



Alexander Fleming

# DEADLY CRITTERS

There are more bacteria cells on your body than human cells! But don't worry, pretty much 99% of ALL bacteria are good and helpful.

**Just** 100 years ago, bacterial infections were a deadly condition. It was only in 1928 that Professor Alexander Fleming at Oxford University accidentally discovered a type of bacteria-killing substance when he forgot to clean some petri dishes lying around in the back of his laboratory and they started to mould. He noticed that the areas around the growing mould were free of bacteria, which he had previously put in his dishes for a different experiment. He deduced that the mould, penicillin notatum, must be killing the bacteria, leading to the development of the world's first antibiotic, penicillin. Thanks to his work, today, having a bacterial infection is really no big deal at all – you take some antibiotic pills for about a week from your local doctor and you will be all better in no time. Examples of common antibiotics include penicillin, amoxicillin and erythromycin. They might seem familiar to you, as you have probably taken at least one of these antibiotics at some point when you have been sick to kill bacteria too!

So now, it seems as if we have completely solved the problem of bacteria getting in our bodies and making us sick, right? Unfortunately, that's not the case. We are currently faced with the rise of what are aptly named "**superbugs**" by the media. Superbugs are types of bacteria that are resistant to multiple types of antibiotics. As you can imagine, this makes patients who have infections caused by these superbugs

## How do superbugs come about?

Bacteria are very small organisms with small genomes and very high reproduction rates. This means that they evolve and adapt very quickly depending on their surroundings through mutating their genes to have the ones best suited for survival in a certain environment. This is why bacteria can be found all over the world, from the surface of your kitchen table to the murky pond, volcanic rocks, the glaciers on top of Mount Everest, and even deep sea hydrothermal vents dozens of miles underwater. When bacteria are exposed to antibiotics, many of them can die; however, many of them are also able to mutate quickly and survive. As such, the application of the antibiotic is futile. If a type of bacteria is able to mutate enough and survive multiple types of known antibiotics, it is called a superbug; it is very difficult, if not impossible, to treat. As more and more strains of bacteria are learning how to mutate to beat antibiotics administered by doctors, we are struggling to treat infections caused by superbug bacteria.

## Why are superbugs suddenly becoming a problem?

Since the antibiotic's discovery nearly 100 years ago, people have been using them very widely across various sectors, not just in medicine treating infections. For example, antibiotics are used on large scales and very frequently in agriculture to prevent animals from getting sick, as well as to promote growth in livestock, as it has been shown from experience that chicks grow faster and larger when fed certain bacterial shells along with their food. As bacteria are exposed to more and more antibiotics, many strains of bacteria are learning to become resistant to certain drugs – they have simply become used to them and have mutated their genes accordingly so that they can survive in the presence of antibiotic drugs. In essence, bacterial resistance and the rise of superbugs was inevitable from the moment that antibiotics were discovered; in fact, Fleming himself predicted this when he made his groundbreaking discovery with penicillin. In August 2016, a Nevada woman who had recently travelled

to India contracted a rare bacterial infection resistant to 26 different types of antibiotics, and in September 2016, a toddler in Connecticut caught a bacterial infection after vacationing in the Caribbean earlier that year.

## What are we doing right now to combat superbugs?

Regardless of these extremely exceptional cases of superbugs, superbugs are still very rare. Nevertheless, researchers all around the world have been prompted to continue efforts developing newer, stronger antibiotics that can potentially combat superbugs. Recently, labs at Monash University have been able to identify the molecular mechanism by which some superbugs are able to survive antibiotics. This gives the scientific community crucial information on how we can potentially go forward with drug development to kill these superbugs. In addition, rules and regulations set out by the FDA regarding antibiotic use in agriculture have also become more stringent in efforts to limit antibiotic use on larger scales. This reduces antibiotic exposure to bacteria, slowing down the development of their resistance toward antibiotics.

## DID YOU KNOW...

No one really knows how many species of bacteria there are in the world, but estimates by scientists lie in the tens of millions to even billions!

Right: a colony of Paenibacillus vortex bacteria, a species of beautiful pattern-forming bacteria

