

Compendium 11

Learning Outcomes

- Describe the structure and functions of proteins
- Describe the structure of nucleic acids, differentiating between DNA and RNA
- Define the components of a nucleotide
- Differentiate between the nucleotide bases of DNA and RNA
- Explain what the genetic code is and what it is coding for
- Describe the two-step process (transcription & translation) that results in gene expression
- Explain the role of DNA, rRNA, tRNA and mRNA in the production of a protein
- Describe the cell cycle
- Give the details of DNA replication
- Explain what occurs during mitosis and cytokinesis
- Describe how mitosis differs from meiosis

Key Terms

Ribosome, mRNA, tRNA, DNA, gene, alleles, chromosome, chromatid, structural proteins, functional proteins, amino acids, filamentous proteins, globular proteins, nucleotide, nitrogenous base, guanine, cytosine, thymine, adenine, uracil, codon, triplet, anticodon, mutation, sickle cell anaemia, centrioles, gametes, mitosis, meiosis, polypeptide, peptide, somatic, autosomal, homologous, interphase, prophase, metaphase, telophase, cytokinesis

Glossary

- Allele - An alternative form of gene
- Autosomal - A chromosome that is not a sex chromosome
- Chromatid - One half of a chromosome
- Chromosome - Cellular structure which contains the primary genetic information of the cell
- Cytokinesis - Cytoplasmic division during mitosis
- Deoxyribonucleic acid (DNA) - The genetic information of a cell
- Gametes - A cell (ovum or sperm) that is specialised for sexual reproduction
- Gene - Functional unit of heredity
- Homologous - The maternal and paternal pair of chromosome
- Meiosis - The act of germ cell division
- Mitosis - The series of events that lead to the production of two cells by division of a mother cell into two daughter cells
- Nitrogenous base - A nitrogen containing molecule that has the same chemical properties as a base and bonds nucleic acids together
- Ribonucleic acid (RNA) - A nucleic acid containing ribose as the sugar component which helps direct protein synthesis
- Ribosome - A cytoplasmic organelle which is the site of protein synthesis
- Somatic - The cells of the body except the reproductive cells

Lecture Notes

Introduction to DNA

- DNA: deoxyribonucleic acid
- Genetic information contained in nucleus
- Contains genetic information for protein formation
- Approximately 23 000 genes in human genome
- Genes code for proteins
- Only 1.5% of DNA is due to genes
- 98.5% of DNA is non-coding - e.g. regulatory sequences, introns, and noncoding DNA - e.g. repeat elements

Structure of DNA

- Double-stranded (double helix - twisted ladder)
- Sugar-phosphate backbone
- Complementary nitrogenous bases
 - Adenine-thymine
 - Guanine-cytosine

Organisation of DNA

- Double strand of DNA - twisted ladder
- DNA wrapped around proteins called histones
- Histones & DNA bundled together - chromatin
- Chromatin twists around to make chromosomes

How much DNA is in a cell?

- Each somatic human cell has two copies of each chromosome - one you inherited from Mum and one from Dad
- The maternal and paternal chromosomes of a pair are called homologous chromosomes (make a homologous pair)
- Humans have 22 pairs of autosomal chromosomes and 1 pair of sex chromosomes
- Women have 2 X chromosomes and men have an X and Y
- Somatic cells with 46 chromosomes (23 pairs) are said to be diploid (have the full amount of DNA)
- Gametes (sperm and egg) only have 1 chromosome of each homologous pair (have 23 chromosomes) and are called haploid (have half the normal amount of DNA)
- When cells are dividing, the chromosomes become easier to see and we can arrange them next to their pair - this kind of map is a karyotype

Karyotype: A map of chromosomes in dividing cell

Some more words you may hear

- Genetics: study of heredity
- Gene: piece of DNA that codes for a protein