RESISTANCE

WHEN ANTIBIOTICS DON'T WORK

by Matt Boucher

Whether it's a cold that gives you the sniffles, a flu that makes you ache, or a sore throat that just won't go away – everyone gets sick. Usually, infections clear up on their own or can be treated with antibiotics, a kind of medicine that fights bacteria. But some of the antibiotics we once relied on are no longer working. This is called antibiotic resistance. Some scientists say that antibiotic resistance is one of the greatest health problems of our times.

Meet the Bugs: Viruses and Bacteria

When we get sick, we often say we've caught a bug – an odd description when you think about it, but it isn't far from the truth. You have caught something: either a virus or a bacteria. Both can make people sick, however, what they are and how we treat them is very different.

Viruses are tiny – so tiny they can only be seen through a powerful microscope. A virus survives by invading a **host**. The virus then reprograms the host's cells to make copies of itself. These new cells eventually infect other cells … and so the cycle continues. With most viral infections, there's very little the host can do. When that host is you, your body will fight the virus off in its own time. In fact, time – and rest – are your only weapons.

Bacteria are a different kind of bug altogether. They're still microscopic, but they can be up to a hundred times larger than a virus. More importantly, bacteria are living things. Unlike viruses, they don't need a host to survive. A single bacteria cell can eat, breathe, reproduce, and sometimes move on its own. Although bacteria are everywhere, most are harmless to people; some are even helpful, such as lactobacillus, a kind of bacteria that lives in your large intestine and helps digest food. But other bacteria are a problem. They produce chemicals that are **toxic** to their host and cause infection. Sometimes your body can fight off a bacterial infection, but there are times when it needs help. This is where antibiotics come in.

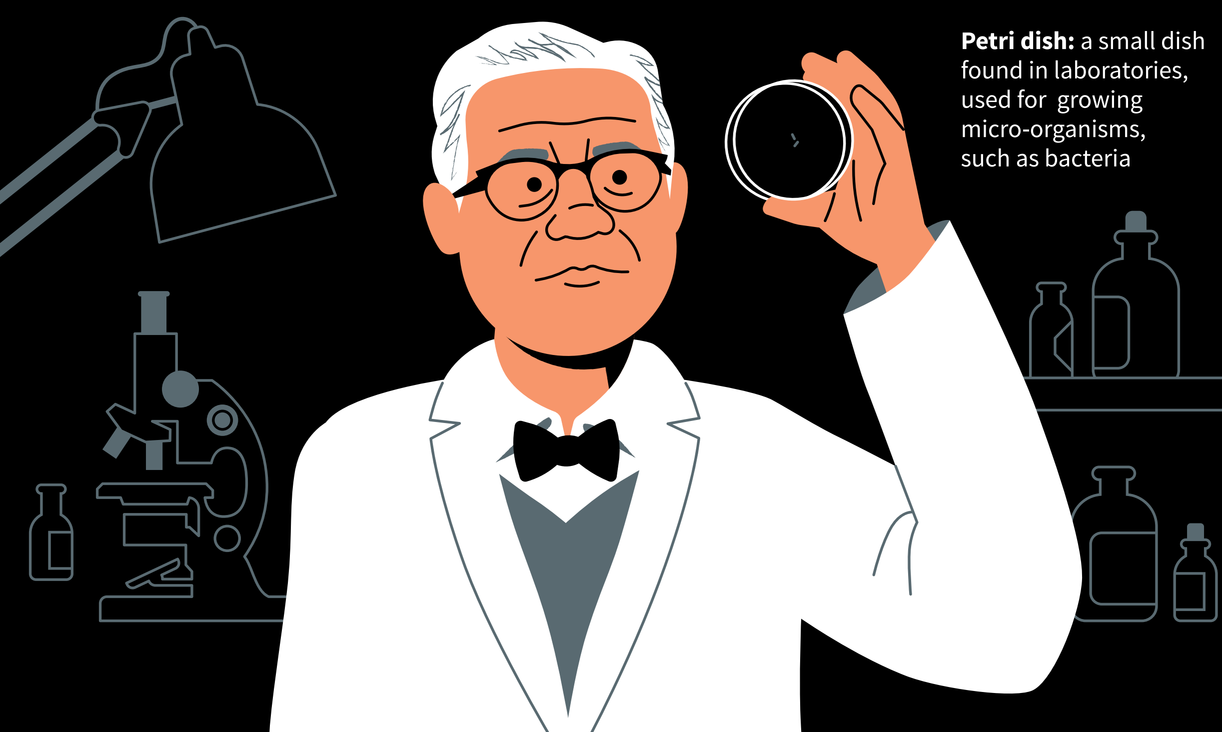
host: a living thing that is home to another living thing (usually a parasite)
toxic: poisonous or harmful

Alexander Fleming's Petri Dish

If you've ever taken antibiotics when you've been sick, you probably felt better after a few days. But it wasn't always this easy. Before 1928, a serious bacterial infection – especially in a wound – often led to death (about a third of all soldiers who died in the First World War died from infection and disease, not from being killed in battle). Common diseases such as pneumonia, tuberculosis, and whooping cough were also killers. Before antibiotics, it was even possible to die from an infection in a tiny cut.

Luckily, in 1928, the Scottish scientist Alexander Fleming accidentally made a life-saving discovery. Fleming was an expert in bacteria, and one day, returning home from holiday, he noticed something strange. Fleming had been growing the bacteria staphylococcus in a **Petri dish** – and now the dish was contaminated with a blue-green mould. What was unusual was that the staphylococcus bacteria had stopped growing around the mould.

Fleming identified the mould as a penicillium. This is a group of common moulds found everywhere: in the soil, in the air, and on food. These moulds produce a chemical called penicillin. The most important thing about penicillin – and what excited Fleming so much – is that it prevents bacteria cells from reproducing properly, and eventually, they die. Fleming had stumbled on something huge, and he knew it. Penicillin went on to become our first antibiotic. Doctors finally had an effective way to treat infection.



Petri dish: a small dish found in laboratories, used for growing micro-organisms, such as bacteria

Resistance

Since Fleming's time, many more antibiotics have been found or created. Their use has been one of the greatest developments in modern medicine. Doctors can now cure patients from diseases and infections that were once untreatable, and millions of lives have been saved. In recent years, however, the story has taken a worrying turn: bacterial resistance. This is something Fleming predicted.

Like people, every bacteria cell is unique, and some – by chance – are more resistant to certain antibiotics than others. These bacteria can either live longer after a dose of antibiotics or not be affected at all. Taking antibiotics when they're not needed helps resistance to develop. The antibiotics will kill off most of the bacteria, leaving only the most resistant alive. When these resistant bacteria reproduce, they pass this resistant **trait** on – and some bacteria reproduce every twenty minutes! Soon, there's a whole new population of resistant bacteria – and a big problem to deal with.

YOUR NOSTRILS: A CASE STUDY

The inside of your nose is coated with bacteria. Because they're in the right place, these bacteria are usually harmless – but elsewhere, such as in a cut, they can cause infection. If this happens, the normal treatment is antibiotics.

Now imagine that you don't have a cut but you do have a cold. You're feeling stuffed up, especially your nose! So you take an antibiotic. The antibiotic won't fix your cold because all colds are caused by a virus and antibiotics can't harm viruses. The antibiotic will, however, kill most of that bacteria in your nose. The only survivors will be the few that have natural resistance.

These surviving bacteria will quickly reproduce. Soon, your nose will have a new coating. Everything seems back to normal ... only is it? It's possible most of the new bacteria have inherited resistance from their parent bacteria – and in particular, resistance to the antibiotic you just used. Now imagine the next week you do get that cut. If the bacteria from your nose gets into the cut and you get an infection, the infection may be harder to treat because the antibiotics won't work as well.

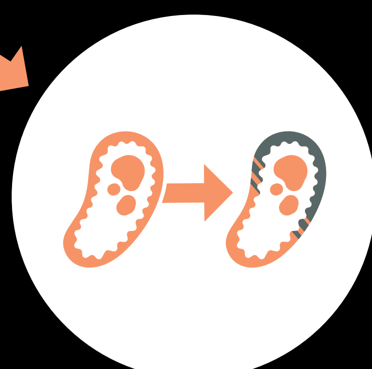
trait: a special feature that's in the genetic material of a living thing

HOW DOES ANTIBIOTIC RESISTANCE OCCUR?

1. A variety of bacteria: a few are resistant to antibiotics.

2. Antibiotics kill the bacteria causing the illness as well as other, harmless bacteria. Only resistant bacteria survive.

3. The resistant bacteria reproduce and take over.



4. Resistant bacteria sometimes transfer their resistance to other bacteria.

The Future of Antibiotics

Most of us have used antibiotics at one time or another. They're often the reason we recovered from being sick. But how long can we rely on these medicines? Because some people use antibiotics too often and to treat the wrong illnesses, bacterial resistance is a fast-growing problem. Some bacteria are already resistant to *all* of the antibiotics scientists have discovered or invented. And more and more bacteria are becoming resistant all the time.

But we can fight back. First, we need to save antibiotics for when they're really needed. This means never for a cold or the flu. The antibiotic won't help you (because it won't work), but it will help antibiotic-resistant bacteria to develop. Secondly, we can do our best to prevent the spread of infectious diseases. Fewer diseases to treat means fewer antibiotics will be used. It also reduces the chances for resistant bacteria to spread.

STOPPING THE SPREAD

Infectious diseases spread from one person to the next, usually through body fluids such as saliva (spit), mucus (snot), and faeces (poo). The bacteria or viruses hitch a ride on these fluids to infect another person. To prevent making other people sick, cover your mouth with your inner elbow when coughing or sneezing. This stops the bugs from getting into the air, on surfaces like furniture, or on your hands, where they can easily be passed on. Washing your hands regularly helps to rinse bugs away, preventing infection from bugs you may have picked up from something – or someone – you've touched.

BEHIND THE SCENES: KEEPING YOU HEALTHY

The Antibiotics Pharmacist

Emma Henderson is an antibiotics pharmacist. She gives advice to doctors about which antibiotics to use for which illnesses, including when an antibiotic isn't needed. Her work helps to ensure patients get the right medicine to treat their illness without them taking anything unnecessarily, which adds to the problem of resistance. Emma's main message is "prevent antibiotic resistance by only taking antibiotics when they're really needed". She also wants to remind people that antibiotics shouldn't be shared.

The Infectious Diseases Doctor

Ayesha Verrall is a doctor who specialises in infectious diseases. She looks after patients with diseases caused by bacteria and viruses. The hardest part of her job is figuring out how to treat people when they have infections caused by bacteria that are resistant to antibiotics. Ayesha works closely with antibiotics pharmacists and microbiologists to choose the best possible treatment for her patients. She wants everyone to make sure they follow their doctor's advice and get their **vaccinations**. This helps to prevent diseases before they start.

The Clinical Microbiologist

Juliet Elvy is a clinical microbiologist. The hospital laboratory where she works receives over a thousand samples of blood and other body fluids every day! Along with her team, Juliet helps to identify which bugs are present in which samples by growing bacteria in Petri dishes (just like Alexander Fleming) and testing them. The team also tests the bacteria for resistance by placing little discs soaked in antibiotics on the dishes to see which antibiotic will prevent the bacteria from growing. She reports this information back to doctors so they can work with antibiotics pharmacists to decide the best treatment for patients.

vaccination: an injection given to a person so they won't get a certain disease

ILLUSTRATIONS BY NED WENLOCK

Emma Henderson, antibiotics pharmacist

Ayesha Verrall, infectious diseases doctor

Juliet Elvy, clinical microbiologist

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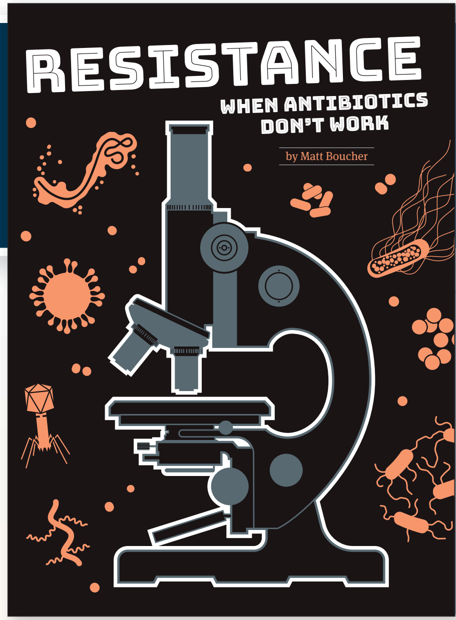

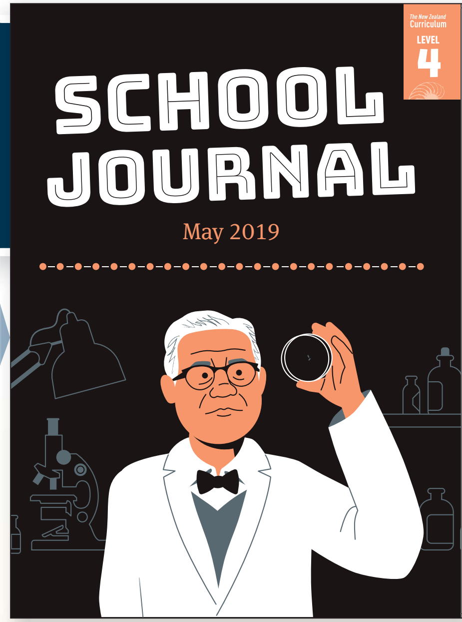

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