



Seven Wonders of the Microbe World

Antibiotics

COMM

Microbes, mostly tiny Bacteria, make up around 90% of the cells in a typical human body – and 10% of our body weight. Most of them are in our gut and on our skin.

Many microbes are beneficial, for example helping us to digest our food. Only a tiny fraction cause disease – and are usually kept in check by our immune system. But when they aren't, microbes also help us to fight back.

Bacteria cause disease when they are able to reproduce in the body. They produce harmful substances called toxins, which damage tissues and organs. But in nature microbes can also produce agents called antibiotics to protect themselves against competitors.

CHARLES

It's a tough world out there. And you might think that you just see competition in the savannahs of Africa but in fact the microbes fight each other as well. In fact, like martial arts, they have ways of fighting other microbes with particular moves and one move they have is to produce antibiotics. These are compounds that allow them to kill other microbes and take all the food for themselves, or the resources that they need. And so the competition between microbes results in these very sophisticated antibiotic molecules.

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The discovery of antibiotics and their power to fight bacterial disease began with Alexander Fleming. He observed the mould *Penicillium Notatum* accidentally growing on a sample of *Staphylococci* – and saw that it had killed the surrounding colonies of disease-causing bacteria.

PAULA

All antibiotics work by disrupting a critical function in the bacterial cell. For example, Penicillin discovered in 1928 prevents the cell from renewing its cell wall during growth. Eventually the cell wall weakens and bursts.

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By the 1950s, the use of antibiotics had revolutionized the treatment of previously untreatable infectious diseases. In 1967 the Surgeon General of the United States of America, William Stewart declared: "The time has come to close the book on infectious diseases... We have basically wiped out infection in the United States." But Stewart's optimism proved premature...

CHARLES

The bad news is that microbes can become resistant to antibiotics, and they can change their biochemistry in order to adapt to these antibiotics and prevent the antibiotics from damaging the cell.

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It's standard evolutionary behaviour. When bacteria reproduce, chance mutations occur. Most will be useless, but sometimes there'll be one that will protect the bacterium against a particular antibiotic. While most of the bacteria succumb to the antibiotic, the one that survives, goes on to reproduce and replicate the resistance. And bacteria reproduce very fast.

Scientists are on an endless quest to develop new antibiotics to defeat resistant bacteria – so called superbugs - but they must be used properly.

CHLOE MCIVOR

Widespread use or misuse of antibiotics for minor infections means that more bacteria become exposed, and so there's more chance of resistance developing and spreading through the microbe world.

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GPs prescribe 133 million courses of antibiotics every year. It's estimated that 50% of these prescriptions are unnecessary – by taking antibiotics that you don't need you could be making yourself more at risk from the disease

If you don't complete your antibiotic course, you expose the microbe to concentrations of antibiotic, which don't kill it.

Some bacteria, such as MRSA have become highly drug-resistant. These 'superbugs' aren't some complex and new set of diseases, merely variations of common bacteria that we used to find easy to control.

PAULA

The good news is that scientists are developing new synthetic antibiotics that target resistant bacteria.

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But who knows whether one day a mutated bacteria might be resistant to all synthetic antibioticsa super superbug...