The Microbial World

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Microbes

Common word that refers to any member of the microscopic world. Sometimes referred to as “germs” but not all are infectious. Include:

- Viruses
- Bacteria (Prokaryotes)
- Protozoans i.e. protista (Eukaryotes)

Pathogenic – term used in science to mean disease causing.

Viruses

Non-cellular infectious particles that multiply only inside living cells

A virus is smaller than any cell and has no metabolic machinery of its own – uses host cell to reproduce.

Consists of:
- genetic material (DNA or RNA)
- a protein coat
Bacteriophages – look like aliens

Viruses that infect:
- Bacteria
- Archaeans.

Steps in Viral Replication
1. Attachment – lock onto host cell
2. Penetration – viral particle or genetic material crosses the PM of the host cell.
3. Replication & Synthesis – Viral genetic material hijacks cell’s replication mechanism to make more copies of itself.
4. Assembly – protein coat encases new viral genetic material created by host cell.
5. Release

Bacteriophage Replication

I. Lytic pathway
- Under direction of viral genes, the host makes an enzyme that lyses i.e. breaks open & kills the cell

II. Lysogenic pathway
- Virus enters a latent (dormant) state
- Host replicates viral genes and passes them on to descendents before entering lytic pathway

The Attack – A matter of infiltration
Examples of Viruses

- Common cold aka rhinoviruses
- Herpes
- HIV – Human Immune Deficiency Virus > AIDS
- Rabies
- Chicken pox
- Measels
- Flu (e.g. swine flu)

Viruses cannot be treated AFTER infection, symptoms can only be managed. Prevention via vaccinations most effective way of preventing viral diseases, but scientists have not been able to develop vaccinations for all viruses e.g. common cold (b/c of rapid mutation rates).

HIV

Special case virus called a retrovirus. In its replication it uses a single strand RNA molecule (its genetic stock material) to make copies of DNA within host cell, which get incorporated into the host's chromosome. This process is opposite of normal – hence “retro”.

Requires a special enzyme called reverse transcriptase to make DNA within host cell.

New DNA hybrid inside host's cell makes more RNA that passes into cytoplasm of its own cell. RNA then directs production of protein shell around new viral genetic RNA molecule. Released. Virus travels in body fluids.
Why do new viruses emerge?

Viruses have a high mutation rate.
They can blend with a host cell's DNA, even crossing between species.
Cold virus – originally came from human contact with horses.
Flu viruses – often merge from poultry or waterfowl with human material. Changes form frequently.
HIV retrovirus – thought to originate from human contact with chimpanzees.

Other infectious agents

**Viroids** are short sequences of infectious RNA
Affects plants

**Prions** are infectious misfolded versions of normal proteins. Examples:
- Mad cow disease
- Creutzfeldt-Jacob disease
- Scrapie
- CWD