rare, infection of the tissues between the skin and underlying muscle. Also known as the "flesh-eating disease," NF progresses quickly, causing gangrene and often leading to limb loss and even death.

The infection usually enters the bloodstream through a wound or through a small abrasion or cut in the skin. One reason NF is so devastating is that the site of infection may look like nothing more than a bug bite. Consequently, NF survivors often report that they were treated only for their flu-like symptoms. By the time the true cause of symptoms is known, the infection has often had enough time to inflict severe damage or even take a person's life.

Jackie Chambers' life was on the line when he acquired NF after amputation surgery. Chambers, who had already lost his right leg above the knee to a staph infection, was scheduled to have his left leg amputated above the knee because of circulation problems. While still in post-operation, his mother, who was sitting with him until he woke up, noticed a terrible smell. The odor was caused by the NF ravaging Chambers' flesh.

When the nurses were called in, Chambers, though unconscious, was going into a fit, pulling out his bandages and IV drip. He was wheeled to ICU before being taken to a larger hospital by an emergency medical team. When the doctors made the diagnosis, Chambers' mom was told that her son had only 12 hours to live. Refusing to give up, she urged the medical team of 10 doctors to do everything they could to save his life. They put him in a medically induced coma and on life support. His heart had to be restarted five times. "The fifth time, my heart stopped for seven minutes," he says. "The doctors said I just kept fighting for my life."

Chambers had a long fight. Before the end of the ordeal, he would spend a month in ICU, followed by five more months in the hospital, finally to emerge a left hip-disarticulation amputee with severe scarring on his abdomen. Chambers is emotionally scarred from the experience as well. "I wouldn't wish this disease on my worst enemy," he says. Now, Chambers is just trying to pick up the pieces and move on.

Meningococcal Meningitis

Neisseria meningitides

Meningitis, which is spread by respiratory droplets, occurs when the membranes and fluid surrounding the brain and spinal cord become inflamed. This can happen with infection from both bacteria and viruses, but bacterial infections tend to be more serious, accounting for a greater number of complications and deaths than viral meningitis. Bacterial meningitis can be caused by several different strains, but the most common bacteria responsible for the disease is Neisseria meningitides, which causes meningococcal disease, also known as cerebrospinal meningitis.

About 2,600 people get meningococcal disease each year. Although teenagers and young adults are at greatest risk, the disease can strike anyone. Fortunately, there are vaccines available for long-term prevention, and one woman is using her experience with the disease as a platform to advocate for being vaccinated.

A healthy 42-year-old, Carolyn Woodward fell well outside the risk category, yet she acquired

Carolyn Woodward

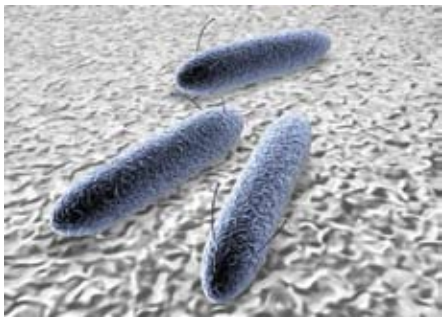
the bacteria while on vacation. The first symptoms appeared within 40 hours after Woodward returned home. She thought she was getting a cold. When the pain increased, she figured she had a serious case of the flu and made a trip to the ER to get a shot for the pain.

She did not have some of the classic signs of meningitis, including stiff neck, fever and dementia, and her white blood cell count was too high to do a spinal tap, so the diagnosis took another 40 hours. Then Woodward broke out in the purple rash associated with septicemia. Her right hand experienced severe tissue damage and both feet had to be amputated.

Being out of work for 10 months was just one of the setbacks Woodward faced. "I used to hike Stone Mountain every day," she says. "I'm still trying to get back to where I was before the illness." Woodward recently shared her story while participating in a bicycle Health Awareness Tour, in which she rode from Nashville to Atlanta (over 250 miles) in four days. Her main message to others: "Take care of yourself and get immunized."

Washing Away the Problem?

Bacteria can be intimidating, and not just for their Latinate names. It only takes a few species of pathogenic bacteria to cause some of the worst sicknesses known



to humans. Anyone with lowered immunity is at greater risk for getting an infection, but healthy people can get sick too. However, you can take steps to protect yourself. It's important to be proactive with your health, while keeping risks in perspective. The best advice is to be aware but not panicked.

More and more antibacterial products on the market are playing on people's fears, but no antibacterial soaps or silly products like antibacterial pencils are going to stop the problem. In fact, they can even make it worse. According to the Food and Drug Administration, antibiotic chemicals may be playing a role in antibiotic resistance. And remember the natural bacteria on human skin? Well, antibacterial soaps kill the friendly bacteria that keep people healthy. The best advice is to wash your hands with a mild soap for 15 to 20 seconds in warm water. Washing your hands frequently and teaching children to do the same are the most important things that you can do on a daily basis to keep healthy.

For doctors, it's more important than ever to weigh whether an antibiotic is needed or not. Many doctors will write prescriptions for antibiotics simply because a patient demanded one – even for viral infections. It is dangerous to use antibiotics too frequently - not only because of problems with resistance, but also because they will kill the friendly bacteria living in the gut that can help the body stay healthy. If antibiotics are necessary, then it is the user's responsibility to finish the prescription in full, even when no signs of infection seem present.

It's equally important not to write off the early warning signs of an infection. In their early phases, many dangerous infections can look like a common cold or flu. If a doctor's treatment isn't working, be persistent. It's okay to demand that certain bacterial infections be ruled out. In all cases, the earlier the diagnosis and treatment begins, the better the prognosis. ■

Related Resources:

Alliance for Prudent Use of Antibiotics
http://www.tufts.edu/med/apua/

Centers for Disease Control and Prevention
www.cdc.gov

The Mayo Clinic
www.mayoclinic.com

Meningitis Foundation of America
www.meningitisfoundationofamerica.org

MRSA Resources
www.mrsaresources.com

National Necrotizing Fasciitis Foundation
www.nnff.org