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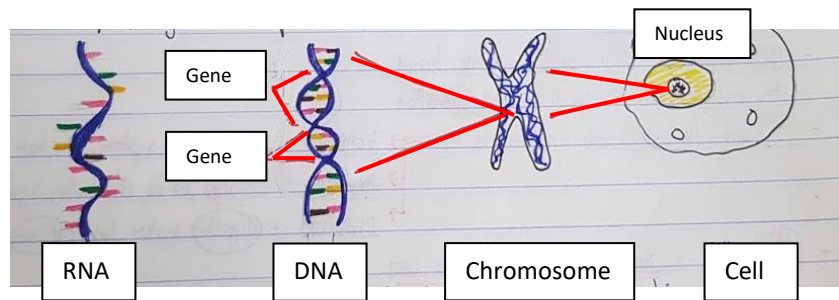
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## Topic 1: Biological development

### Genetics



#### Genes

- Sections of the DNA
- Stored in the nucleus
- Part of the chromosomes
- Made up of DNA
- Are a series of letters strung along each rung: contain information on building specific molecules e.g. Proteins/hormones
- Are copied letter for letter to ribonucleic acid (RNA)

**DNA (deoxyribonucleic acid):** the information coded in genes that's then copied on to RNA

#### Chromosomes

- Humans have 46 chromosomes: 23 pairs
  - Pair 1-22 = autosomes (1st is the biggest, 22nd is the smallest)
  - Pair 23 = sex chromosomes (men: XY, women: XX)
- We have 2 sets of genes/instructions
  - 1 set from the mother (23 chromosomes) = the egg is always X
  - 1 set from the father (23 chromosomes) = the sperm can be either X/Y

**An allele:** variation of a gene

- Homozygous: alleles from both parents are the same (both dominant/recessive)
- Heterozygous: alleles from both parents are different (1 dominant and 1 recessive)

#### Types of inheritance

- **Dominant genes:** over-power the recessive genes e.g. brown eyes, curly hair, A and B blood types
- **Recessive genes:** are over-powered by the dominant genes, need 2 alleles to be present e.g. blue eyes, O blood type
  - E.g. Mother with AO alleles (A blood type) x Father with OO alleles (O blood type)
    - child will have either AO (A blood type) or OO (O blood type)
- **co-dominant genes:** Each allele in the gene pair has equal weight and will show up as a combined physical characteristic (i.e., mixed phenotype)
  - e.g. AB blood group - A allele is as strong as B allele

#### Genotype and phenotype

- **Phenotype:** observable trait
- **Genotype:** genes that produce the observable trait
- E.g. Blood group A is a phenotype, AO alleles is a genotype

### Prenatal development

#### Prenatal periods

1. **Germinal/zygote period:** from conception until implantation of the zygote in the uterus wall
  - Rapid cell replication (multiplication) of the zygote -> Blastocyst (ball of cells)
  - Layers of the blastocyst:
    - **Trophoblast layer** (outer): fluid-filled cavity
      - Develops into tissues that support, protect and nourish the developing embryo
    - **Embryonic disk** (inner)

- Contains the cell that will become the embryo
    - The blastocyst reaches the uterus and then puts out tiny branches that burrow into the uterus wall (i.e., implantation – 6-7 days after fertilisation)
    - After implantation: membranes grow rapidly from the trophoblast layer
      - Layers of the membrane:
        - *Amnion* (inner): forms as a watertight sac full of fluid from the mother's tissue (i.e., amniotic fluid)
          - The amniotic fluid: protects from mother's movement, helps maintain temperature, provides support and a medium to move
          - Inside the amniotic fluid: *yolk sac* - produces blood cells until the embryo can do it themselves
        - *Chorion* (outer): becomes the foetal part of the placenta
          - The placenta: prevents bloodstream from coming into direct contact, allows nutrients, oxygen and waste to be exchanged
        - *Allantois*: forms the umbilical cord
2. **Embryonic period:** from implantation until the end of the 8th week of gestation
  - *Organogenesis*: all the basic organs are formed
  - The embryo begins to respond to direct stimulation
  - In the 3rd week: the embryo disk differentiates into;
    - *Ectoderm*: form the central nervous system, skin, hair
    - *Mesoderm*: form the muscles, bones, circulatory system, internal organs
    - *Endoderm*: form the digestive system, lungs, urinary tract, glands
  - First tissue to form: neural tube/ primitive spinal cord
  - In the end of the 1st month;
    - the brain has begun to develop
    - the heart has formed and begun to beat
    - Muscles are forming
    - The backbone, ribs and digestive system have begun to form
    - Limb buds, the beginning of arms and legs have appeared
  - Second month;
    - Eyes, ears, nose, mouth, neck and limbs develop
    - 7th week - has a rudimentary skeleton
    - 8th week - movement begins, bones begin to harden
    - The brain can direct primitive muscle contractions
    - Sexual development has begun
    - Circulatory system is functioning on its own (the yolk sac is no longer needed)
  - Remaining 7 months: refining, interconnecting and making functional structures
3. **Period of the foetus:** 2/3 through the first trimester
  - *Histogenesis*: organs take on their final form and begin to function
  - End of 1st trimester (13 weeks)
    - The spinal cord is recognisable
    - Kidneys can secrete
    - The sexes are externally different
    - Foetus responds reflexively to a touch on the face
  - End of 2nd trimester (26 weeks)
    - moving/kicking
    - Suck and swallow reflexes are present
    - The brain is differentiating
    - The sheathing of nerve fibres has begun
    - Can hear sounds, close/open eyes
    - Internal genitals are formed