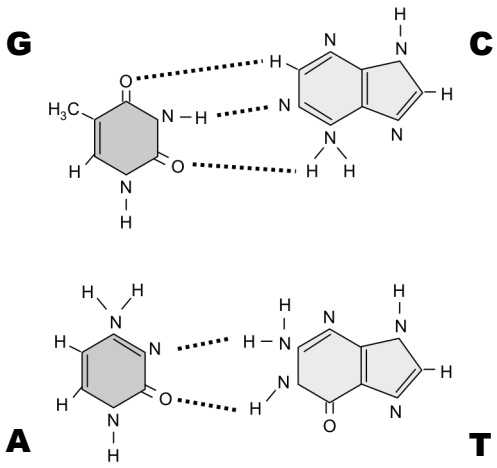
DNA Structure (7.1) & DNA Replication (7.2)

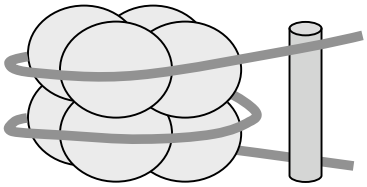
Describe the structure of DNA (7.1.1)

- Nucleotides joined by phosphodiester bonds between the 5'-phosphate & 3'-hydroxyl group
- In order for bases to pair, two complementary DNA strands must run in anti-parallel directions
- The double-ringed purines (A + G) pair with the single-ringed pyrimidines (T + C) as follows:
- Guanine and Cytosine = 3 hydrogen bonds
- Adenine and Thymine = 2 hydrogen bonds
- **Remember:** P**y**rimidine = Th**y**mine & C**y**tosine



Structure and function of a nucleosome (7.1.2 / 7.1.3)

- DNA is wrapped around a core of 8 histone proteins (octamer) to form a 'beads on a string' arrangement
- Octamers are linked by H1 histones to form nucleosomes
- Nucleosomes help to supercoil chromosomes and also help to regulate transcription



Types of DNA (7.1.4 / 7.1.5)

Unique / Single Copy Genes:

- Carry genetic information in the form of codons and code for proteins (usually)
- Make up only a small portion of total DNA (approximately 1.5 - 2%)
- In eukaryotes, coding sequences (exons) may be interspersed with non-coding introns

Highly Repetitive Sequences:

- Non-coding sequences comprised of base repeats ranging from ~5 - 300 base pairs
- Makes up a much larger proportion of the genome (between 5 - 45%)
- Sequences frequently much longer in length than genes and may be used for profiling

DNA replication (7.2.1 - 7.2.3)

- DNA replication is semi-conservative: new molecules are made of one new strand and one template strand
- **DNA helicase** unwinds and separates strands by breaking the hydrogen bonds between base pairs
- **RNA primase** lays down a short RNA primer to provide a starting point for replication
- Replication occurs in a 5' → 3' direction; as strands are anti-parallel, replication occurs bi-directionally
- On the leading strand replication is continuous, *deoxynucleoside triphosphates* (dNTPs) line up opposite their complementary base pair and **DNA polymerase III** covalently join them together
- It does this by removing the two additional phosphate groups from the dNTPs and using this energy to form a phosphodiester bond between to adjacent nucleotides
- On the lagging strand replication occurs away from the replication fork and requires several RNA primers to generate a series of discontinuous *Okazaki fragments*
- **DNA polymerase I** removes the RNA primers and replaces the missing bases before **DNA ligase** joins the fragments together
- DNA replication is initiated at many points in eukaryotic chromosomes