

BIOL10004 REVISION (semester 1)
CELL BIOLOGY

Evolution: single most important concept in biology
 2 step process: variability, natural selection (ordering of variability – descent with modification)

Evolution through natural selection – CHARLES DARWIN
 Can account for the diversity and relatedness through natural selection

First generalisation of biology – theory of common descent

- All organisms arose from more primitive forms
- All organisms therefore must be related or share a common ancestry

Second generalisation of biology – unity of biochemical processes

- Organisms share certain biochemical processes/reactions

Third generalisation of biology – all organisms consist of cells

Cell theory

All living organisms are composed of cells
All cells come from pre-existing cells
The cell is the smallest organisational unit

Cell membranes – selectively permeable – permitting the regulation of inflow and outflow

Darwin's dilemma - to explain the origins of life on Earth
 Where did the first cell(s) come from?

2 major events during the pre-cambrian period

- Origin of life - first cells were small in size and simple in structure (prokaryotes)
 - Origin of these cells are unknown
- Emergence of a new kind of cell – in these new cells genetic material is aggregated into a distinct nucleus bound by membrane (eukaryotes)

Structure and function of prokaryotic cells

Early earth history - atmosphere/oceans had 0 oxygen, high CO₂, ammonia, methane & intense radiation
 Prokaryotes can be used in biotechnology applications – GM (gen. modified) bacteria to make pharmaceuticals

Photosynthetic cyanobacteria changed this;

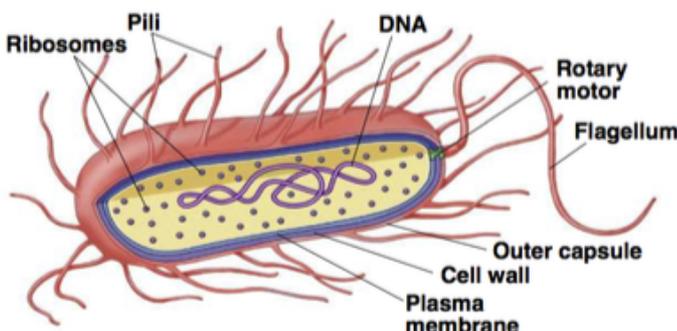
- Primary producers, started to photosynthesize and produce oxygen
 - o Contain Chlorophyll A, plus phycocyanin and phycoerythrin as accessory pigments

Prokaryotes vs Eukaryotes

(no nucleus/cell components) vs (nucleus)

Two domains of prokaryotes: BACTERIA (including cyanobacteria) and ARCHEA (simplest of cells)

PROKARYOTIC CELL STRUCTURE



- Semi rigid cell wall – shape maintenance
- Semi permeable plasma membrane
- Cytosol – liquid component inside cells
- Amount of ribosomes in cell depends on how metabolic the cell is
- Cytosol + ribosomes = cytoplasm
- Single, circular DNA in an area called the nucleoid
- Outer capsule – cell recognition
- Pilli – communication to other cells

Hypothalamo-pituitary control of ovary

- Hypothalamo-pituitary-gonadal axis

1. Follicle growth	2. Ovulation	3. After ovulation
GnRH stimulates LH and FSH released from the pituitary - FSH stimulates follicle growth/oogenesis, oestradiol production Oestradiol regulates GnRH (negative feedback)	Females only ovulate when oestradiol levels are high - Large follicles → high oestradiol (high E2 → positive feedback) Surge of LH causes ovulation (follicle remainder makes corpus luteum) High E2 prepares the brain for mating	Ovulated follicle transforms into corpus luteum - Oestradiol production fails - Progesterone production increases Progesterone → negative feedback on FSH → prevent follicle growth

Contraception

Contains either progestin or a combination of progestin/oestrogen mix

Increased breast cancer exposure to oestrogen → positive feedback → risk of breast cancer

- Oral and injectable contraceptive pill
 - o Progestin + oestrogen
 - o Suppress GnRH in the hypothalamus
 - Lowers FSH and LH
- Prevents follicle growth and ovulation

Methods of contraception

- Vasectomy (vas deferens cut and tied)
- Tubal ligation (fallopian tubes cut and tied)
- PROTECTION (condoms etc.)

Diversity

Diversity within species

- Phenotypic: observed variation in individuals in morphology, development or behaviour
- Genotypic: genes an organism inherits, underlying and critical sources of diversity

Diversity is a product of evolutionary processes

Evolutionary forces contributing to diversity: mutation, migration, selection, drift

<p>Mutation Change to the structure of an organisms DNA</p> <ul style="list-style-type: none"> - Accumulation of many mutations required for an actual evolutionary change - Germline mutations (in cells that produce eggs/sperm) can be passed on 	<p>Migration (gene flow) Movement of genes between populations</p> <ul style="list-style-type: none"> - Gene flow varies across species - Can introduce/reintroduce genes to different parts of populations increasing genetic variation
<p>Natural Selection Individuals vary in attributes/traits</p> <ul style="list-style-type: none"> - Selection acts on individuals not species <p>Favours individuals that produce more offspring</p> <ul style="list-style-type: none"> - Species competition is an ecological process not evolutionary 	<p>Genetic drift 'Random' changes to the genetic makeup of a population</p> <ul style="list-style-type: none"> - Does not produce adaptations - Two common forms: genetic bottlenecks (less varied populations), founder effects

Genetic drift is not responsible for adaptations, natural selection is