Subheading 1

EPIGENETICS AND STEM CELLS

Definition of stem cell

An unspecialised cell which is differentiated and can give rise to specialised cells as well as divide to produce more stem cells

Definition of totipotent stem cell

A cell that has the ability to differentiate into all cell types

Definition of polygenic

A characteristic showing continuous variation caused by multiple genes at different loci

Difference between tissue and organ

Tissue is made of one type of cell whereas an organ is made of different tissues

How a tissue differs in structure from a system

- tissue contains one type of cell
- a system contains (many) {different tissues / organs }

Difference between t. and p. stem cells

1. totipotent cells can { give rise to / differentiate to become } {any cell / extra embryonic tissues / eq }

Difference between t. and p. stem cells (cont)

2. pluripotent cannot { give rise to / differentiate to become } { all cells in the body / extra embryonic tissues / eq }
3. idea that only totipotent cells give rise to other totipotent cells
4. idea that totipotent cells can give rise to an entire human being, pluripotent cells cannot

Cell specialisation / differentiation

1. stimulus / chemical / hormone
2. genes that are (active / switched on / expressed) are transcribed to produce mRNA for the active genes
3. mRNA is translated to produce protein
5. this protein (permanently) modifies cell OR idea that this protein determines { cell structure / function }

Becoming specialised beta cells

1. stimulus e.g. chemical
2. some genes are { active / switched on / expressed }
3. transcription / mRNA produced at active genes
4. mRNA is {translated / used} to produce
5. this protein modifies cell OR idea that this protein

Describe how cells become specialised

1. stimulus / chemical / hormone
2. some genes are { active / switched on / expressed } ;
3. transcription / mRNA produced } at active genes ;
4. mRNA is { translated / used } to produce { protein / polypeptide } ;
5. this protein (permanently) modifies cell OR idea that this protein determines { cell structure / function }

How cells become specialised

- chemical signal cause some genes to be activated/switched on
- only activated genes are transcribed/produce mRNA
- (mRNA leads to) synthesis of specific proteins which causes cell modification

Epigenetic mod. in daughter cells

- genes { activated / deactivated } (in stem cells)
- (because of) { methylation of DNA / histone binding }
- (therefore) the same genes will be activated in the daughter cells

Subheading 2

EUKARYOTES AND PROKARYOTES

rER in transport of proteins within pancreas cell

1. idea that ribosomes synthesise the { polypeptide / protein / eq }
2. proteins { move into / transported through / eq } (the rER)
3. protein is folded / forms {3-D shape / secondary structure / tertiary structure }
4. idea that vesicles (containing the protein) are formed by rER

How insulin is MPS by cell

1. in the rER insulin is folded e.g. forms {3-D shape, secondary / tertiary structure
2. insulin being packaged into (transport) vesicles by the rER ;
3. vesicles { move to / fuse with / eq } the Golgi apparatus / vesicles (fuse to) form the Golgi apparatus ;
4. insulin being changed in Golgi apparatus ;
5. idea of insulin being transferred in (secretory) vesicles from the Golgi apparatus to the cell (surface) membrane ;

How insulin is MPS by cell (cont)

6. vesicles (containing insulin) fuse with cell (surface) membrane / exocytosis ;

Note: MPS (abbreviation since I couldn't fit it in the title): modified, packaged and secreted

Journey of protein in cell

1. proteins are produced on the ribosomes

2. proteins which are produced on the ribosomes on the surface of rER are foded and processed in rER

3. proteins are then modified in the golgi apparatus/body

4. golgi apparatus packages proteins into vesicles around the cell

5. proteins leave the cell by exocytosis once vesicles fuse with the cell membrane

Subheading 3

CELLS AND REPRODUCTION

Definition of a locus

The location of a gene on a chromsome

Definition of a sex-linked disorder

A disorder caused by a { mutated / faulty } gene located on the {X / Y } chromsome

Role of cell cycle

• growth of organism

• asexual reproduction

• repair of tissues

• idea of control of cell { growth / division / mitosis }

Events of fertilisation after acrosome reaction

1. Fusion of sperm cell (membrane) with egg cell membrane

2. Cortical granules release contents (into zona pellucida)

3. Contents of cortical granules react with the zona pellucida / zona pellucida {thickens / hardens }

4. Fusion of { sperm and egg / haploid } nuclei

Role of meiosis in production of gametes

1. idea of producing haploid { nuclei / cells }

2. genetic variation through { crossing over / independent assortment } / eq

3. Random / independent assortment gives rise to { new / different / eq } combinations of (paternal and maternal) chromosomes

4. crossing over involves swapping of { sections / eq } of chromatids

5. new combinations of alleles produced

Mitosis and meiosis comparison

• both mitosis and meiosis increase the number of cells

• mitosis produces diploid cells	• meiosis produces haploid cells
• mitosis produces genetically identical cells	• meiosis produces cells that are genetically different to each other
• mitosis results in 8 spermatocytes from each stem cell	• meiosis results in 4 sperm cells from spermatocyte
• mitosis results in 2 genetically identical daughter cells	• meiosis results in 4 genetically varied daughter cells

How meiosis causes GV in gametes

1. independent assortment { of maternal and paternal chromosomes / eq }

2. crossing over - swapping over { DNA / sections of chromatid } / eq

3. produces recombinants / new combinations of alleles / eq

Interphase (cell cycle)

1. G1 - cell grows bigger and replicates its organelles. A high amount of protein synthesis is taking place in order to build new organelles.

2. S - The cell replicates its DNA

3. G2 - The cell keeps growing until all of the organelles have duplicated.

Mitosis stages

• Interphase – DNA rep / normal cell functions

• Prophase – nuclear membrane breaks down / chromosomes condense become visible

• Metaphase – meet in middle / equator

• Anaphase – chromatids pulled to opposite poles

• Telophase – nuclear membrane reformed – chromosomes lengthen

CO and IA

• crossing over is the exchange of sections of DNA between non-sister chromatids

• independent assortment is a random process where either chromosome from any gamete could be anywhere

Subheading 4

CORE PRACTICAL 5

Controls for CP 5

- same variety/age/length of the garlic root tip
- same stain (toluidine blue stain)
- temperature
- humidity
- mineral ion concentration

Stages of mitosis pract.

1. carefully remove the root tip from an onion that has been grown in water
2. place the root tip in hydrochloric acid which will soften the tissue
3. leave the root tip in the hydrochloric acid for 5 minutes then take it out and place it in distilled water
4. add a few drops of toluidine blue stain
5. add a cover slip on top and macerate the root tip
6. view under a microscope from the lowest magnification first then the highest magnification
7. calculate the mitotic index (insert equation here)

How to prepare a RTS so chromosomes can be seen

1. removal of 5-10mm of root tips
2. use of hydrochloric acid to separate cells / soften tissue
3. add stain, e.g. toluidine (blue), orcein ;
4. heating slide to intensify the colour / stain ;
5. place the root tip on microscope slide, covering and squashing (to separate the cells)

Mitosis practical (another ans.)

1. samples from different distances from the tip of the root taken
2. measure distance from tip using an eyepiece graticule
3. details of root tip squash procedure (e.g. correct use of hydrochloric acid, maceration procedure, squashing to produce single layer of cells)
4. use of an appropriate named stain (e.g. toluidine stain, ethanoic orcein stain)
5. squash { under a coverslip / on a microscope slide }
6. details of how to assess percentage of cells undergoing mitosis (e.g. count total number of cells and number of mitotic cells)

Note: Obviously you need to develop your answer. These are just points...

Mitotic index

$$\text{MITOTIC INDEX} = \frac{\text{NUMBER OF CELLS WITH VISIBLE CHROMOSOMES}}{\text{TOTAL NUMBER OF CELLS}}$$