BIOL-BLE: YOUR BIOL1020 BIBLE (PART TWO)

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BASED ON SEMESTER 1, 2016 CONTENT

NOTES FROM MODULES IN AND ALL FIGURES FROM PRINCIPLES OF BIOLOGY TEXTBOOK

Welcome to your guide to make it through BIOL1020! There is a lot of content, but hopefully the biol-ble will help you to manage and understand it all.

Included in Part Two are all modules covered in Weeks 5-7 of Semester 1, 2016 in preparation for Mini Test 2. These are modules 32, 33, 47-54, 56-58 and 60. Parts One, Three and Four are also available for purchase on StudentVIP.

Due to the interactive nature of the Principles of Biology textbook, some figures may be referred to that are not found here, and that is likely as they are interactives exclusively available by purchase of the online textbook.

Please note that this should in no way serve as a replacement for a completing required readings, but are an extensive additional resource and great for exam revision.

Many abbreviations as well as acronyms have been used as shorthand within modules and for this reason a comprehensive table containing all of them and their relevant meanings in alphabetical order has been provided at the end of the biol-ble.

Good luck in your studies!

Module 32 Cell Division

- One cell to two cells via **cell division (CD)**
- Two daug. cells almost genetically identical to parent cell
- Multicellular like humans, CD for growth and replacing damaged/worn-out cells e.g. cells lining oesophagus only last 2 or 3 days before replaced
- CD to repair injury e.g. skin cells over a wound or broken bone knits
- Dividing cells in animal embryos are **stem cells** and prod. all specialised cells
- PK via **binary fission (BF)**, EK cells via **mitosis** or **meiosis**
- During BF, B replicate their genetic material (usually single chromo.-like struc.), grow to certain size and then split into 2 daug. cells (Fig 1)
- Mitosis, EK cells prod. exact copies of parent cell's chromo. and make 2 sep. nuclei followed by **cytokinesis** to prod. 2 daug. cells
- Meiodid, daug. cells w/ half # chromo. of parent cell (not exact copies) - creates **gametes** which fuse w/ another gamete during sexual reprod.
- PK CD:
    - Most B w/ 1 circular chromo. and no nucleus
    - B DNA still has lots of info. for survival e.g. *Escherichia coli* are B in human gut and other environ. and if stretched out, chromo. is 1500x length of *E.coli* cell - this is facilitated by proteins that **supercoil** DNA into compact struc.
    - Use fluoro. molecules to label OOR:
        - As DNA rep., labelled region goes in opp. directions from single pt. of origin until 2 rep. forks meet and complete duplication of chromo.
        - Cell increases in size
        - Two copies of B genome sep. and move to opp. ends of cell (or in some B, diff. spec. places)
        - One protein appears to help chromo. move, another seems to help pinch the PM together to sep. parent cell to 2 daug. cells
        - Other cellular components gather near pt. of division to redirect cell wall formation and prevent DNA damage
        - If DNA rep. finishes w/out errors, each daug. cell will have same genome as parent cell

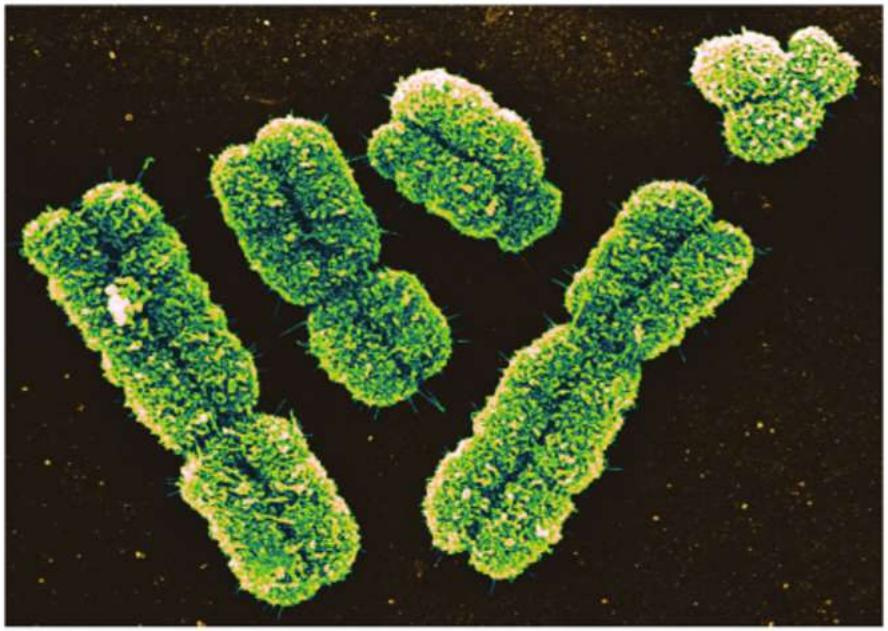

FIGURE 2 Condensed human chromosomes. Scanning electron micrograph of several human chromosomes in a condensed form prior to cell division. magnification = 25,000×

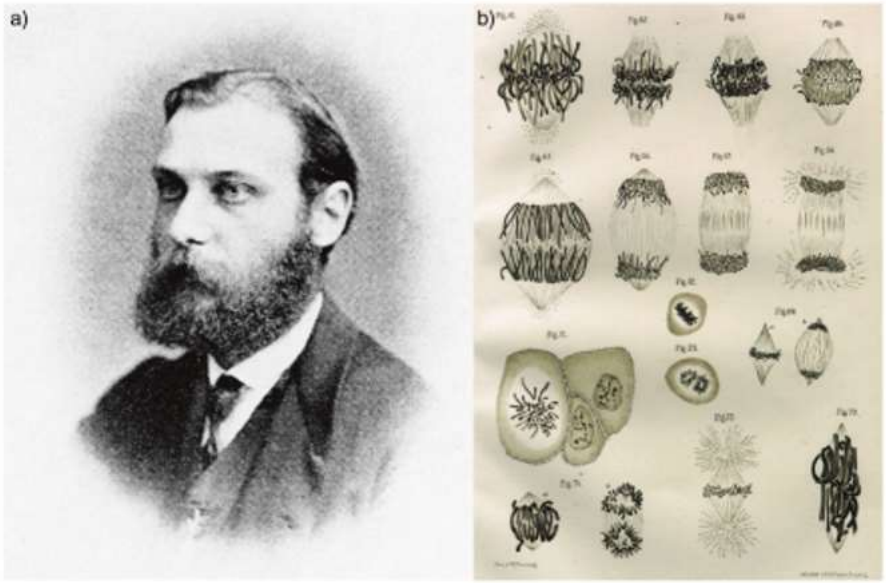

FIGURE 3 Walther Flemming and his late 19th century illustrations of mitosis. a) Walther Flemming was the first to record the process of mitosis. b) Drawings of mitosis created by Flemming. These drawings inspired many textbook illustrations.

- In harsh environ., many B prod**. endospores**, dormant forms that can survive under severe environ. conditions:
  - e.g. common soil B, ***Bacillus subtilis***, may prod. resilient endospore w/in parent vegetative cell that can live for 1000s of years - when conditions favour growth of species, endospore germinates to prod. normal B
- Other B prod. spores as part of their life cycle:
  - e.g. ***Metabacterium polyspora*** (a B that lives symbiotically in the guinea pig gastrointestinal tract):
    - Prod. endospores that pass into individual's faeces
    - Faeces eaten by animal to extract more nutrients
    - Endospores pass via stomach and germinate into viable B at small intestine
- 3D microscopy techniques e.g. scanning e^- microscopy (SEM) prod. images of cell's surface and help visualise B reprod.
- Certain B reprod. asymmetrically by **budding**, breaking off daug. cells from tip of B or end of a stalk
- In some species, daug. cell immediately develops into cell identical to parent
- Others, daug. cells enter diff. part of life cycle:
  - e.g. ***Pedomicrobium***:
    - Cells are immobile but prod. flagellated buds that swim away from the parent before maturing into immobile adults
    - Daug. cells move in search of food and improve survival by reducing competition among newly formed cells
- 1 division, 2+ cells:
  - e.g. in stressful environ. conditions:
    - Some B undergo multiple fission events
    - Some cyano.-B always reprod. via multiple fission events
    - e.g. cyano.-B ***Stanieria*** rep. DNA but don't increase size of cytoplasm before CD - divide rapidly many times to prod. up to 1000 small cells called **baeocytes**
    - Rupture of multiple cell walls that have formed releases baeocytes
    - e.g. ***Streptomyces coelicolor*** grow underground by extending fil. that break into multiple long cells - when nutrients depleted, B extend above ground and release spores into the air

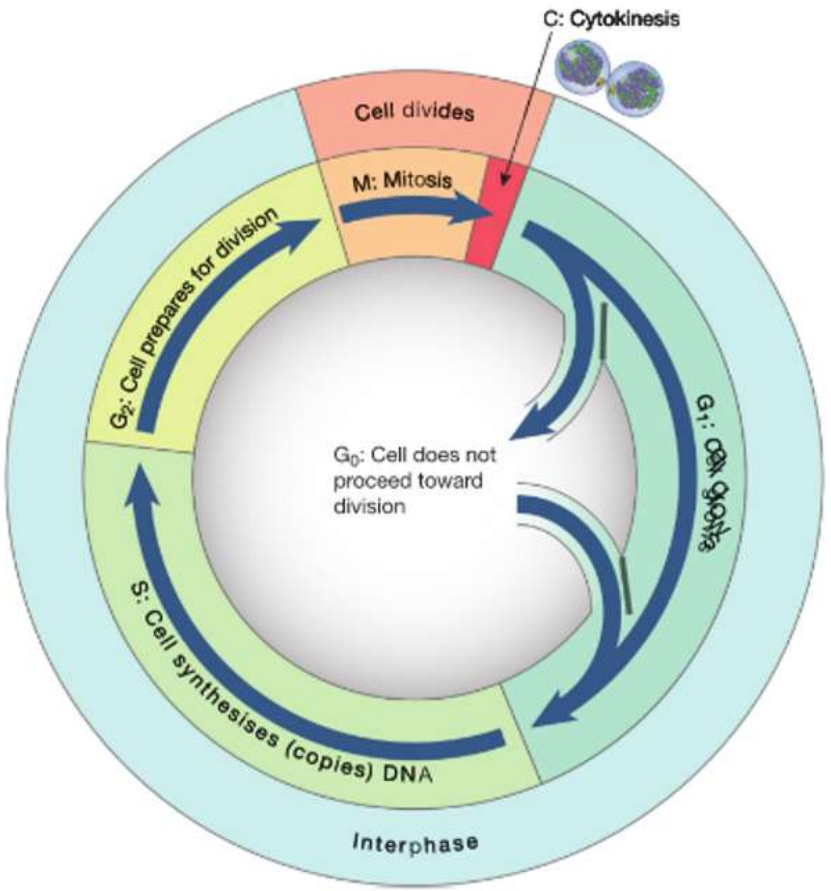

FIGURE 4 The cell cycle. In the cell cycle, interphase includes the G_1, S and G_2 phases. Non-dividing cells can remain in interphase indefinitely by entering the G_0 phase. The relatively short processes of cell division include mitosis and cytokinesis.