

# **SAMPLE NOTES**

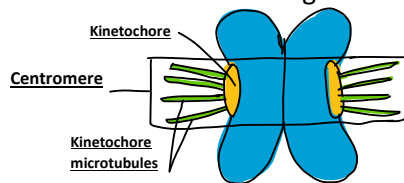
**BIOL10004**

## Cell Cycle

- **G<sub>0</sub>**: quiescence, differentiate into highly specialised cell
- **G<sub>1</sub>**: Gap 1, growth phase
  - **Checkpoint 1**: big enough?
- **S**: DNA synthesis and chromosomes duplicate; thus, nucleus grows
- **G<sub>2</sub>**: Gap before mitosis, growth phase and organisation
  - **Checkpoint 2**: DNA replicated?
- **M**: Mitosis and cytokinesis NO interphase
  - **Checkpoint 3**: are they all there? (during metaphase)

## Mitosis

- **Mitosis**: the process of chromosome condensation, nuclear envelope breakdown, sister chromatid separation and formation of 2 daughter nuclei in eukaryotes. There are 5 phases



- **Aster**: when tubules grow out of centrosome and form star
- **Centrosome**: nucleating points, microtubules grow out and create mitotic spindle

- **Prophase**: sister chromatids condense, spindle starts to form, nuclear envelope disaggregates
- **Prometaphase**: spindle fully formed, microtubules connect to kinetochore
- **Metaphase**: chromatids align along metaphase plate
- **Anaphase**: chromatids separate towards poles – kinetochore microtubules shorten and polar microtubules lengthen to push the poles apart
- **Telophase**: chromosomes decondense, nuclear membrane reforms, cleavage furrow develops
- **Cytokinesis**: cells separate into two identical daughter cells

## Cytokinesis in Plants vs Animal Cells

- **Animal**: contractile ring of actin and myosin pinches and then disappears once cells have split
- **Plant**: 3 key structural differences
  - No true centrosomes as they lack centriole, although they do have similar structures
  - No cell cleavage, densely fibrous phragmoplast forms
  - Preprophase band: microtubules indicating where phragmoplast will form

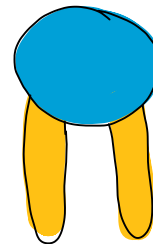
## Cell Membranes & Membrane Transport

### Lipids

- **Lipids** are insoluble in water but soluble in organic solvents. They contain C, H, O but less O<sub>2</sub> than carbohydrates and are great for storing energy
- Simple lipids: contain glycerol and fatty acid
  - **Wax**: 2 hydrocarbon chains, repel water, used by plants
  - **Fat**: ester linkages to 3 fatty acid tails, solid at room temp, saturated (single bonds)
  - **Oil**: ester linkages to 3 fatty acid tails, liquid at room temp, unsaturated (double bonds)
- Complex lipids: **phospholipids** contain 2 ester linkages to fatty acids with 1 negatively charged phosphate head
  - They are **amphipathic** meaning one end likes water and the other repels it
  - Can form a **micelle** (monolayer) or **vesicle** (bilayer)

**Hydrophilic**  
**phosphate**  
**head (polar)**

**Hydrophobic**  
**fatty acid tail**  
**(non-polar)**



### Plasma Membrane

- The **plasma membrane** is an active phospholipid bilayer which separates internal and external cell contents. It contains proteins (transmembrane, integral, peripheral), glycolipids and glycoproteins,

organ), transfer close or in female reproductive tract, fewer gametes, pre-req for viviparity (birth of live young with exceptions of monotremes) *E.g. humans*

### Other Sexual Organs

- **Placenta**: nutrients for foetus, remove waste, hormone production
- **Mammary glands**: nutrients transfer in mammals
- **Brain**: behaviour, hormones

### Strategies

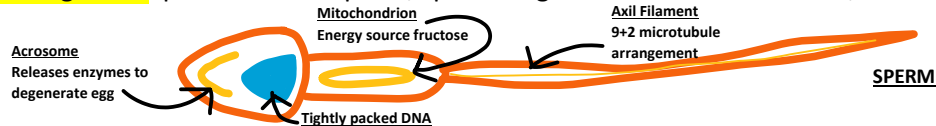
- Reproductive strategy doesn't matter as long as traits are passed on to the next generation

Characteristic	Benefit	Cost
Mating displays	Attracting mates	Attracting predators
Harems (polygynous)	Access to mates	Male fighting
External fertilisation	Physiology the same	Many gametes lost
Internal fertilisation	Make less gametes	Complex physiology
Viviparity	High survival of young	Risk to pregnant mother
Post-natal care	High survival of young	Huge investment for parents

## Reproduction: Gametes and Hormones

### Male Reproduction

- **Testis**: contain highly convoluted seminiferous tubules surrounded by muscular cells
  - **Sertoli (nurse) cells**: inside tubules, produce sperm via spermatogenesis
  - **Leydig cells**: between tubules, produce testosterone (steroid & androgen), precursor cholesterol
- **Spermatogenesis**: production of sperm, spermatogonium divides via mitosis, DNA through meiosis



- **Testosterone**: produced by Leydig, acts via androgen receptors, stimulates sex organs, converted to **oestradiol** by Sertoli cells
- **DHT (dihydrotestosterone)** as a more potent androgen, assists in puberty
- **Hormonal process**: **hypothalamo-pituitary-gonadal (HPG) axis**. Hypothalamus > releases Gonadotrophin releasing hormone (GnRH) > anterior pituitary > LH and FSH
  - **LH**: stimulates testosterone production in Leydig cells
  - **FSH**: stimulates spermatogenesis in Sertoli cells
- **Feedback**: neg as testosterone inhibits GnRH and LH secretion and Inhibin from Sertoli cells inhibits FSH secretion

### Female Reproduction

- **Ovaries**: ovoid shape, tough epithelium
  - **cortex**: follicles
  - **medulla**: connective tissue, blood, nerves
- **Folliculogenesis**: development of follicle, egg surrounded by cumulus cells, goes through oogenesis (maturation via meiosis), follicle contains two main types of cells
  - **Theca cells** (Leydig): outer cells with blood vessel, make androgens from cholesterol in blood
  - **Granulosa cells** (Sertoli): surround egg, make oestradiol from androgen
- **Progesterone** (P4): steroid progestogen, produced by corpus luteum after ovulation, acts via progesterone receptors, regulates sex organs, prepares for implantation on endometrium for embryo, regulator of pregnancy by modulating effects of oestradiol – ‘brake’ to prevent follicle

