

Biology Outcomes

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The Microscope

Light Microscopes

1. Check that lenses are clean and undamaged.
2. Swing L.P. objective into line.
3. Switch on light source (0 = off, 1 = on).
4. Adjust light intensity (on the right hand side of the base), 4-5 is adequate for most specimens.
5. Position slide on stage.
6. Focus on the specimen by rotating the coarse focusing knob (the large, outer ring). Watch from the side while raising stage then look down eyepiece while lowering stage to focus on specimen.
7. Raise condenser and open iris diaphragm, move specimen aside
8. Lower the condenser until paper on light source is in focus.
9. Adjust iris diaphragm by removing eyepiece and closing the diaphragm until 3/4 of the field of view is illuminated.
10. Replace specimen, fine focus with the smaller central knob.
11. Centre specimen.
12. Position H.P. objective.
13. Adjust iris diaphragm.
14. Fine focus.

Scaling drawings

- A scale is necessary on all drawings so the representation can be related to the **size** of the specimen.
- A scale rather than a magnification is used as photo-reduction or photo-enlargement may cause **distortion**.
- Scale bars are drawn **horizontally**.
- Scale bar units should be **whole numbers** and should represent about a **quarter** to a **third** of the size of the drawn object.

Estimating size of drawings

- When the diameter of the field of view of an objective lens is known, the approximate size of an object viewed on a slide can be determined by estimating the **number of times** the object fits across the **diameter** of the **field of view**.

Cell Structure

Cell Theory

- A cell is the basic structural and functional unit of living organisms. So when you define cell properties you are defining the properties of life.
- The activity of an organism depends on both the individual and the collective activities of its cells.
- According to the principle of **complementarity of structure and function**, the biochemical activities of cells are dictated by the relative number of their specific subcellular structures.
- Continuity of life from one generation to another has a cellular basis

Cells – structure and function

Structure of Cells

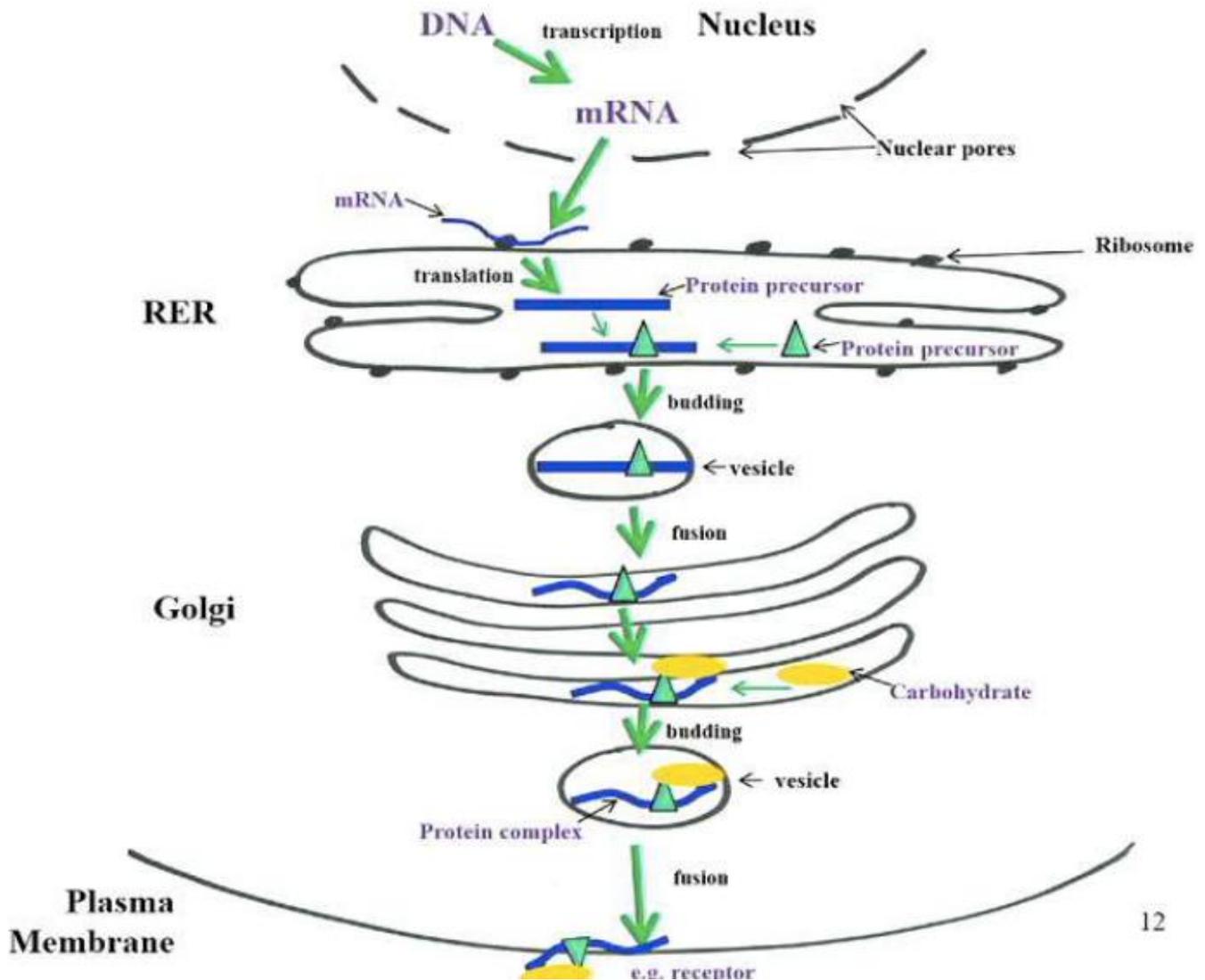
- Nucleus – Contains genetic material of cell (DNA) and nucleoli; site of RNA synthesis and ribosomal subunit assembly
- Nucleolus – assembles ribosomes
- Nuclear Envelope
 - Have nuclear pores
- Ribosome – Site of protein synthesis
 - mRNA → protein precursor
- Rough endoplasmic reticulum (RT) – assemble proteins
- Smooth endoplasmic reticulum (sarcoplasmic reticulum) – assembles lipids, detoxify poisons (a lot found in liver and muscles)
- Mitochondrion – produces ATP (therefore energy for the cell); site of aerobic respiration
 - Enzymes on Cristas inside mitochondria
 - Theory that it was produced from bacteria (evolution)
- Golgi Apparatus – Process and package proteins
 - Carbohydrates, lipids
 - Hormones and channel proteins
- Lysosome – breakdown waste

- Digest particles
- Cells defense
- Centriole
- Cytoplasm (cytosol) – liquid inside cell in which everything is held
- Cytoskeletal filaments – hold cell in place
 - Microtubules (centrioles, cilia and flagella)
 - Intermediate filaments (Mechanical support for cells, actin and myosin)
 - Microfilaments (microvilli – little hairs, anchor membrane proteins – anchor receptors)
- Vesicle – Transports cell
- Plasma Membrane (cell membrane) – Allows certain things into cell (by diffusion)
 - Protein channels and pumps – any channel or pump in the cell membrane
 - Made up of phospholipids
 - Phosphate containing heads are hydrophilic
 - Non-polar fatty acid ends are hydrophobic
 - Selectively permeable
 - Allow some substances (lipid-soluble molecules) but not others (non-lipid soluble molecules)
 - Passive and active transport
 - Exocytosis
 - Secretory vesicles leave the cell
 - Endocytosis
 - Vesicle forms and enters cell
- Projections
 - Cilia – move substances over surfaces of certain cells
 - Flagella – propel sperm cells
 - Microvilli - Increase the surface area of certain cells
- ATP
 - Breaks down into adenine diphosphate and energy

Function of Cells

- Cell metabolism and energy use
- Synthesis of molecules
- Communication
- Reproduction and inheritance

The endomembrane system



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Surface area to volume ratios (cells)

- surface area to the volume ratio gets smaller as the cell gets larger
- Larger cells have a lower SA:V ratio so their overall heat loss relative to surface area will be lower than that of smaller cells.
- **1. Why does the rate of diffusion into or out of a cell decrease as the cell increases in size?**
 - The rate of diffusion into or out of a cell decreases as the cell increases in size because there is less surface area per unit of volume across which to exchange substances.
- **2. What determines the maximum size to which a cell can grow?**
 - The maximum size to which a cell can grow is determined by the rate of diffusion of nutrients and gases across the cell surface.
- **3. How can a cell increase the maximum size to which it can grow?**