HPS202 Exam Revision

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Week 1 – Biological Development

DNA

- Looks like a twisted ladder
- Long strands of a chemical substance called deoxyribonucleic acid
- The genes are like a series of letters strung along each rung.
- These letters are used like an instruction book.
- The letter sequence of each gene contains information on building specific molecules (such as proteins or hormones, both essential to the growth and maintenance of the human body).
- The genes are copied 'letter for letter' to a similar substance called ribonucleic acid (RNA).
- Genes are part of chromosomes (DNA)

<u>Genes</u>

- The 46 chromosomes in the human cell are made up of 22 paired chromosomes.
- These are numbered from 1 to 22 according to size, with chromosome number 1 being the biggest.
- These numbered chromosomes are called autosomes.
- Cells in the body of a woman also contain two sex chromosomes called X chromosomes (sex chromosomes), in addition to the 44 autosomes. Body cells in men contain an X and a Y chromosome (sex chromosomes) and 44 autosomes.
- The mother's egg always contributes an X, while the father's sperm provides either an X or a Y.
- An XX pairing means a girl, while an XY pairing means a boy.
- As well as determining sex, these chromosomes carry genes that control other body functions.
- There are many genes located on the X chromosome, but only a few on the Y chromosome.
- 23,000 genes come in pairs.
- One gene in each pair is inherited from the person's mother and the other from their father.
- A sperm and an egg each contain one copy of every gene needed to make up a person (one set of 23 chromosomes each).
- When the sperm fertilises the egg, two copies of each gene are present (46 chromosomes), and so a new life can begin.

How characteristics are inherited from our mother/father

- We can inherit characteristics in many different ways.
- One characteristic can have many different forms – for example, blood type can be A, B, AB or O
- Variations in the gene for that characteristic cause these different forms.
- Each variation of a gene is called an allele.
- We can inherit different alleles of the gene pair (one from each parent) in different ways.

Types of Inheritance

Dominant Genes and Recessive Genes

- Dominant inheritance is when one allele of a gene is dominant within the pair. The other one is recessive.
- For blood groups, the A allele is dominant over the O allele, so a person with one A allele and one O allele has the blood group AO.
- Another way of saying this is that the O group is recessive – a person needs two O alleles to have the blood group O.
- So a child may have blood group A because the blood group A gene inherited from their mother is dominant over the blood group O gene inherited from their father.

- If the mother has an A allele and an O allele (AO), her blood group will be A because the A is dominant.
- The father has two O alleles (OO), so he has the blood group O.
- Each one of their children has a 50 per cent chance of having blood group A (AO) and a 50 per cent chance of having blood group O (OO), depending on which alleles they inherit.

Co-Dominant Genes

- Not all genes are either dominant or recessive.
- Sometimes, each allele in the gene pair carries equal weight and will show up as a combined physical characteristic.
- For example, with blood groups, the A allele is as 'strong' as the B allele. So someone with one copy of A and one copy of B has the blood group AB.

Genotype and Phenotype

- Phenotype is the observable trait
- Genotype is the genes that produce the observable trait
- A person with the alleles AO will have the blood group A. The observable trait – blood group – is known as the phenotype.
- So the person with blood group A and AO alleles has the blood group A phenotype but the AO genotype.

Prenatal Periods

Germinal Period

- Period of the Zygote
- Period of rapid cell replication so that by the time the zygote reaches the uterus it already has hundreds of cells
- Inner cells mass becomes the embryo and outer cell mass becomes the placenta
- Implantation of the zygote in the wall of the uterus
- 0-2 Weeks

Embryonic Period

- The period from implantation until about the end of 8 weeks of gestation
- When all the basic organs are formed – organogenesis
- Embryo begins to respond to direct stimulation
- Very rapid development

- By the third week after conception the embryonic disk begins to differentiate into 3 cells: ectoderm, mesoderm and endoderm.
- Ectoderm- Outer cell- forms skin, hair, teeth, sense organs, brain and spinal cord
- Mesoderm- Middle cell- forms muscles, bones, blood, and circulatory system
- Endoderm- Inside cell- forms digestive system, liver, pancreas, and respiratory system
- 3-8 weeks

Foetal Period

- Referred to as histogenesis
- Organs and systems mature and become functional
- Brain hemispheres develop
- Hormones are released
- Foetus kicks
- Suck and swallow reflexes are present
- Can hear sounds and open and close eyes
- 9 weeks to birth

Teratogens

- Any agent that causes a birth defect
- Maternal disorders, blood disorders, diet, irradiation, drug use, temperature and oxygen levels
- Maternal characteristics, age, emotional state, number of children had
- Thalidomide – drug diagnosed for nausea symptoms caused pregnant women to have children with various birth defects- deformed limbs, phocomelia, face abnormalities, etc.
- Anaemia- death, brain damage
- Diabetes- death, stillbirth, metabolic disorders
- Chicken pox- physical malformation, mental retardation
- AIDS- brain damage, repeated illness, death
- Syphillis- blindness, deafness, mental retardation, death
- Foetal-alcohol syndrome- malformations of head, heart and face
- There are sensitive periods of various kinds of teratogens
- Tissue-specific- some teratogens affect certain parts of the body
- Dose-response relationship- the greater the concentration of the teratogen the greater the effect
- Individual differences- not every baby is affected by teratogens
- Effects on mothers- mothers may not suffer effects from teratogens (e.g. thalidomide)