Module 6. Nucleotides and Nucleic Acids

This section makes up 12% of the test and includes 3 sub-sections.

1. Metabolism of purines and pyrimidines
2. Chemistry
   1. Structure
   2. Properties
   3. Function
3. DNA, RNA and protein synthesis
4. METABOLISM
   1. Purines and pyrimidines are synthesized de novo or recycled by a salvage pathway from normal catabolism
   2. The end product of the complete catabolism of PURINES is URIC ACID
   3. Catabolism of PYRIMIDINES forms KREBS CYCLE INTERMEDIATES
   4. When the nucleus of a cell is destroyed, DNA and RNA are degraded. Adenosine, inosine and guanosine (nucleosides of the nucleotides) are released. These substances are further degraded to form hypoxanthine, which is then converted to xanthine. Excessive cell destruction or excess purine in the diet causes excess production of xanthine, which is converted to uric acid by xanthine oxidase. Excess uric acid production or decreased uric acid secretion from the kidney will result in gout.
5. CHEMISTRY
   1. STRUCTURE
      1. NucleoTides are made up of a pentose sugar (either ribose for RNA or deoxyribose for DNA), a nitrogen base (a purine or a pyrimidine) and a phosphate group (the part that differentiates a nucleotide from a nucleoside)
      2. NucleoSides are made up of the pentose sugar and a nitrogenous base.
   2. PROPERTIES
      1. Pyrimidine bases include Uracil, Cytosine and Thymine (don’t confuse with Thymine). U Can’t Topple the PYRamids.
      2. Purines bases include Adenine and Guanine. All Girls are PURfect.
   3. FUNCTION
      1. The first major role of nucleotides is in the formation of energy-rich compounds like ATP, GTP and UTP.
6. DNA, RNA and Protein Synthesis
   1. DNA REPLICATION. DNA is made up of two parallel-antiparallel polynucleotide strands joined by hydrogen bonds. Two hydrogen bonds join adenine to thymine. Three hydrogen bonds join guanine to cytosine. Phosphodiester bonds join the deoxyribose molecules to each other. Replication takes place in a semi-conservative manner. HELICASE unwinds the DNA strand. DNA POLYMERASE III elongates by attaching carbon 5 of one sugar to carbon 3 of another sugar on the LEADING STRAND. On the LAGGING STRAND, an RNA PRIMER make a carbon 3 available, so that DNA POLYMERASE III can elongate and form an OKAZAKI FRAGMENT. DNA POLYMERASE I removes the primer. LIGASE links the Okazaki fragments. Replication takes place in the nucleus.
   2. TRANSCRIPTION. DNA is used as a “pattern” to form MESSENGER RNA (mRNA), the RNA molecule that takes the information that is contained in the DNA, out into the cell. Transcription factor IID initiates the process. RNA POLYMERASE II forms / elongates the growing RNA strand. Transcription takes place in the nucleus.
   3. TRANSLATION. Translation takes place on the ribosome. A charged tRNA matches an amino acid to the mRNA, forming a polypeptide chain, based on the information contained in the mRNA.