MODULE B5: GROWTH AND DEVELOPMENT

B5.1 How does an organism produce new cells?

1. recall that DNA has a double helix structure;
2. understand that cell division by mitosis produces two new cells identical to each other and to the parent cell;
3. describe the main processes of the cell cycle:
    - cell growth during which:
        - numbers of organelles increase;
        - the chromosomes are copied when the two strands of each DNA molecule separate and new strands form alongside them;
    - mitosis during which:
        - copies of the chromosomes separate;
        - the cell divides;

ⓘ Candidates are not expected to recall intermediate stages of mitosis.

4 recall that meiosis is a type of cell division that produces gametes;

5 understand why, in meiosis, it is important that the cells produced only contain half the chromosome number of the parent cell;

6 understand that a zygote contains a set of chromosomes from each parent.

ⓘ Candidates are not expected to recall intermediate stages of meiosis.

B5.2 How do genes control growth and development within the cell?

1. recall that the genetic code is in the cell nucleus but proteins are produced in the cell cytoplasm;
2. understand that genes do not leave the nucleus but a copy of the gene is produced to carry the genetic code to the cytoplasm;
3. recall that both strands of the DNA molecule are made up of four different bases, which always pair up in the same way;
4. **explain how the order of bases in a gene is the code for building up amino acids in the correct order to make a particular protein;**

ⓘ Candidates are not expected to recall details of nucleotide structure, transcription or translation.

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B5.3 How do new organisms develop from a single cell?

1. recall that the zygote divides by mitosis to form an embryo;
2. understand that in a human embryo, up to the eight cell stage, all the cells are identical and could produce any sort of cell required by the organism (embryonic stem cells);
3. understand that after this point the cells become specialised and form different types of tissue;
4. understand that although body cells in an organism contain the same genes, many genes in a particular cell are not active because it only produces the specific proteins it needs;
5. **understand that, in carefully controlled conditions of mammalian cloning, it is possible to reactivate inactive genes in the nucleus of a body cell to form cells of all tissue types;**
6. **understand that adult and embryonic stem cells have the potential to produce cells needed to replace damaged tissues;**
7. recall that new cells in plants specialise into cells of roots, leaves or flowers;
8. understand that unlike animal cells some plant cells remain unspecialised and can develop into any type of plant cell;
9. relate the presence of these unspecialised cells to the production of clones of a plant with desirable features, from cuttings;
10. recall that unlike animals, most plants continue to grow in height and width throughout their lives;
11. understand that plant meristems divide to produce cells that result in increased height, length of roots, and girth of the plant;
12. understand that, if the hormonal conditions in their environment are changed, unspecialised plant cells can develop into a range of other tissues (to include xylem and phloem) or organs (to include leaves, roots and flowers);
13. describe how cut stems from a plant can develop roots in the presence of plant hormones **(auxins)** and grow into a complete plant which is a clone of the parent;
14. understand how phototropism increases the plant's chance of survival;
15. **explain phototropism in terms of the effect of light on the distribution of auxin in a shoot tip.**