

BIO152 Cell Biology

Learning Objective Notes

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Cell structure

- Introduction to cells
- Cell ultrastructure

Proteins, enzymes, membranes

- Protein biosynthesis
- Protein structure
- Enzymes
- Membranes and transport processes

Cell energy generation

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- The TCA cycle
- Oxidative phosphorylation and growth
- Alternative fuels
- Gluconeogenesis

Prokaryotic metabolism and growth

- Diversity of prokaryotic metabolisms
- Photosynthesis

DNA replication, mutation, expression

- Mutation

Eukaryotic cellular growth, genetic diversity and inheritance

- Eukaryotic cell growth and death
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- Meiosis and genetic diversity
- Single gene inheritance
- Sex determination and inheritance
- Differentiation

Cell Structure

Introduction to cells

Learning objectives:

- Understand cell theory
- Identify limiting factors for cells
- Identify features that distinguish prokaryotes from eukaryotes

Understand cell theory

1. All organisms consist of one or more cells
2. The cell is the basic unit of life
3. All cells come from pre-existing, living cells

All cells contain: plasma membrane, DNA, ribosomes, cytoplasm

Identify limiting factors for cells

- Cells need to exchange molecules, gases, etc over large surface area

Two options:

- Cells remain unicellular but are small and unsuccessful (bacteria)
- Large, multicellular, complex organisms, but still with small cells

Prokaryotes vs Eukaryotes

	Prokaryotes	Eukaryotes
Cell No.	Single-celled	Single or multi-celled
Growth	rapid	slow
Size	Small 0.5-3µm	Large (5-20µm)
Nucleus	None	Yes
Membrane-bound organelles	None	Many
Chromosome (DNA)	Single circular	Double linear
Ribosomes	Small 70S	Large 80S
Cell wall	Mostly present	Present in some
Cell division	Binary fission	Mitosis
Examples	Bacteria & archaea	Animals & plants

Cell ultrastructure

Learning objectives:

- Name major organelles in eukaryotic cells and describe structure and function
- Describe distinguishing features of plant and animal cells

Major organelles in eukaryotic cells

Organelle	Structure	Function
Cell Membrane	<p>Phospholipid bilayer with pores (proteins)</p> <p>Polar head, non polar tail</p>	<ul style="list-style-type: none"> Define compartment Cell to cell communication Endocytosis (taking in external environment) and exocytosis (secretion)
Nucleus	Double membrane, pores, nucleolus	<ul style="list-style-type: none"> Chromosomes (DNA) Histones: DNA binding proteins
Mitochondria	Double membrane, cristae (inner folds), DNA, matrix, enzymes	<ul style="list-style-type: none"> Cristae generate ATP for energy Aerobic respiration Electron transport
Endoplasmic Reticulum	Single membrane, lumen inside, attached to nucleus	<ul style="list-style-type: none"> Rough = protein synthesis Smooth = lipid/steroid synthesis, detoxification
Golgi Apparatus	Single membrane-bound sacs, lumen	<ul style="list-style-type: none"> Forms vesicle and secretes from cell by fusing with membrane Synthesis of complex sugars (polysaccharides)
Lysosome	Single membrane bound vesicle	<ul style="list-style-type: none"> Destroy/lyse material in vesicles Recycle cell contents Store enzymes
Chloroplast	Double membrane, thylakoids in third membrane joined by tubular membranes, forms granum	<ul style="list-style-type: none"> Photosynthesis
Peroxisome (plant and animal)	Vesicle, single membrane, crystalline core	<ul style="list-style-type: none"> Buds from ER Packages and destroys hydrogen peroxide (H_2O_2) by turning into water and oxygen using catalase Protects from damaging reactive oxygen species

