Lecture 1

Classification gives: order, understand evolution, communication (talking about same species)

Taxonomy = naming organisms

- Binomial: genus then species name
- Names are in Latin, italics
- Genus = capitalised, species = lower case
- Arranged by hierarchy (K P C O F G S) King Phillip Came Over From Great Spain

Linnaeus = father of taxonomy

Type specimen = ideal specimen on which other species are based on/named

Different taxonomy codes for different kingdoms, different rules: first valid name is legitimate, species must match gender, cannot have same name as another plant/animal, and cannot name after yourself

Issues with code: renaming, splitting, joining species

Monophyletic = single common ancestor, **paraphyletic** = some but not all descendants of a particular ancestor, **polyphyletic**= group containing descendants from two or more distantly related ancestors

Classified on visible traits and reproductive features (**morphology**), **molecular evidence** (DNA, proteins, secondary metabolites)

Cladistics – infers evolutionary relationship

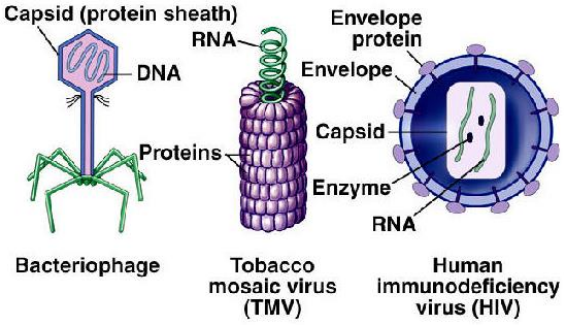
Homologous traits = common origin, different function – divergent evolution (different selective pressures)

Analogous traits = different origin, same function – convergent evolution (similar environment)

Cladogram = phylogeny tree - represents most **parsimonious** relationship (fewest character changes)

Phylogeny using molecular evidence has slight difference, depending on what DNA sequence used, useful microscopic organisms where hard to distinguish physical traits

Lecture 2



Virus

- Non cellular, cannot reproduce by itself
- Genome: DNA/RNA (single stranded or double stranded) – coding template for proteins
    - Highly mutable
    - **Retrovirus** – uses reverse transcriptase to turn RNA → DNA, insert DNA into host's genome so it replicates every time cell replicates
- **capsid** (protein coat)
    - constructed from **capsomeres** – self assembling, different shapes
- sometimes has lipid membrane

- Complete infectious particle = **virion**
- 20-300 nm (biggest 1 micron)

Virus replication

- Require host cell to reproduce itself, provide energy, ribosomes
- Taken up by injection, endocytosis, wounds
- Releases genome into cell, hijacks nucleus and ribosomes, replicates genome and capsid, ruptures host cell and released

Virus classification

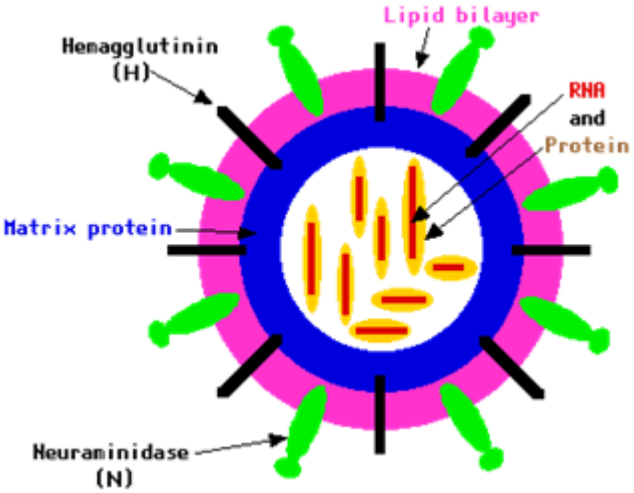
- Morphology, type of nucleic acid, ss or ds, vector, mode of replication (Baltimore system), severity
- Not classified by symptoms but instead how it works for easier treatment, vaccines

Combat viruses with vaccination (smallpox, rinderpest, polio)

Influenza virus

Hemagglutinin – glycoprotein that enables virus to enter host cell

Neuraminidase – glycoprotein that enables virus to leave host cell



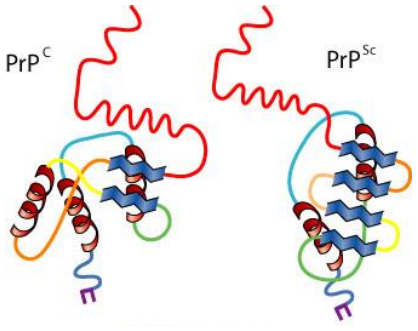
Each virus carries one gene for H and another different one for N, genes on separate pieces of RNA, has total of 8 genes in flu virus

Many different variations (H1N1 – 1918 flu pandemic, swine flu, H2N2 – Asian flu, H5N1 – bird flu)

Zoonosis = flu being able to jump between species (eg. Human, birds, pigs)

Viroids

- Single circular strand of naked RNA
- No protein capsid
- 1/1000 the size of a virion
- Causes plant diseases



Prions (proteinaceous infectious particle)

- Protein only
- No nucleic acid
- Unknown pathogenesis (how it causes disease)
- PrP^{Sc} (prion) causes PrP (normal brain protein) to spontaneously convert to PrP^{Sc}
    - Structural isomers, conformational change
- Forms insoluble plaques in the brain, mad cow disease, kuru)

Lecture 3

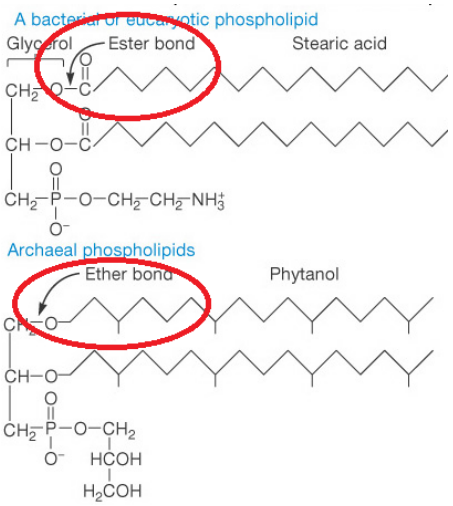
Three domains of Life (Bacterium, archaea, eukaryotes)

- Conduct glycolysis
- Replicate DNA semi-conservatively
- DNA encodes proteins, transcription, translation
- Surrounded by membrane

Prokaryotes

- Lack membrane bound nucleus/organelles and cytoskeleton
- Peptidoglycan well wall in bacteria
- Different rRNA sequences, smaller ribosomes
- Heterotrophic or autotrophic
- Photosynthetic anoxygenic → oxygenic cyanobacteria (transformed environment to oxygen, organic carbon, nitrification, sulphur)
- Most **saprophytes** (live off decaying matter) or **symbionts** (live in symbiosis), few pathogenic (no pathogenic archaea)

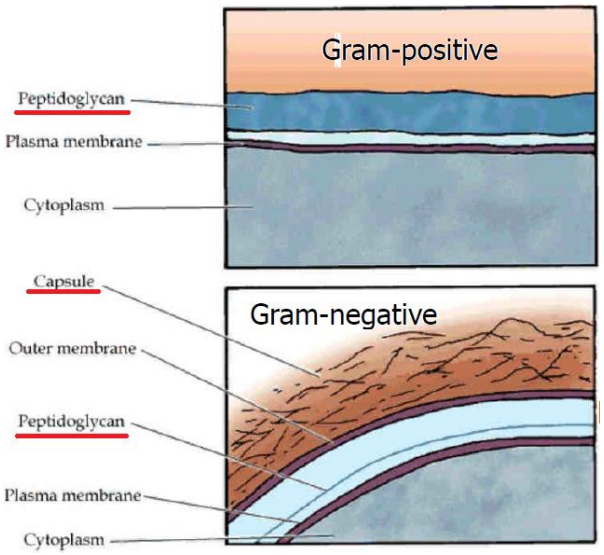
Archaea (monophyletic)



- Small genome
- Lack peptidoglycan wall
- Can live in extreme environments: **extremophiles** (halophile (salt), thermophile, methanogen)
- Unique membrane, cyclic monolayer, different properties, fluidity
    - Have **ether bond in phospholipids** (vs bacteria and eukaryotic = ester bond)
- Eg. Halobacterium halobium
    - Hypersaline solution, needs 1.5M salt conc or else membrane ruptures
    - Facultative phototroph, captures light energy without chlorophyll
    - Uses **retinal** as photosynthetic pigment and **opsin proteins**
    - Drives chemiosmotic production of ATP, pumps H+ and Cl- ions across membrane

Bacterium (paraphyletic)

- Small prokaryotes (0.5-5µm), lack nucleus, smaller ribosomes
- Peptidoglycan cell wall
  - Gram positive = thick peptidoglycan layer, one membrane, stains purple
  - Gram negative = thin peptidoglycan layer, two membranes, capsule, stains pink
- Ester bond in phospholipids
- Rods (bacilli), spheres (cocci), spirals/helical



Evolution of bacteria (3.5 billion years ago, transformed environment from low oxygen to now

- Reproduction
  - Asexual – binary fission, spores
  - **Conjugation**: **bacterial sex**
    - Plasmid or part of genome/ bacterial chromosome is transferred to another bacterium through sexual process
    - **Sex pilus** – attach to another bacterium
    - Can transfer metabolic genes, resistance genes
  - **Transformation**
    - Bacterium takes up foreign DNA from outside
  - **Transduction**
    - Virus (phage) infects bacterium and accidentally takes up bacterial DNA into its own genome
    - Then injects it into another bacterium which gets incorporated into new one
  - Mutation

Creates genetic diversity