Infections – bacterial and viral

Summary

- Many human illnesses are caused by infection with either bacteria or viruses.
- Most bacterial diseases can be treated with antibiotics, although antibiotic-resistant strains are starting to emerge.
- Viruses pose a challenge to the body's immune system because they hide inside cells.
- It is possible to be vaccinated against some of the major disease-causing viruses (such as measles and polio), as well as bacterial diseases such as Hemophilus influenza Type b (Hib), tetanus and whooping cough.

Many human infections are caused by either bacteria or viruses. Bacteria are tiny single-celled organisms, thought by some researchers to be related to plants. They are among the most successful life forms on the planet, and range in habitat from ice slopes to deserts.

Bacteria can be beneficial – for instance, gut bacteria help us to digest food – but some are responsible for a range of infections. These disease-causing varieties are called pathogenic bacteria. Many bacterial infections can be treated successfully with appropriate antibiotics, although antibiotic-resistant strains are beginning to emerge. Immunisation is available to prevent many important bacterial diseases.

A virus is an even smaller micro-organism that can only reproduce inside a host's living cell. It is very difficult to kill a virus. That's why some of the most serious communicable diseases known to medical science are viral in origin.

How bacteria and viruses enter the body

To cause disease, pathogenic **bacteria** must gain access into the body. The range of access routes for bacteria includes:

- Cuts
- Contaminated food or water
- Close contact with an infected person
- Contact with the faeces of an infected person
- Breathing in the exhaled droplets when an infected person coughs or sneezes
- Indirectly, by touching contaminated surfaces – such as taps, toilet handles, toys and nappies.

Viruses are spread from one person to another by:

- Coughs
- Sneezes
- Vomits
- Bites from infected animals or insects
- Exposure to infected bodily fluids through activities such as sexual intercourse or sharing hypodermic needles.

Forgetting to wash your hands after handling pets and animals is another way for germs to be taken in by mouth.

Bacteria types

Bacteria that cause disease are broadly classified according to their shape. The four main groups include:

- **Bacilli** – shaped like a rod with a length of around 0.03mm. Illnesses such as typhoid and cystitis are caused by bacilli strains.
- **Cocci** – shaped like a sphere with a diameter of around 0.001mm. Depending on the sort, cocci bacteria group themselves in a range of ways, such as in pairs, long lines or tight clusters. Examples include *Staphylococci* (which cause a host of infections including boils) and *Gonococci* (which cause the sexually transmissible infection gonorrhoea).
- **Spirochaetes** – as the name suggests, these bacteria are shaped like tiny spirals. Spirochaetes bacteria are responsible for a range of diseases, including the sexually transmissible infection syphilis.
- **Vibrio** – shaped like a comma. The tropical disease cholera, characterised by severe diarrhoea and dehydration, is caused by the vibrio bacteria.

Characteristics of the bacterium

Most bacteria, apart from the cocci variety, move around with the aid of small lashing tails (flagella) or by whipping their bodies from side to side. Under the right conditions, a bacterium reproduces by dividing in two. Each 'daughter' cell then divides in two and so on, so that a single bacterium can bloom into a population of some 500,000 or more within just eight hours.

If the environmental conditions don't suit the bacteria, some varieties morph into a dormant state. They develop a tough outer coating and await the appropriate change of conditions. These hibernating bacteria are called spores. Spores are harder to kill than active bacteria because of their outer coating.

Curing a bacterial infection

The body reacts to disease-causing bacteria by increasing local blood flow (inflammation) and sending in cells from the immune system to attack and destroy the bacteria. Antibodies produced by the immune system attach to the bacteria and help in their destruction. They may also inactivate toxins produced by particular pathogens, for example tetanus and diphtheria.

Serious infections can be treated with antibiotics, which work by disrupting the bacterium's metabolic processes, although antibiotic-resistant strains are starting to emerge. Immunisation is available to prevent many important bacterial diseases such as Hemophilus influenza Type b (Hib), tetanus and whooping cough..

Virus types

A virus is a miniscule pocket of protein that contains genetic material. If you placed a virus next to a bacterium, the virus would be dwarfed. For example, the polio virus is around 50 times smaller than a *Streptococci* bacterium, which itself is only 0.003mm long. Viruses can be described as either RNA or DNA viruses, according to which type of nucleic acid forms their core.

The four main types of virus include:

- **Icosahedral** – the outer shell (capsid) is made from 20 flat sides, which gives a spherical shape. Most viruses are icosahedral.
- **Helical** – the capsid is shaped like a rod.
- **Enveloped** – the capsid is encased in a baggy membrane, which can change shape but often appears spherical.
- **Complex** – the genetic material is coated, but without a capsid.

The body's response to viral infection

Viruses pose a considerable challenge to the body's immune system because they hide inside cells. This makes it difficult for antibodies to reach them. Some special immune system cells, called T-lymphocytes, **can** recognise and kill cells containing viruses, since the surface of infected cells is changed when the virus begins to multiply. Many

viruses, when released from infected cells, will be effectively knocked out by antibodies that have been produced in response to infection or previous immunisation.

Curing a viral infection

Antibiotics are useless against viral infections. This is because viruses are so simple that they use their host cells to perform their activities for them. So antiviral drugs work differently to antibiotics, by interfering with the viral enzymes instead.

Antiviral drugs are currently only effective against a few viral diseases, such as influenza, herpes, hepatitis B and C and HIV – but research is ongoing. A naturally occurring protein, called interferon (which the body produces to help fight viral infections), can now be produced in the laboratory and is used to treat hepatitis C infections.

Immunisation against viral infection is not always possible

It is possible to vaccinate against many serious viral infections such as measles, mumps, hepatitis A and hepatitis B. An aggressive worldwide vaccination campaign, headed by the World Health Organization (WHO), managed to wipe out smallpox. However, some viruses – such as those that cause the common cold – are capable of mutating from one person to the next. This is how an infection with essentially the same virus can keep dodging the immune system. Vaccination for these kinds of viruses is difficult, because the viruses have already changed their format by the time vaccines are developed.

Where to get help

- Your doctor
- Your pharmacist

Things to remember

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This page has been produced in consultation with and approved by:

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