Structure of protein, carbohydrates and lipids

The Structure of Protein

Proteins are formed from a string of multiple amino acids joined together by a peptide bond by a condensation reaction and each protein consists of one amino acid, polypeptide, chain. The different function of each protein is determined by which amino acids and side chains are present in the amino acid chain. All proteins are built from a combination from a set of 20 amino acids, the primary structure. The proteins are a three dimensional shape due to the folding of the polypeptide chain. Proteins contain a chain in multiple variances of two secondary configurations. The molecules are structured by Alpha-Helices and Beta-Sheet configurations of which the protein molecule can contain a different number of helices and sheets The Alpha-Helix is a tightly coiled polypeptide chain which is right-handed if the helix is naturally formed. Proteins can have a left-handed or right-handed helix configuration. Beta-Sheets are formed by amino acid chains beside one another, where the peptide bond is not contained within the chain but joining with other strands of the chain to from a sheet. The tertiary level of structure is a once folded chain which is supported by a hydrogen bond and sulphate bridges. Quaternary structures are globular structures containing more than one protein. The function of proteins in the body is varied. The role in the body can include in the immune system, as storage and as a catalyst for enzyme reactions.

The Structure of Carbohydrates

Carbohydrates can be made from three variances. The three structures that they follow are Monosaccharides; only containing one sugar, Disaccharides which contain two sugars or Polysaccharides which contain many sugars.

Monosaccharides are a simple sugar. The most common monosaccharide is Glucose. Monosaccharides including Glucose are broken down to provide a readily available source of energy. Disaccharides, also known as a double-sugar, are composed of two separate sugar molecules. The most common being Sucrose. Sucrose is composed from Glucose and Fructose. Disaccharides help within the structure of cell membranes. Polysaccharides can contain a large number of monosaccharides in their structure. Polysaccharides make up a number of things including cellulose and starch. Cellulose is important in the structure of cell walls in plants.

The Structure of Lipids

Lipids are a highly varied in both function and structure. Despite this diversity lipids can be broken down into the major groups. These three groups are fats and oils, phospholipids and steroids and waxes. Fats and Oils consist of two kinds of molecules, glycerol and 3 fatty acids which are bonded via a condensation reaction(losing a water molecule). The components in the structure lead these molecules to be called triglycerides, 3 fatty acids and a glycerol molecule. Fats are known as fats because they are solid at room temperature and oils are so called because they are liquid at room temperature. Fats and oils are important in the body as they provide a protective layer around organs and provide insulation.

Phospholipids are constituted of glycerol, two fatty acids, a phosphate group and some other molecule attached at the end. The phosphate group and other molecule forms the “ head” and the fatty acids for a “ tail”. Phospholipids are an important part in cell membranes. The head of the molecule is situated on the outside of the membrane while the tail forms the inner. The molecules are positioned in two rows with tails touching, shown below.

(Clermont College, 1996, Lipids: Fats, Oils, Waxes, Etc, http://biology. clc. uc. edu/courses/bio104/lipids. htm, accessed 20/01/2013)

Steroids are a carbon based molecule. All steroids share the same basic core composition, shown below.

(VCU School of Pharmacy, Steroids – Introduction, http://www. people. vcu. edu/~urdesai/intro. htm, accessed 20/01/2013)

All steroids are a variant on the structure above. By adding further molecules to the carbon rings above all steroids can be achieved. The list of steroids that can be synthesized includes Cholesterol. Steroids play an important role in regulating the body’s biological processes. Cholesterol apart from being the precursor to other steroids can also be found in the cell membrane to help protect the cell in colder temperatures. Waxes are composed of a chain of fatty acids and fatty alcohols. Waxes are used as a coating for skin and other exposed parts on animals and to prevent the loss of water from a plant.

The Structure of Nucleic Acids

Nucleic acids are the means to transport genetic data and are composed of DNA (Deoxyribonucleic Acid) and RNA (Ribonucleic Acid). Both nucleic acids are composed of nucleotides, which are a nitrogen base, Ribose and a phosphate group. The nucleotides are bonded the same way as proteins via dehydrated synthesis. DNA is the “ coding” for how proteins should be produced. RNA produces the proteins. DIFFERENT TYPES OF RNA

The Structure and Function of The Liver

The liver is made up of 4 lobes. The left, right and two further smaller lobes. The lobes of the liver contain clusters of hepatocytes around a central vein. The clusters of hepatocytes are called lobules. Each cluster of hepatocytes is surrounded by a cavity called a sinusiod. The sinusoids are where the blood that has entered the liver through the hepatic artery and portal vein into a tiny blood vessels is deposited. This contact between the blood in the sinusoids and the cell membranes of the hepatocyte cells is where nutrients are absorbed and other proteins can be secreted.

It is thought that 80% of the livers mass is made up of hepatocytes. In addition to the cell nucleus hepatocytes are made up for a variety of other organelles to contribute towards its function. The hepatocytes contain rough and smooth endoplasmic reticulum(RER & SER), golgi, mitochondria, cytoplasm, membrane, ribosomes, centrioles, vessicles, lysosomes and peroxisomes.

The hepatocytes produce many proteins through the ribosomes on the the rough endoplasmic reticulum, the RER is made up of phospholipids and shares the structure with the cell membrane. The RER is also the network in which the proteins produced in the ribsomes is transported. One of the proteins that is produced is albumin. Albumin is synthesized in the liver as a different compound. Albumin is first synthesized as proalbumin in the ribosomes before it passes through the rough endoplasmic reticulum and before glycosylation takes places in the golgi. Glycosylation in the golgi is when proalbumin is reacted with carbohydrates to change the structure to albumin. The albumin in then secreted into the blood where it makes up about 50% of the blood serum. Albumin plays an important role in transporting other substances around the body. Once glycosylation has taken place the albumin is excreted to the vessicles. Ribosomes are instructed by RNA and are provided the " code" for the proteins it produces from the DNA. The code used in the robosomes structures the polypeptide chain to synthesise each different protein. The organelles in the hepatocyte to produce albumin are first instructed by the DNA in the ribosomes to produce the certain protein. The process further carries on by secretion of the protein to and then from the rough endoplasmic reticulum to the golgi, where the protein is reacted to form the albumin. Hepatocyte cells contain a vast amount of RER to aide in their protein production. The cell functions all of the time in the synthesis of protein. The cell needs a constant source of energy to be able to produce proteins and this is where the mitochondria come in to play. Hepatocytes and any protein synthesising cell will have a large number of mitochondria to produce the energy needed. A mitochondrion produces chemical energy by producing adenosene triphosphate(ATP). ATP is produced on an inner membrane inside the mitochondrion by oxidising products like glucose. The oxidisation of molecules inside the mitochondria is called cell respiration.

Hepatocytes are interlaced with permeable vascular channels to permit substances to enter, or leave, the blood stream. There are two different ways a substance can cross the cell membrane into the blood.

Passive transport requires no energy. The reason passive transport requires no energy is because the substances diffuse from a higher concentration to the lower one. Passive transport of certain molecules is done by facilitated diffusion. Within the cell membrane there are carrier proteins which have specific receptor sites for specific molecules. Larger molecules that are not lipid soluble can be diffused through the carrier protein to go down the concentration gradient. Diffusion works on the same principle as facilitated diffusion but works for lipid soluble molecules. Water soluble molecules pass through a channel protein to the side of lowest concentration.

Osmosis is similar to diffusion but governs only the water balance of each cell. There are 3 states in which the water level can exist. Hypertonic, Hypotonic and Isotonic. Hypertonic is when a cell is solute rich, hypotonic is when the cell is solute deficient and isotonic is when the cell and exterior environment are equal.

(Unknown Author, Ms. Pollina's Advanced Studies in Biology, http://advancedstudiesbiology. wikispaces. com, accessed 27/01)

Active transport is the transport of substances that requires energy. Active transport is used in the sodium potassium pump. This kind of transport is used when a cell needs to gather minerals into a higher concentration of minerals, where diffusion can not take place. The ion pump is powered by ATP. ATP is broken down by removal of one of the phosphate groups by an enzyme reaction. This allows the pump to move 3 sodium ions from the inside of the membrane and to potassium ions from the outside of the membrane. The energy obtained from the removal of a phosphate group changes the shape of the pump allowing the movement of the ions into the side of higher concentration.

Animal, Plant and Bacteria differentiations

(Encyclopædia Britannica, Inc, Cell: Typical Cells, http://www. britannica. com, accessed 20/01/2013)

Animals and plants are all made up of eukaryotic cells. The cells are named this because they contain a membrane bound nucleus and membrane bound organelles. One of the differences between animal and plant cells is that animal cells have a flexible membrane and plants have a cell wall which is made from cellulose, this enables rigidity in the plant cells. Both animal and plant cells are made up of ER(Endoplasmic Reticulum), Golgi, Ribosomes, Nucleus, Nucleolus, Mitochondria, Cytoplasm, membranes and vacuoles, only plants have large permanent vacuoles. Another big difference between animal and plant cells is that plant cells also contain chloroplasts, which enable the plant to produce energy by photosynthesis. Another organelle that differentiates the plant cell from the animal cell is a large vacoule. The vacoule stores water and can also store other molecules and ions. The water is used to create a pressure to push the cell wall against the membrane.

Prokaryotic cells (Bacteria) are names as the house no membrane bound neucleus or membrane bound organelles. Within the bacteria cell all of the organelles contained within are “ free floating” within the cytoplasm. There is no nucleus to house the chromosomes and the ribsomes and mesosomes float freely within the cytoplasm. A bacteria cell has flagellum and pili to enable it to move round. Unlike an animal cell which has a fluid membrane which enables movement. Both plants and bacterial cells have a plasma membrane and a cell wall unlike an animal cell which only the membrane houses all of the organelles. Bacterial cells are also housed within a capsule. The capsule of bacterial cells is constructed of a tangled polysaccharide fiber layer.