* The percentage of proteins in inner membrane is huge compared to outer and plasma
* Etc is located in the inner membrane of mitochondria
* Inner membrane forms invagination called cristae – increase surface so can put enzymes of etc and mitochondria can produce more ATP
* Matrix – soluble part
* Inside the mitochondria – several processes that can happen
  + Outer membrane – fatty acid metabolism – saturation and elongation
  + Inner membrane – etc, oxidative phosphorylation, fatty acid transport
  + Matrix – pyruvate dehydrogenase complex,…
  + Outer membrane is more porous than inner – but are still regulated – inner membrane is more tightly regulated
* Electron transport chain
  + Complexes – I, II, III, IV involve in electron transport
  + Complex IV – ATP synthase – synthesise ATP – use the proton gradient generated in etc
  + Outside the inner membrane is the intermembrane space
  + Complex I transports proton from matrix to intermembrane space
  + Complex II no transport of proton
  + Complex III and IV both
  + 4 integral membrane complexes – I to IV
  + Integral membrane – part of it is inside membrane and a portion that goes into the matrix – allow them to transfer protons form one side to another side
  + Call complexes because they are formed by multiple proteins – subunits forming entire the complex – 40 proteins forming complex I
  + 3 chemical reactions
  + Complex II is part of cac – succinate dehydrogenase – succinate to fumarate (oxidation) – produce FADH2 that further transports enzyme to CoQ
* Redox reactions
  + Species that accept electrons
  + Species that donate electrons
  + OILRIG – oxidation is loss – reduction is gain
  + Species oxidised – lose elections
  + Species reduced – gain electrons – accept elections
  + Reductant – reduce another one – will be oxidised
  + Oxidant will be oxidised
  + Oxidation loses electron
  + Eo – standard reduction potential
  + If a species has higher standard reduction potential – more likely to accept electrons
  + Important for etc – species that can oxidised and species that get reduced – there will be a species that is stronger at catching electrons
  + Eo’ – the prime indicates standard biochemical reaction – ph 7 – 25 degrees C
  + Delta E0’ is the difference between the E0’ of e- acceptor and donor
* Glucose can be fully oxidised to 6CO2
* Glycolysis and CAC – glucose produces 24 electrons – used by electron transport chain to transfer to oxygen and pump protons across membranes
* Every molecule of glucose produces 24 e-
* Each cofactor – NADH and FADH2 – is able to transfer 2 e-
* Glycolysis – produce 2 NADH – 4 e-
* Pyruvate to acoa – 1 produce 1 NADH – have 2 pyruvate so 2 NADH
* CAC – 16 e-
* In total 24 e-
  + 20 generated into the mitochondria – excluding glycolysis – available for etc and oxidative phosphorylation
* To calculate E0 – create Galvanic cell – right standard hydrogen electrode – insert H gas – will go from H+ to H2
  + On the other side put the substance we want to test – eg. Fe iron
  + Iron has more reducing potential because it is attracting more electrons
  + Everything that is more reducing than H has positive value – less reducing has negative value
  + Can measure for several species found in biochemistry
  + Highest E0’ is oxygen – make sense because it is the final electron acceptor
  + Don’t want electrons to escape – will start oxidising lipids, proteins etc and mitochondria will break
  + Take 40 proteins in complex I to oxidise NADH to NAD+
  + Always go toward Oxygen
* The difference in delta G and E0 will be converted into the proton gradient
* CoQ takes electrons from complex I and II and transfer to complex III
* Complex that transfers protons – III and IV
* II transfers electrons
* Various e- carriers
  + Flavoproteins
  + Iron-sulfur proteins –
  + Coenzyme Q
  + Cytochrome C
* Iron-sulfur clusters – iron (orange) in middle – cysteine blocking the centre – cysteine sulphur
* Can have 2 electron carriers or 1 e- carrier
* Coenzyme Q
  + Isoprene unit – lipophilic – really likes lipid
  + Oxidised coQ – reduced to form semiquinone sth – reduced to Q10
* Cytochromes
  + Have cytochrome c and c1, a and a3
  + Have heme structure
  + Difference is that c and c1 are attached covalently to protein cysteine
  + A and a3 not attached to protein
  + Cytochrome c is located on the intermembrane space (still attached to the innermembrane)
* Complex I
  + Multisubunits
  + Oxidise NADH to NAD+
  + 4 protons are transferred
  + Electron is transferred and accepted by coQ – reduced to QH2
* Complex II
  + Multisubunit
  + Part of CAC
  + Transfer 2 e- from succinate to fumurate
  + CoQ becomes CoQH2
  + Oxidation
  + No proton transfer
* Role of CoQ
  + Cofactor located inside inner membrane
  + Get electron from Complex I and II and also from fatty acid
  + Transfer electrons from complex I and II to III
  + Reduced and transfer to complex III
* Complex III
  + Transfer of e- to cytochrome c
  + Cycle of CoQ – transferring e- to a lot of centres
  + Cytochrome C in intermembrane space
  + Have proton transfer
  + Q cycle – four protons are transferred
* Cytochrome IV
  + Cytochrome c Oxidase
  + Oxidise cytochrome C
  + Cytochrome C is in reduced form
  + Reduce oxygen
  + Pump 2 protons
  + So from 1 molecule of NADH – we pumped 10 protons
  + FADH2