Lecture-membrane proteins→ACTIVE TRANSPORT

- **Two types of active transport:**
  - Primary active transport
    - Uses energy directly from chem reaction ATP
  - secondary active transport
    - Uses energy in existing Electrochem gradients→use S1 to cotransport S2. COUPLING
- **ATP driven pumps:**
  - P type carriers- phosphorylated and dephos during transport of Na, K and other ions
  - F type carrier-transport proton at expense of ATP hydrolysis→make ATP in reverse direction
    - Can go both directions→make **and burn ATP.**
    - **F and V go in opposite directions→ make or break ATP.**
  - V type carriers-proton pumps→acidify inside of lysosomes, vesicles etc
  - ABC transporters: **dont produce ion gradients,** highly conserved ATP binding region.
    - Use ATP breaking down energy to transport **molecules (as opposed to ions e.g. H+, Na+)** through membrane.
- **ATP Driven pumps:**
  - T domain- transmembrane region
  - Actuator domain-substrate binding region.
  - P domain-gets phosphorylated to block/unblock the pump.
  - N domain- ATP binds here first.
- **Na/K/ATPase:**
  - P type ATP driven antiporter
  - Maintains high K and low Na inside cells against steep Electrochem gradients.
  - **Why gate is open to cytosol and only Na binds instead of Na and K→** binding sites only properly formed when in correct conformation-the Na binding site is only in correct conformation when exposed to the cytosol! This makes sure that only Na gets pumped out of the cell and drives the pump.
    - The affinity of the binding site changes with changing conformation
  - For each ATP broken down, moves 3 Na out and 2 K in
  - Uses about 40% of ATP made in cells
  - Relatively slow when compared to ion channel-because has many different steps that need to occur!
  - N and K are transported against their Electrochem gradient.
  - Binding sites of Na and K:
    - Na binding site is close to the external part of the channel→makes it easier to pump it out of the cell
    - K binding site is close to cytosol part of channel
    - This means that the ions have to travel deep down into the channel in order for them to get to their binding site.

- **ABC transporters:**
  - Can transport amino acids, sugars, inorganic ions, polysaccharides, peptides→**pumps it out of the cell.**
  - Without ATP bound, substrate binding site exposed to extra cell matrix or cytosol
  - ATP binding leads to **conformation change** in the pump and substrate binding on other side is exposed.
  - ATP hydrolysis followed by ADP dissociation returns the transporter to its original conformation
  - Can be dimers or tetramers
  - Nucleotide binding domain is on cytosolic side
  - Bind to nucleotide/ATP on each side→the binding sites for ATP are on the cytosolic side

Figure 1-ABC transporters

- **Ion channels:**
  - Ion selective-have pores lined with oppositely charged amino acids
  - Faster than ATP driven pumps
  - Use voltage gate-depolarise/polarise inside/outside of cell→change in voltage allows movement of ions to the outside of cell
  - **Pumping occurs due to voltage change instead of ATP being broken down.**
    - Cation channels are lined with –ve charged residues
    - Anion channels are lined with +ve charged residues
    - Channels can be gated-open or close in response to a triggering signal
    - Ions may flow in either hydrated or non hydrated depending on width of channel
    - Channel proteins transport water or specific types of ions down their conc gradient
    - Rapid diffusion rate
  - **Potassium channels:**
    - Membrane spanning porteins
    - Selectively conducts K+ across cell membrane
    - Fast
    - Occurs due to
      - Water filled pore that allows K+ to flow across cell membrane
      - There is a filter in there that is selective only for K