

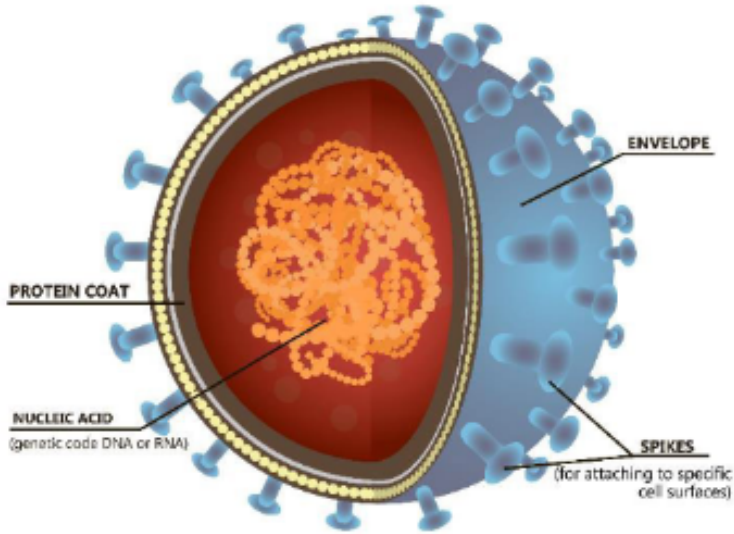
Module 3: Global Health

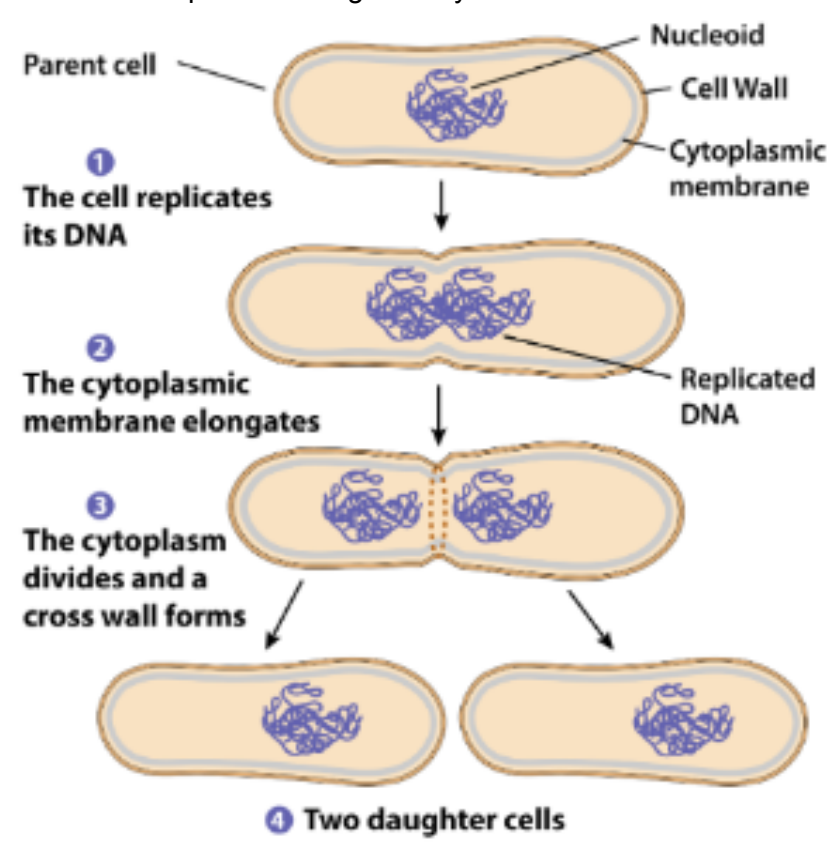
Lecture 19 - Microbiology and the 'One Health' concept

Learning outcomes:

- Define the five major types of microbes (viruses, bacteria, fungi, protists, algae)
- Describe key inventions and ideas in microbiology:
 - Microscopy
 - Agar plates
 - Spontaneous generation
 - Germ theory
 - Koch's postulates
 - Penicillin
- Discuss difference between normal flora, transients, & pathogens
- Explain the concept of 'One Health'
- Describe one major problematic infectious disease

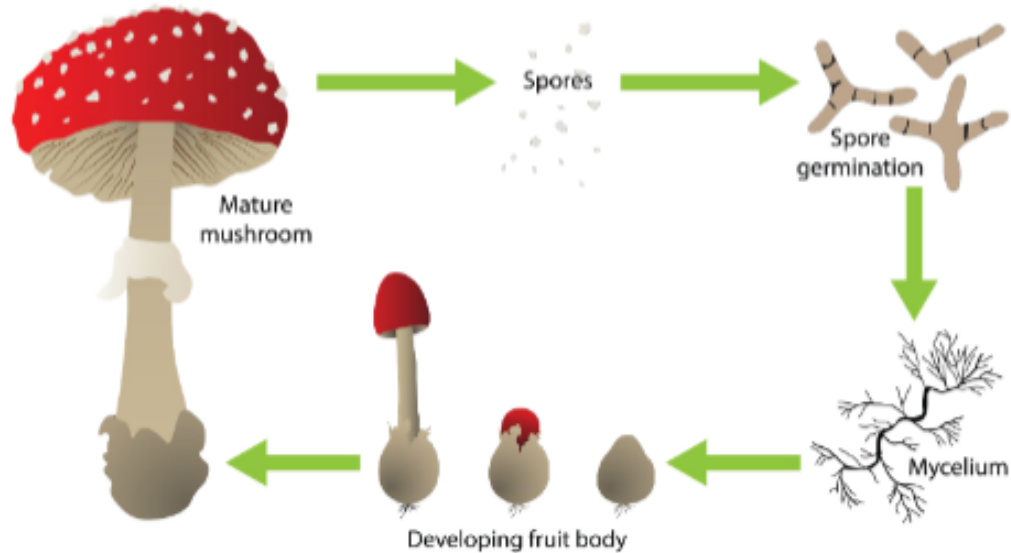
10 trillion human cells 30 trillion non-human cells on and within the human body

Virus	<p>The smallest and simplest biological entities</p> <ul style="list-style-type: none">- Acellular (nonliving)- Are comprised of a DNA or RNA in a protein shell- Don't last long without a host, and need a host cell for replication and metabolism<ul style="list-style-type: none">- Viruses utilise host cell machinery and steal nutrients and energy in order to multiply.  <p>The diagram illustrates the structure of a virus. It features a central orange, tangled mass labeled 'NUCLEIC ACID (genetic code DNA or RNA)'. This is surrounded by a red, textured layer labeled 'PROTEIN COAT'. The entire virus is enclosed in a blue, irregular outer layer labeled 'ENVELOPE'. Protruding from the envelope are blue, spike-like structures labeled 'SPIKES (for attaching to specific cell surfaces)'.</p> <p>Viruses will either cause cells to:</p> <ul style="list-style-type: none">- Lyse (burst and spread to infect other cells)- Or hide in our genome
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	<p>Viruses are very small and have a tiny genome.. But they have a huge impact on organisms and ecosystems</p>
Bacteria	<ul style="list-style-type: none">- Unicellular structure, many are prokaryotes- Bacteria are the smallest cellular organisms. Can be “true living”<ul style="list-style-type: none">- Undergo their own metabolism and energy production <p>Bacteria can self replicate through binary fission.</p>  <p>The diagram illustrates the process of binary fission in a bacterial cell. It consists of four numbered stages:</p> <ol style="list-style-type: none">1 The cell replicates its DNA: A parent cell containing a single nucleoid (blue squiggly mass) is shown. Labels point to the Nucleoid, Cell Wall, and Cytoplasmic membrane.2 The cytoplasmic membrane elongates: The cell has grown, and the DNA has replicated into two nucleoids. A label points to the Replicated DNA.3 The cytoplasm divides and a cross wall forms: The cell is further elongated, and a dashed line indicates the formation of a cross wall between the two nucleoids.4 Two daughter cells: The process is complete, resulting in two separate daughter cells, each with its own nucleoid. <p>Bacteria also have their own metabolism and processes which are not seen in higher order organisms</p> <p>Bacteria act as primary producers and decomposers in the ecosystem.</p> <p>Cocci – spherical bacteria</p> <p>Bacilli – rod-shaped bacteria</p> <p>Filaments – long, thread-like bacteria (often chains of cells)</p>
Fungi	<p>Large and complex cells</p> <ul style="list-style-type: none">- Eukaryotes:<ul style="list-style-type: none">- Membrane bound nucleus- Complex organelles (eg, mitochondria, golgi apparatus etc..) <p>Fungi can be unicellular and multicellular</p> <ul style="list-style-type: none">- Yeasts (unicellulars)- Moulds and mushrooms (multicellular)

Fungi can be microscopic and macroscopic and these can also be in differing stages of the fungus development

Fungi reproduce via spores and fruiting bodies



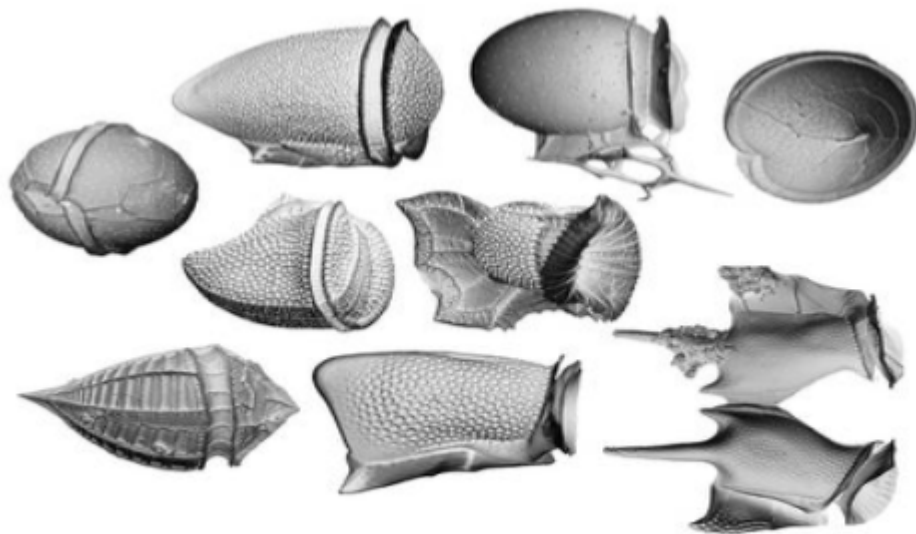
Protist

Large complex cells

- Eukaryotes:
 - Membrane bound nucleus
 - Complex organelles (eg, mitochondria, golgi apparatus etc..)

There is a massive diversity of protists, many differ in their:

- Morphology
- Lifestyle
- Evolution



There are two types of protists:

	<ol style="list-style-type: none">1. Photosynthetic (produce their own energy)2. Predatory, also called protozoa (feed on other organisms)
Algae	<ul style="list-style-type: none">- Eukaryotic or prokaryotic- Are photosynthetic → the largest players in global photosynthesis- Have complex cellular structures.