# AP® Biology
# 2002 Sample Student Responses
# Form B

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Q3-R
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3. The physical form of cells and organisms is often influenced by special structural polymers. Choose **one** polymer from **each** of the following three pairs of polymers:

   Pair 1: tubulin . . myosin

   Pair 2: cellulose . . chitin

   Pair 3: messenger RNA . . transfer RNA

   For each of the three polymers you have chosen, **describe** its

   (a) structure, and

   (b) role in a cell or organism.

a) ~~Myosin~~ Tubulin:

Tubulin is a tertiary protein that exists in two forms: ~~Alpha~~ alpha tubulin and beta tubulin. These globular proteins have a specific three dimensional shape determined by the interaction between R groups, hydrophobic and hydrophilic regions, disulphide bridges and hydrogen bonds. Tubulins have an almost spherical shape.

b) Alpha tubulins and beta tubulins dimerize. These tubulin dimers then ~~bond~~ combine to form the structure of microtubules. The tubulins are arranged in a twisted helix. The microtubules function as support for the cell and are also involved in mitosis.

a) Cellulose:

Cellulose is a polymer of beta glucose. ~~Beta glucose~~ In beta glucose, the hydroxyl group is above the plane of the ring. Alternate glucose monomers are rotated through 180° to form long straigh molecules of glucose. Adjacent strands are attached by hydrogen bonds. This makes cellulose very strong.

b) ~~Cellulose~~ Cellulose molecules form the tough outer covering of plant cells. They are found in the cell walls and provide structural support for the cells. ~~and~~ These molecules are strong and straight and therefore difficult to break.

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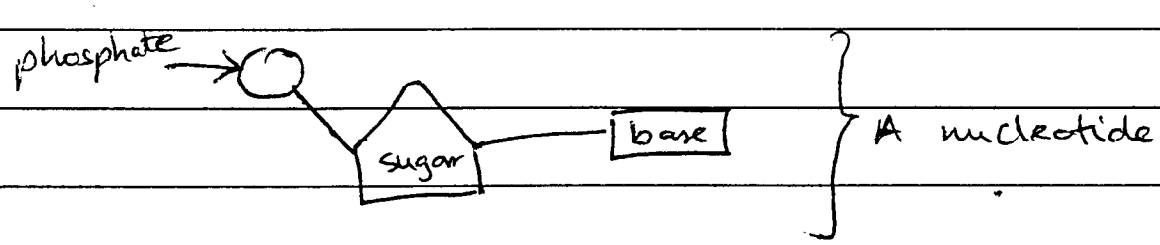
a) messenger RNA:

This molecule (mRNA) is composed of the ~~Sm~~ five carbon sugar ribose. It is single stranded and is transcribed from a template DNA strand. It ~~cos~~ consists of the bases adenine, cytosine, uracil and guanine. ~~mRNA~~ The structural unit of mRNA is the nucleotide. ~~The~~ A nucleotide consists of a sugar, base and a phosphate. There are usually 75 to 3000 nucleotides in each molecule of mRNA. mRNA also has a 5' and 3' end. ~~Translation of mRNA occurs~~. These molecules are uncoiled and straight.




b) mRNA molecules are transcribed from DNA in the nucleus. They then transport the genetic information from the nucleus to the cytoplasm. They leave the nucleus through nuclear pores. Ribosomes attach to the mRNA when it is in the cytoplasm. Translation of the nucleotides in mRNA occurs at the 5' end. A polypeptide chain is ~~compl~~ produced when translation is complete. Thus, mRNA are the carriers of the genetic information and play an important role in protein synthesis.

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For tubulin, it is made up of tubulin protein that form microtubules in a 9-2 arrangement. The tubulin coils around is a spiral manner and thus leaving a hollow hole in the center. The tubulin then aggregate into 9-2 microtubules. The function of microtubules in the cell is vital. It provides the tracks in which the organelles can use to move around in the cell. This must be supplied with ATP. More, the tubulin also take part in cell structure and change shape when a certain stimulus activate signal transduction pathway. Most important is that microtubules help in cell secreting proteins and vesicles.

Cellulose is a type of carbohydrate with a monomer of $C_6H_{12}O_6$. It then hydrolyze together to form cellulose. The monomer's connecting point for cellulose is opposite orientation, making the adjacent bonding monomers to flip upside down to connect. Plus, the chains of cellulose aggregate via hydrogen bonds between chains and form fibers that are very strong and thick. Cellulose is highly available in plant's cell wall. The function of cellulose in cell wall is to reinforce & make the wall strong. so that plant cell can withhold harzardous conditions. This makes carnivores unable to digest plants.

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Plus, hard cell walls allow plants to tolerate intense environmental stress.

The messenger RNA is constructed with a ribose sugar backbone with phosphate group attached to it. The nucleotides consists of adenine, guanine, cytosine & uracil in replacement of thymine. It has a direction function of 5' -> 3'. Messenger RNA is single stranded. The function of mRNA is very important in both cellular & organismal level. mRNA carries out the genes coding for proteins or enzymes. The RNA polymerase transcribe the DNA into mRNA. mRNA is the processed in a process called RNA processing. Here, spliceosomes and other proteins exise and connect the RNA. The result is introns cut out, retention of exons. The mRNA is the translate into proteins that will regulate gene expression or cell function. Different splicing of introns in mRNA causes different proteins to be translate and thus, expressing different phenotype.

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- Tubulin is a form of protein that is found in the microtubules of a cell. Microtubeuoles range in functions of structural support, movement of the cell throughits enviorment (flagella), movement of organelles within the cell, and the splitting of a cell during ~~se~~ mitosis & meiosis (cytokinesis). Tubulin is a major player in the cell.
- Chitin is a polymer of carbohydrates, and is most commonly used as hard armored plates in insects & arthropods, insulating hair is formed of chitin, and things such as scales, talons, or other defencence mechansims are also created from the chitin ~~polyr~~ polymer.
- Messenger RNA is a polymer ~~comprised~~ comprised of a ~~hair of~~ ~~5 Carbo Ribose sugars and attached to an amino acid~~ These ~~nucleotides~~ are a chain of nucleotides. ~~or~~. These nucleotides are comprised of a Ribose sugar and an amino acid (Adenine, Guanine, Cytosine, and Uracil). ~~to be~~. These chains of nucleotides form m-RNA, and this m-RNA is

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responsible for the production of proteins in every organism. It is used ~~as~~ as a blueprint by a cells ribosomes to secure t-RNA and its complimentary amino acid into a polypeptide chain. This polypeptide is in turn altered, modified, and packaged by the Golgi Apparatus to be excreted by the cell, or it is used for functions within the cell. m-RNA is responsible for the protein production of cells and hence their effect upon the organism.

~~if a missence p~~ If their is a mutation in the mRNA sequence a missence or Nonsense mutation in the organism could occur. If a missence mutation occurs then nothing happens, however if a missence mutation occurs, then a diseases such as cystic fibrosis will occur, because the protein made by the translation of m-RNA was created with an altered 3 tertiary structure, thus not alowing it to control ~~for~~ certain functions in an organisms lungs.