HPS202 Child and Adolescence Development

Weekly Content Summary

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W1 – Prenatal Development

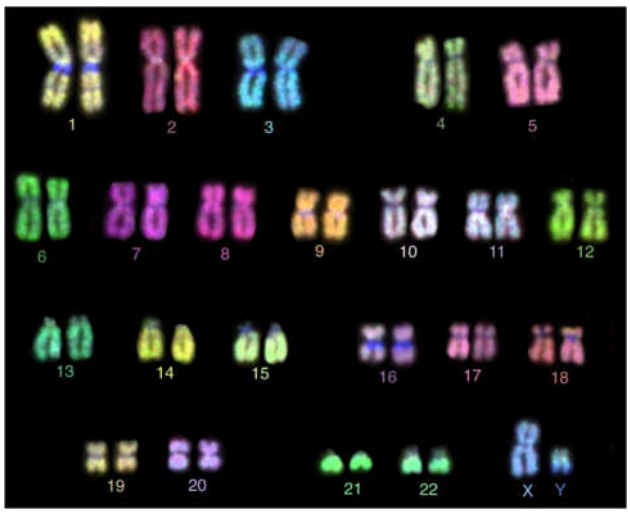
Learning objectives:

- Describe DNA
- Describe how characteristics are inherited from our biological parents
- Describe (Dominant & Recessive, Co-dominant genes)
- Understand the difference between Genotype & Phenotype
- Describe the 3 prenatal periods
- Understand the concept of a teratogen
- Understand
  - Synapses
  - Myelination
  - The contribution of genetics and environmental factors to brain development
  - Brain development in adolescence – which part of the brain develops last?

Each person is made up of cells and inside a cell is a nucleus. In that nucleus, we find chromosomes and each of them contain a strand of double helix held together by chemical bases— this double helix strand is called deoxyribonucleic acid or DNA. On the DNA, there are sequences that provide instructions for creating synthesising proteins and enzymes which in turn create particular aspects of our characteristics— this sequence is called a gene.

Chromosomes – there are 23 pairs (for human) thus 46 altogether.

- One of each pair (along with a gene or one set of instruction) is inherited from our biological mum and the other is inherited from our biological dad.
- Each chromosome is paired by similarity and are numbered (1-22) with #1 being the largest.
- Pair #1 to #22 are autosomes, which carry all genetic info that are necessary to create most of characteristics i.e. height, weight, organs



- The 23th pair is called the sex chromosome which determine the sex of the person (XX is female and XY is male). Thus, the egg from the mother always is the X half of the sex chromosomes and it's the father's sperm that decide the sex (can give X or Y).
- The number of chromosomes DOES NOT correspond to the complexity of that being. I.e. A carp has 104 chromosomes but it's not more complex than a human.

As we know, autosomes carry all the genetic info/instructions to make us and we get half of each pair from our mum and the other half from our dad. But which set of instructions/genes (mum's or dad's) will be used.

Phenotype – refers to the expression of a gene (or genotype). E.g. I have straight hair thus my phenotype is for straight hair or Person A has green eyes so their phenotype is for green eyes.

Genotypes – genetic make-up of a person or a particular type of gene that we carry.

- Sometimes the gene that we carry are always shown in the phenotype such that I could have one gene for straight hair (from mum) and one gene for curly hair (from dad) thus the genotype for me includes curly and straight hair.
- These alternative forms or variations are called allele.
    - Heterozygous genotype – alleles from both parents are difference. E.g. Having 'curly hair' gene from dad and 'straight hair' gene from mum.
    - Homozygous genotype – alleles from both parents are the same. E.g. Instead of having 'curly hair' and 'straight hair' instructions/genes, I have 'straight hair' instruction/gene from both mum and dad.

Recessive inheritance – two copies of the same gene are needed from both parents for a particular trait i.e. hair type to be expressed in the phenotype, thus the genotype has to be homozygous.

Dominant inheritance – only one copy of gene is needed from either parent for the trait to be expressed e.g. Curly hair is the dominant gene so if a foetus has genotype for curly hair and straight hair, only curly hair can be phenotype thus it will then have curly hair.

Co-Dominance inheritance – both characteristics are expressed in phenotype such as blood type. For example, if the egg has a genotype Blood Type A (2 sets) and sperm has a genotype of blood type B (2 sets) then the child will have the genotype of Blood Type A and B thus the child's phenotype will be Blood Type AB.

E.g. Use Punnett's Square to illustrate the types of inheritance

		Father	
		C	c
Mother	**C**	**CC** 1st child	**C**c 2nd child
	c	**C**c 3rd child	cc 4th child

C = Dominant allele (Curly hair)

c = Recessive allele (Straight hair)

According to this table, only the 4th child will have straight hair as he/she inherited the same copies of straight hair gene from the parents i.e. her genotype is homozygous— example of recessive inheritance

The 1st three children inherited 2 different copies of hair type genes from the parents and because Curly hair gene is dominant, the children will have curly hair i.e. their genotype is heterozygous— example of dominant inheritance

Prenatal Development – refers to the development period from conception up until birth. There are 3 periods:

Periods	Characteristics

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Germinal OR Period of the zygote Day 1 to 14	- When the sperm and the egg comes together we have a period of rapid cell division (or cell/neuronal proliferation), a blastocyst (looks like a small golf ball, made up of many cells) is then created. - The blastocyst consists of 2 cell layers: o Trophoblast layer – outer cell mass. Develop into tissue that support, nourish and protect the developing embryo o Embryonic disc – inner cell mass, fluid-filled cavity. Contains the cells that will become the embryo - Implantation – when blastocyst reaches the uterus, trophoblast cells burrow their tiny branches into the spongy wall of the uterus until they come into contact with the maternal blood. - After implantation, membranes grew from trophoblast layer to protect and provide for the developing embryo: o Amnion – inner membrane forms the ammonic fluid (watertight sac to protect the organism from jolts cause by mum's movements, also provide constant temperature and space where it can move), within ammonic fluid a yolk sac is formed which produces blood cells until embryo can do it itself. o Chorion – outer membrane, formed around the amnion. Becomes the foetal part of the placenta (complex organ made up of tissue from both mum and embryo) which acts as **barrier** that prevents blood streams of mum & kid from coming into contact ALSO as a **filter** that allows nutrients and oxygen and waste products to be exchanged. o Allantois – forms umbilical cord which link placenta and embryo
Embryonic OR Period of the embryo Week 2 to 8	- After implantation, we have a period of rapid (structural) development where organogenesis (formation of the basic organs of the body) commences. - Embryonic disc rapidly differentiates into 3 cells layers that will give rise to all parts of the body: o Ectoderm – form the nervous system, skin and hair o Mesoderm – form muscles, bones, circulatory system and other internal systems o Endoderm – form the digestive system, lungs urinary tract and glands - 1st tissue formed is the neural tube or primitive spinal cord

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