Biology Guardian

BIOLOGY GUARDIAN

Chapter # 1

CELL STRUCTURE AND FUNCTIONS

SLO = 2006

NBF
KPK
BTB

Lecture # 1

2000

Fresh = MCQ, SQ, LQ

MDCAT = MCQ

By

Abid Ali Mughal

Assistant Professor/Head of Biology Department

slamabad Model College for Boys H-9, Islamabad

biologyguardian@gmail.com

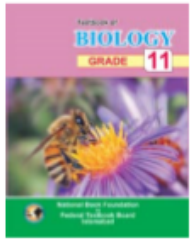
1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

OUR MOTTO

• Standards • Outcomes • Access • Style

Textbook of
Biology Grade - 11



Note:
The material given in the box (Science titbits, Did you know, Critical thinking, STSC, Activity, Teacher's Point) and parenthesis are not part of the text or SLO's.

Authors : **Prof. Jawaid Mohsin Malick**

Prof. Abid Ali Mughal

Pedagogical Author :
Elaborator / Designer : **Hafiz Rafiuddin, Mr. Shahzad Ahmad**
Editor : **Majeed-ur-Rehman Malik**
Management of : **Ishtiaq Ahmed Malik**
Supervision of : **Prof. Dr. Attash Durrani (T.I., S.I.), Advisor FTBB (NBF), Member National Curriculum Council**

First Edition	:	2013	Qty: 60,000
New developed edition	:	2017	Qty.: 18000
3rd Print	:	April 2018	Qty: 30000
Price	:	Rs. 280/=	
Code	:	STE-512	
ISBN	:	978-969-37-1038-0	
Printer	:	Zeeshan & Ahmad Printing Press Lahore.	

for Information about other National Book Foundation Publications,
visit our Web site **http://www.nbf.org.pk** or call **92-51-9261125**
or Email us at: **books@nbf.org.pk**

Contents

1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

In the Name of Allah, the Most Gracious, the Most Merciful

CONTENTS

1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

SECTION 1

Cell Biology

Electron microscope

1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

1

CELL STRUCTURE AND FUNCTIONS

After completing this lesson, you will be able to

This is a 16 days unit

- List the principles and identify the apparatus used in the techniques of fractionation, differential staining, centrifugation, micro-dissection, tissue culture, chromatography, electrophoresis and spectrophotometry.
- Describe the terms of resolution and magnification with reference to microscopy.
- Explain the use of graticule and micrometer.
- Describe the locations, chemical compositions and significance of the primary and secondary cell walls and of middle lamella.
- Explain the chemical composition of plasma membrane.
- Rationalize the authenticity of the fluid mosaic model of plasma membrane.
- Relate the lipid foundation and the variety of proteins of the membrane structure with their roles.
- Identify the role of glycolipids and glycoproteins as the cell surface markers.
- Explain the role of plasma membrane in regulating cell's interactions with its environment.
- Describe the chemical nature and metabolic roles of cytoplasm.
- Distinguish between smooth and rough endoplasmic reticulum in terms of their structures and functions.
- Explain the structure, chemical composition and function of ribosome.
- Describe the structure and functions of the Golgi complex.
- State the structure and functions of the peroxysomes and glyoxysomes in animal and plant cells.
- Describe the formation, structure and functions of the lysosomes.
- Interpret the storage diseases with reference to the malfunctioning of lysosomes.
- Explain the external and internal structure of mitochondrion and interlink it with its function.
- Explain the external and internal structure of chloroplast and interlink it with its function.
- Describe the structure, composition and functions of centriole.
- Describe the types, structure, composition and functions of cytoskeleton.
- Explain the structure of cilia and flagella and the mechanisms of their movement.
- Describe the chemical composition and structure of nuclear envelope.
- Compare the chemical composition of nucleoplasm with that of cytoplasm.
- Explain that nucleoli are the areas where ribosomes are assembled.
- Describe the structure, chemical composition and function of chromosome.
- List the structures missing in prokaryotic cells.
- Describe the composition of cell wall in a prokaryotic cell.
- Differentiate between the patterns of cell division in prokaryotic and eukaryotic cells.
- Relate the structure of bacteria as a model prokaryotic cell.

Learning Objectives

- Introduction
- Concept of cell and cell theory
- Techniques used in cell biology
  - Cell Fractionation
    - Homogenization
    - Centrifugation

1st Year
NBF Biology
Lecture # 1

The Cell

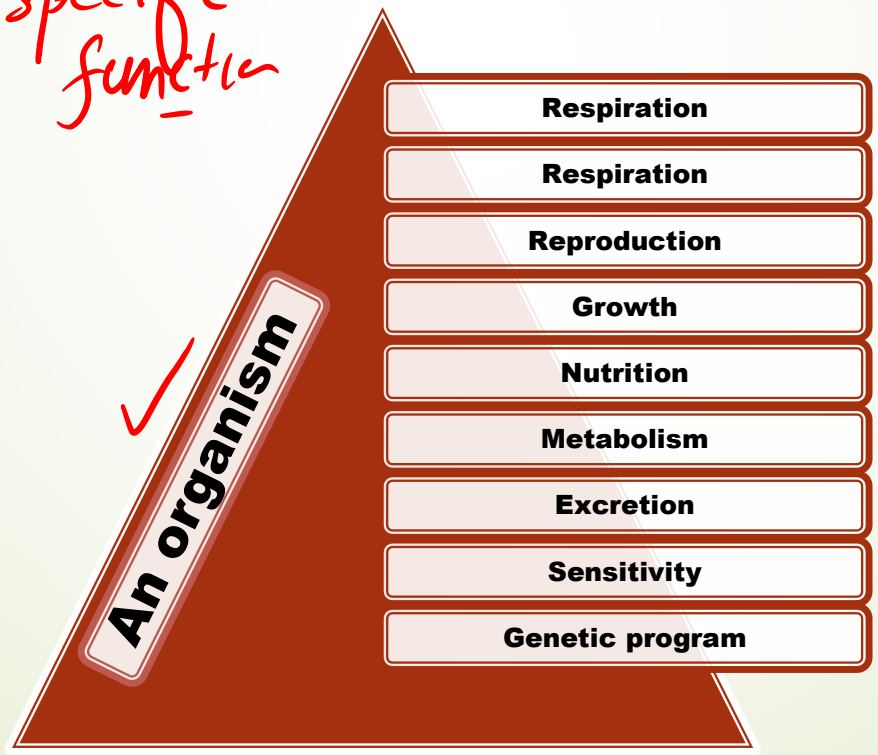
BIOLOGY GUARDIAN

Fundamental structural and functional unit of an organism

Brick

Cells → Tissues → Organs → Organ Systems → Whole Organism

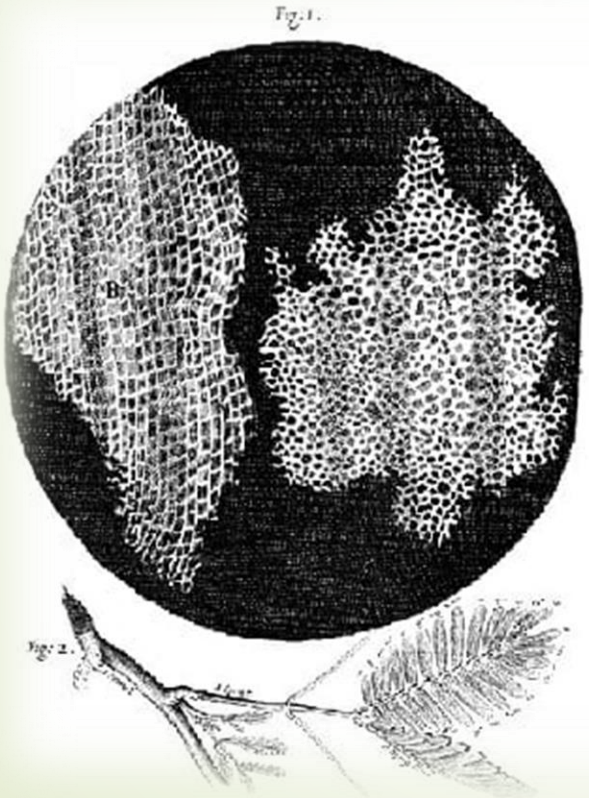
specific function



Cell Theory

= Generalization about a cells.
All living beings are composed of one or more cell

Year	Scientist/	Contribution/event
1665	Robert Hook	Discovery of cell



Empty boxes bounded by thick wall

cell = cellula = Box / Compartment

Micrographia

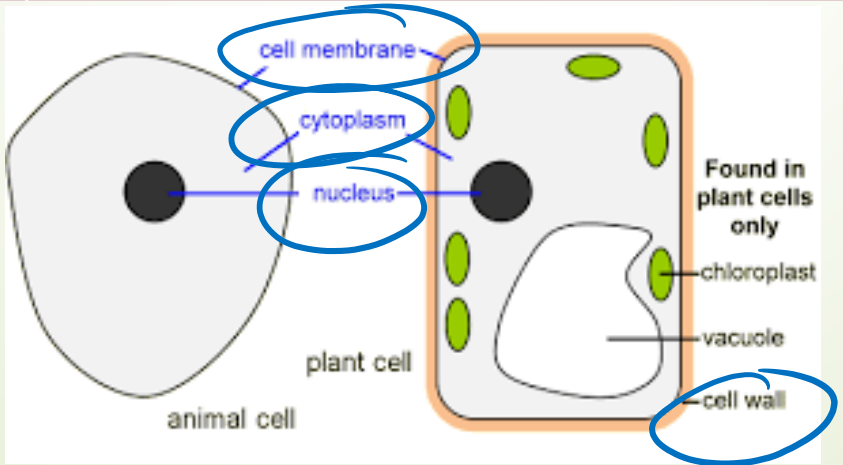
Cell Theory

Extra Reading Material

Year	Scientist/	Contribution/event
1665	Robert Hook	Discovery of cell
1805	Lorenz Oken	"All living beings originate from or consist of vesicles or cells"
1809	Lamark	"No body can have life if its constituent parts are not cellular tissues or not formed by cellular tissues"
1831	Robert Brown	Discovery of nucleus
1838	Schleiden (Botanist)	All plants are composed of cells
1839	Schwann (Zoologist)	All animals are composed of cells

Empty - boxes or

All living beings are composed of cells



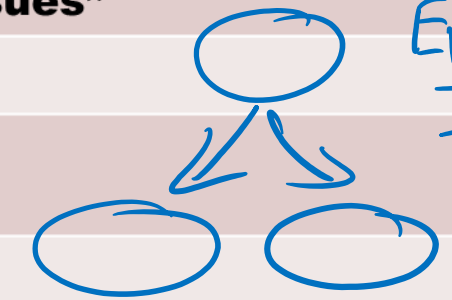
1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

Cell Theory

Extra Reading Material

Year	Scientist/	Contribution/event
1665	Robert Hook	Discovery of cell
1805	Lorenz Oken	"All living beings originate from of consist of vesicles or cells"
1809	Lamark	"No body can have life if its constituent parts are not cellular tissues or not formed by cellular tissues"
1831	Robert Brown	Discovery of nucleus
1838	Schleiden (Botanist)	All plants are composed of cells
1839	Schwann (Zoologist)	All animals are composed of cells
1855	Rodolph Wirschow	New cells always arise by the division of pre existing cells
1862	Loise Pasteure	Provided experimental evidence of biogenesis
1885	August Weismann	All presently living cells have common origin because of their basic similarities in structure and molecules



Abiogenesis
Life can be originated from Non living

1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

Cell Theory

Salient features

(1) All organisms are made up of one or more cells.

(2) Cells arise from other cells through cellular division.

(3) The cell is the fundamental unit of structure and function in living things.

(4) Cells carry genetic material passed to daughter cells during cellular division.

(5) All cells are essentially the same in chemical composition.

1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

Cell Fractionation

- Homogenization
- Centrifugation
  - Differential centrifugation
  - Density gradient Centrifugation

- Cell fractionation is the combination of various methods used to separate a cell organelle and components based upon size and density.

Purpose

- It is very useful for electron microscopy of cell components.

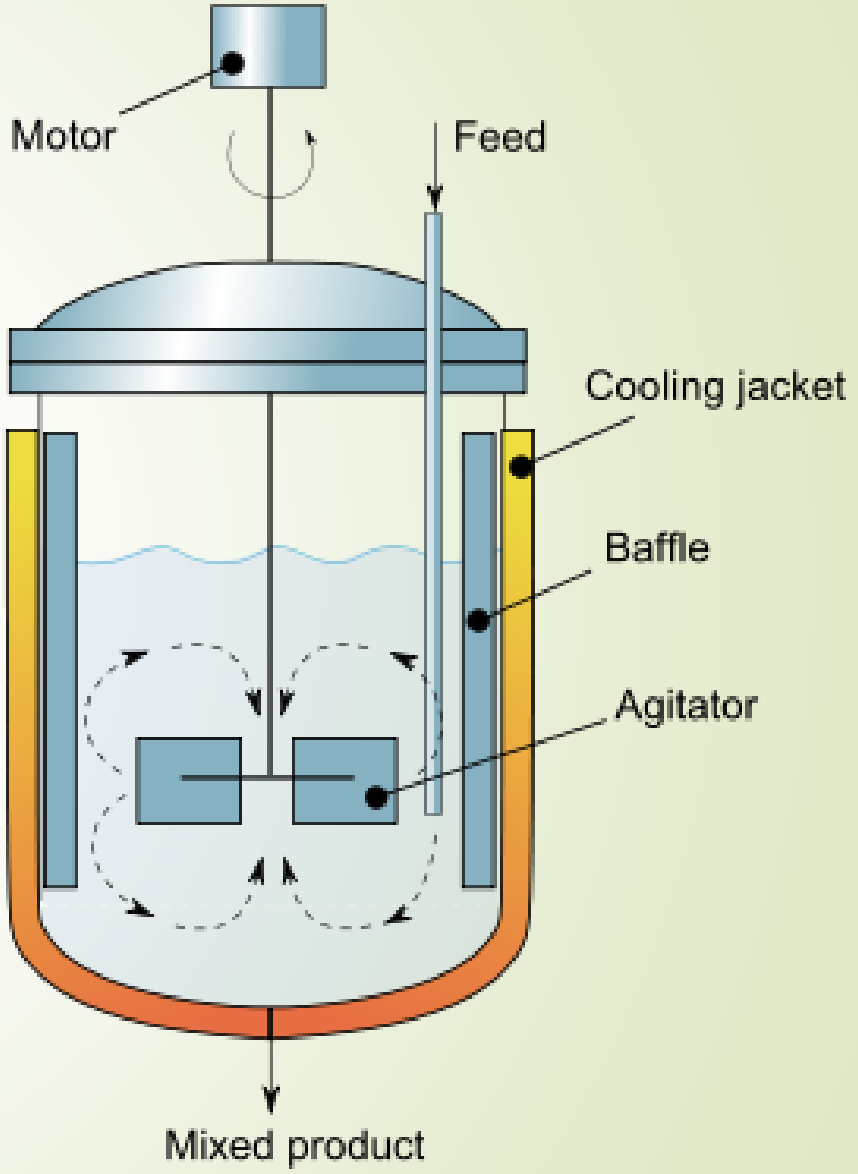
1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

Cell Fractionation

Homogenization

- It is the formation of a homogenous mass of cells (cell homogenate or cell suspension).
- It involves the grinding of cells in a suitable medium with correct pH, ionic composition, temperature and in the presence of certain enzymes that can break the cementing substance of cells.
- For example pectinase which digest middle lamella among plant cells.
- This can be done in a cell homogenizer (food mixer/blender).
- This procedure gives rise a uniform mixture of cells i.e., cell homogenate. The resulting mixture is then centrifuged.



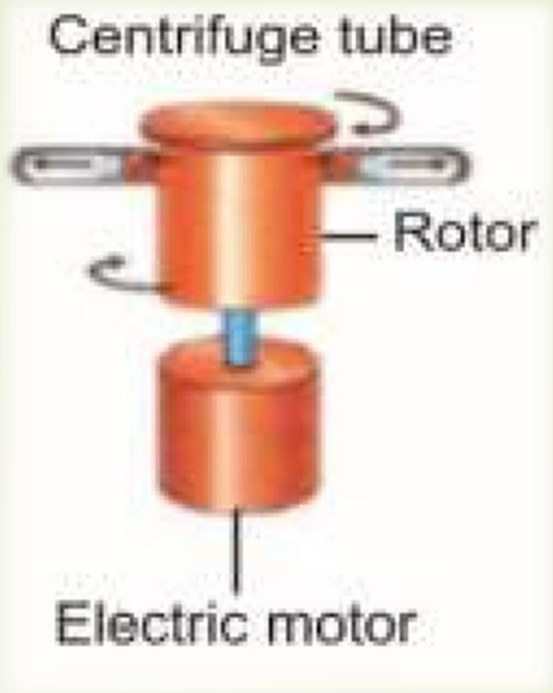
1st Year
NBF Biology
Lecture # 1

BIOLOGY GUARDIAN

Cell Fractionation

Centrifugation

- Centrifugation is the process to separate substances on the basis of their size and densities under the influence of centrifugal force.
- It is done by the machine called centrifuge.
- This machine can spin the tubes. Contents are kept in tubes that are much like the test tubes. Spinning the tubes exerts a centrifugal force on the contents.

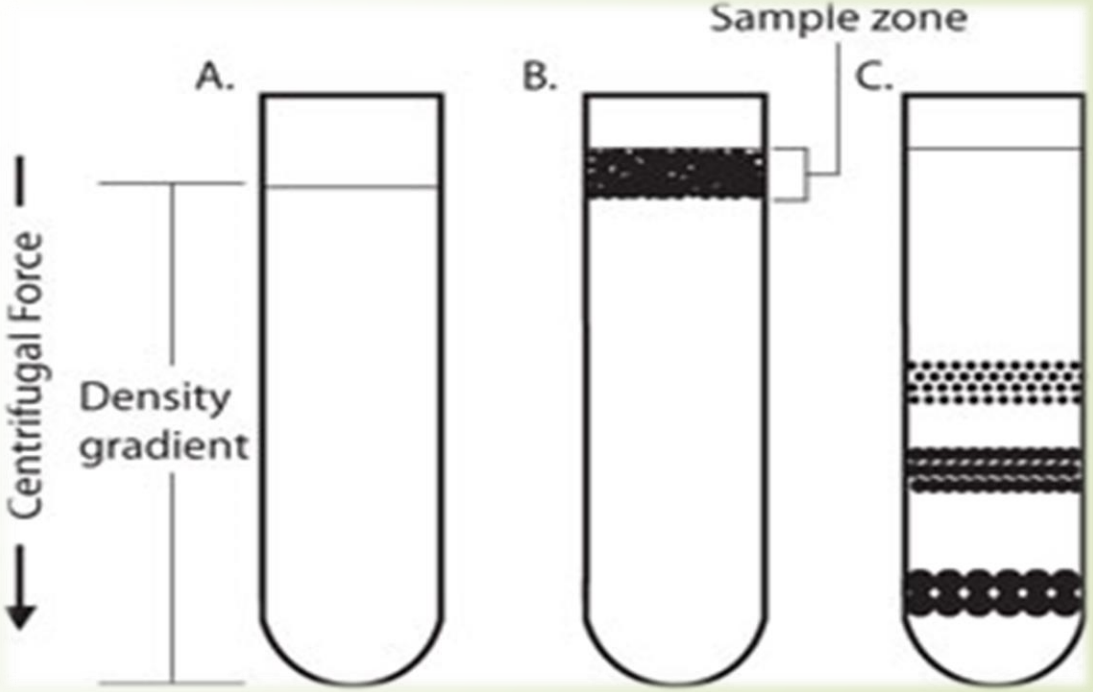


Centrifugation

Density gradient centrifugation

- In density gradient centrifugation, the components of different sizes and densities are separated in the tube containing ionic medium according to their size and densities.

- Only a single speed is used.
- Components are separated in different layers or sediments.
- The upper sediments have smaller and less dense components than lower sediments.



Centrifugation

Differential centrifugation

- In differential centrifugation the sedimentation rate for a particle of a given size and shape measure how fast the particle "settles" or sediments.
- The faster the rotation of the centrifuge, the smaller the particles will sediment.
- A series of increasing speeds can be used.
- At each step, the content which make sediment in the bottom of the tube are called pellet and
- those that remain suspended above the sediment in the form of liquid are called supernatant. After each speed, the supernatant can be drawn off and centrifuge again.