* Biological membrane – most important part of cell biology
* Lipids – main constituent of biological membrane
* Eukaryotic cells – have subcellular compartments – mitochondria, endoplasmic reticulum, Golgi complex, nucleus, nucleolus (core of nucleus), nuclear envelope, lysosome (recycle centre including invasives), basal bodies
* Cells need to carry out metabolic reactions – metabolics meaning synthesis (making molecules, protiens, lipids, long chains of sugars, storage sugars, nucleic acid) – need components to build them – food are broken up and recycled – materials that don’t work are recycled
* Recycling process is called breakdown
* Eukaryotic organsims carry them out in membrane bound structures called organelles – protected by boundary – specific reaction can occur in the compartments – selected for in evolution
* Compartmentation provides protection from environmental fluctuations
* Compartmentation provides efficiency of biochemical, specialised activities carried out in different cellular compartments
* Biological membranes made up of lipids, second major component is proteins, sugars are minor and only in some membranes
* Lipids are hydrophobic or amphipathic (can exist in equilibrium with aqueous)
* Sterols and phospholipids
* Lipids are made up of polar head (colured blue – like water) and long non-polar part (hydrocarbon structure – can be straight or double bond – hydrophobic)
* Lipids are energy storage, member structure, and signalling
* Lipids have very limited solubility
* Lipids that made up the membrane are ampopathic
* The polar head has charged group an long carbon tail – made up of fatty acids – has carboxylic acid head – can be straight chain or double bond – unsaturated are oil (liquid at room temperature)
* Stearate has 18 carbons and one carboxylic
* Oleate ion is the principle component in olive oil
* Can have 12 to 24 carbons – called fatty acid
* Lipids are made of fatty acids – not fats
* The longer the chai length, more solid – shorter with double bond called oil and liquid
* Palmitiric acid from palm oil
* Position of double bond indicated by delta triangle
* Fatty acids that have double bond have cis shape so they are not so stable and that’s why liquid at room temp
* Fats are esters of fatty acid – usually esters of glycerol
* 3 ester groups and 3 long chains – the tops polar but not charged – carbon atoms are highly reduced so produce a lot of energy
* Fats assemble into micelle in water (if they have one tail)
* If have 2 tails, form bilayer – hydrophobic face each other – hydrophilic faces water – after some time water can enter the gap of the hydrophilic head
* Glycerophospholipids – have 2 long hydrophobic chains (to form bilayer) – have phosphate group instead of third group carrying what in R3 table slide 12 – fold up into bilayer form – phosphate group head group attracts water
* Glycoglycerolipids contain sugar group that could substitute phosphatidyl inositol – no phosphate – has carbohydrate head group
* Sphingolipids and glycospingolipids – can ignore the slide
* Cholesterol – fifth class of membrane lipids – contain fused 4 carbon ring – has a little tail at the end – has just 1 OH group – like a little bit of water – long, dense, deep water – stick a bit out into water – weakly – disrupt regular fatty acid – cannot make all steroids we need if not enough cholesterol - we make it ourselves in the liver
* When heat the membrane, the chain get disorganised and become flexible – melting point of lipid bilayer – cholesterol stabilises it by making the peak flatter but doesn’t change the melting point temperature – change the way in which the lipid rearrange – help us to survive in high or cold temperature
* Compositions of biological membrane depend on cell and organelles – also very different from bacteria cell membrane – not so much cholesterol in heart mitochondria
* Steroids are cortisol steroids – control inflammation – hormones involved in regular maintenance of the body
* Integral and peripheral or membrane-anchored
* Integral membrane protein – protein that spans the whole membrane – transport water, ion and molecules across membrane and binding small metabolites that provide signalling – inform inside of the cell what is happening outside
* Peripheral proteins – sit on the membrane – associate with the polar head groups or has attached lipid anchors – partially stuck in the membrane – can move or surf on the membrane
* Seems like proteins have outnumbered lipids – some have carbohydrates some don’t – covalently attached to side chains on the proteins (side chains with OH groups)
* Intergral proteins go through the membrane – peripheral just sitting on the membrane
* Lipid-linked protein stuck to the membrane – have hydrophobic tails to anchor into the membrane – anchor them to make sure key proteins won’t run away
* The green bits are sugars – they serve to recognise the surface – slide 20
* Most membrane proteins are integral – alpha helices embedded in membranes
* 7 transmembrane structure – have the same structure as bacteriorohodopsin
* Bacteria have a structure in their membrane which made up of almost complelety beta sheets called beta-barrels – seen in bacteria not humans
* Peripheral membranes are hold on lipid membrane surface by hydrophobic part – can be short HC extensions or long GPI anchor – short can be farnesyl residue or geranylgeranyl residues that embed themselves into long chain
* Long GPI anchor comes from phosphatidylinositol – big block that sticks itself in the membrane – hold proteins down in the membrane
* They thought lipids are two layers that are frozen to their surfaces – they actually can change their position – lipids are in state of motion – cannot let water pass through – can be considered 2D liquids – molecules on top and bottom can exchange position called flipping but use energy – moving within the plane does not require energy
* Outer surface of membrane has different types of lipid preference
* Inner leaflet – the inside layer facing the interior of the cells or organelles
* Lipid structure is asymmetric – the top layer is different from bottom layer – critical for membrane functions
* Proteins are placed in membranes in specific way eg. receptors, transporters – have orientations
* Biological roles of membranes
  + Form boundaries against diseases and toxins
  + Segregate what is happening inside the cell from outside the cell
  + Keep one cell away from the other - form a wall
  + Mediate regulation of cellular functions – allowing inside to be different from outside
  + Control transports of items in and out of cells
  + Signalling and receptors for external chemical stimuli
  + Generate chemical and electrical signals - protons
  + Specific enzyme works in different site of the membrane
* Lipid bilayers are capable of