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Introduction

Examples

Whether it's flesh-eating necrotising fasciitis or equine morbillivirus, in which the sufferer essentially drowns in fluid leaking from the lungs, infections - be they bacterial or viral - capture the imagination in a way that more workaday conditions such as cancer and heart disease cannot.

Effects

And indeed our battle to outwit the bacteria which have caused death and decimation down the centuries has revealed just what a formidable foe they can be.

They have been around some three billion years longer than we have, and are adept at changing and adapting to their circumstances.

History - Evolution

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From friend to foe

Examples

From friend to foe

We now know that the bacteria behind the current outbreak of pneumonic plague in China - *Yersinia pestis* - started out life as a fairly harmless inhabitant of the intestine before acquiring a gene which allowed it to infect insects, and then return to humans with devastating effects.

Mutation

Examples

The strain of *E.coli* meanwhile which has just left two people seriously ill is a mutant form of the bacterium which lives without causing any trouble in cattle, but can be a killer in humans when it is picked up after touching an animal or eating undercooked, infected food.

Mutation

Examples

Campylobacter jejuni, another cause of bacterial food poisoning, have developed cells with different surfaces: this means that even if most of them are recognised and killed by the host's immune system, some of them will escape and proliferate.

Mutation

Which is what those which have developed resistance to antibiotics are also able to do. Campaigns have been launched aimed at reducing unnecessary use of treatments amid a rising number of resistant strains.

Mutation

Measures

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From friend to foe

The fight

While MRSA rates have fallen dramatically, others - notably antibiotic resistant E. coli strains which cause infections of the urinary tract and the blood - are on the increase.

Measures

"Sensible prescribing is part of the answer but we also need new antibiotics - it's not one of the most attractive areas for pharmaceutical companies as people don't take them for very long, unlike treatments for heart disease or cancer," says Dr David Livermore, an infections expert at the Health Protection Agency.

Socioeconomic

"It is a war of attrition. There have been points where we have been advancing, and points when we have had to beat a retreat.

The fight

The fight

"If we were having this conversation 20 years ago for instance we would be celebrating the vaccine for bacterial meningitis. Really it is vaccines - rather than antibiotics - which hold the key to the big victories."

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Quick exit

In part is the ability to keep people alive for longer which has enabled some bugs to find a chink in our armour. The elderly and the sick, particularly those in hospital, have proved an attractive target for new strains.

The fight

Quick exit

Indeed relatively few bacteria cause disease. For the most part the ones that live within us are doing helpful tasks such as consuming dead skin, or even producing vitamins in the gut.

Properties:
harmful / beneficial

Clostridium difficile is a bacterium which particularly hits elderly people who have already been treated with antibiotics, treatment which has killed off the "good" bacteria that protects the intestines.

Example

It is a give and take relationship - the same probably cannot be said for viruses such as swine flu.

A virus has no cell of its own and so needs to enter a living organism, usually via the skin or internal surfaces such as gut, respiratory system or genitourinary tracts.

Properties:
harmful / beneficial

Once inside they quickly reproduce, and are well-located to make a quick exit to the outside world. In the case of swine flu we sneeze into our hand before shaking another's, and the virus is effectively spread.

Influenza is seen as the most wily of viruses, constantly adapting to thwart our attempts to combat it.

Properties:
harmful / beneficial

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Quick exit

The fight

"But more generally I think we can be upbeat. We will always be at war with microbes. Their genetic promiscuity is impressive, but we are learning more about them all the time. They are versatile and enduring - but so are we."

Benefits
Solutions

In any event, we are learning to make the most of viruses and harness their power.

Benefits
Solutions

Viruses are not only used to carry vaccines into the body to stop us getting some of them in the first place, they may also help us in the fight against cancer.

This appears to be a particularly promising avenue for the treatment of brain tumours. Trials are being carried out into the effectiveness of the herpes virus in combating the cancer.

In this case they enter the cancer cells, "burst" them and then do what viruses do best - replicate.

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