

# **CELL AND MOLECULAR BIOLOGY**

**I M.Sc ZOOLOGY**

**BY**

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CELL AND MOLECULAR BIOLOGY

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**Preamble :** This course facilitates the study of cell structure and function and it revolves around the concept that the cell is the fundamental unit of life. Study of cell can be considered one of the most important areas of biological research. The basic ideas learned at the UG level and are expected to know more about molecular level.

- Unit I :** Structure and functions of cell types - Prokaryotes, Eukaryotes. Plasma membrane - structure of membrane, models. Membrane transport, membrane potentials - Extracellular space - cell adhesion, intercellular recognition - intercellular junctions. Mitochondria - ultrastructure - functions - energetic - cellular respiration - Biogenesis. (25L)
- Unit II :** Ultrastructure of Ribosomes - Endoplasmic reticulum and Golgi complex. Biosynthesis of secretory proteins on ribosomes and rough endoplasmic reticulum - post-translational modifications of proteins both in the RER and SER. Golgi Complex - formation of disulfide bonds - glycosylation - proteolytic cleavage - golgi sorting - molecular mechanism of vesicular traffic - transport of proteins into mitochondria. Lysosome - ultrastructure - enzymes - origin and functions of lysosome. (25L)
- Unit III :** Cell - Cell signaling - signaling mechanisms, signal molecules - signal receptors - form of intracellular signaling - cell surface receptors - signal transduction - pathways - signaling from plasma membrane to nucleus. Cell adhesion - calcium dependent hemophilic cell - cell adhesion - N-CAMs mediated calcium independent hemophilic cell - cell adhesion. Cell matrix adhesion - cell matrix adhesion proteins - integrins - Hemidesmosomes - collagen and non-collagen components. (20L)
- Unit IV :** Nucleus - structure and function. Nucleo-cytoplasmic interaction, Nuclear Transplantation - Cell fusion homokaryons heterokaryons, cytoplasts, karyoplasts. (10L)
- Unit V :** Cell division - mitosis - molecular mechanisms for regulating mitotic events - cyclins and their kinases (cdks) - cell death and its regulation - Characteristics of cancer cells, causes and onset of cancer. (10L)

**Reference Books :**

1. Molecular Cell Biology - By Lodish H, Berk A., Zipursky S, Matsudaira P, Baltimore D. and Darnell J. WH Freeman and Co.
2. Cell and Molecular Biology By Derobertis, EDP ISE Publication
3. Molecular Biology of the Cell by Alberts et al., Garland Publishing inc. New York
4. Cell and Molecular Biology - By Gupta PK Rastogi Publications Meerut, India
5. Cell and Molecular Biology - By Prakash & Lohar MIP Publishers, Chennai

**Practicals**

1. Preparation of grasshopper testis squash to study meiotic cell divisions.
2. Mounting of giant chromosome of the salivary gland in chironomous larva
3. Preparation of human blood smear
4. Observation of blood smear of frog (slide only)
5. Observation of muscle (striated, non-striated and cardiac muscle)
6. Spotters: Microtome, Centrifuge and Ocular Micrometer
7. Observation of chromosomal aberrations using chart.

**UNIT 3**  
**CELL-CELL SIGNALING**

## Cell-cell signaling

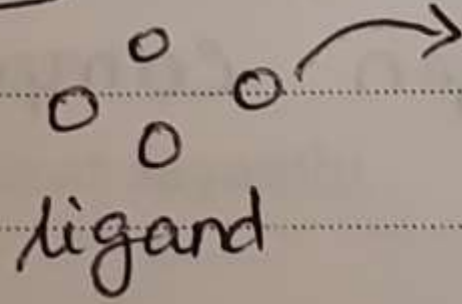
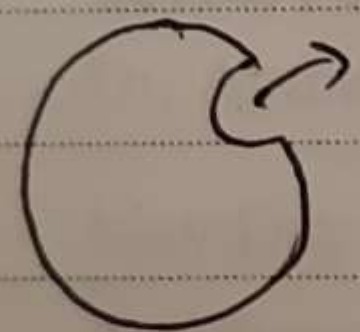
- Cells typically communicate using chemical signals
- These chemical signals which are proteins or other molecules produced by a sending cell, are often secreted from the cell and released into the extracellular space
- There, they can float like messages in a bottle over to neighbouring cells

# Coming Soon: Cell Signaling!



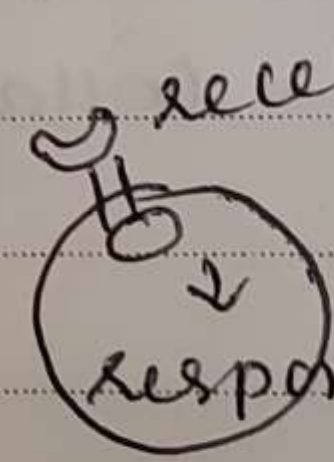
signaling cells

sending cell



ligand

Target cell



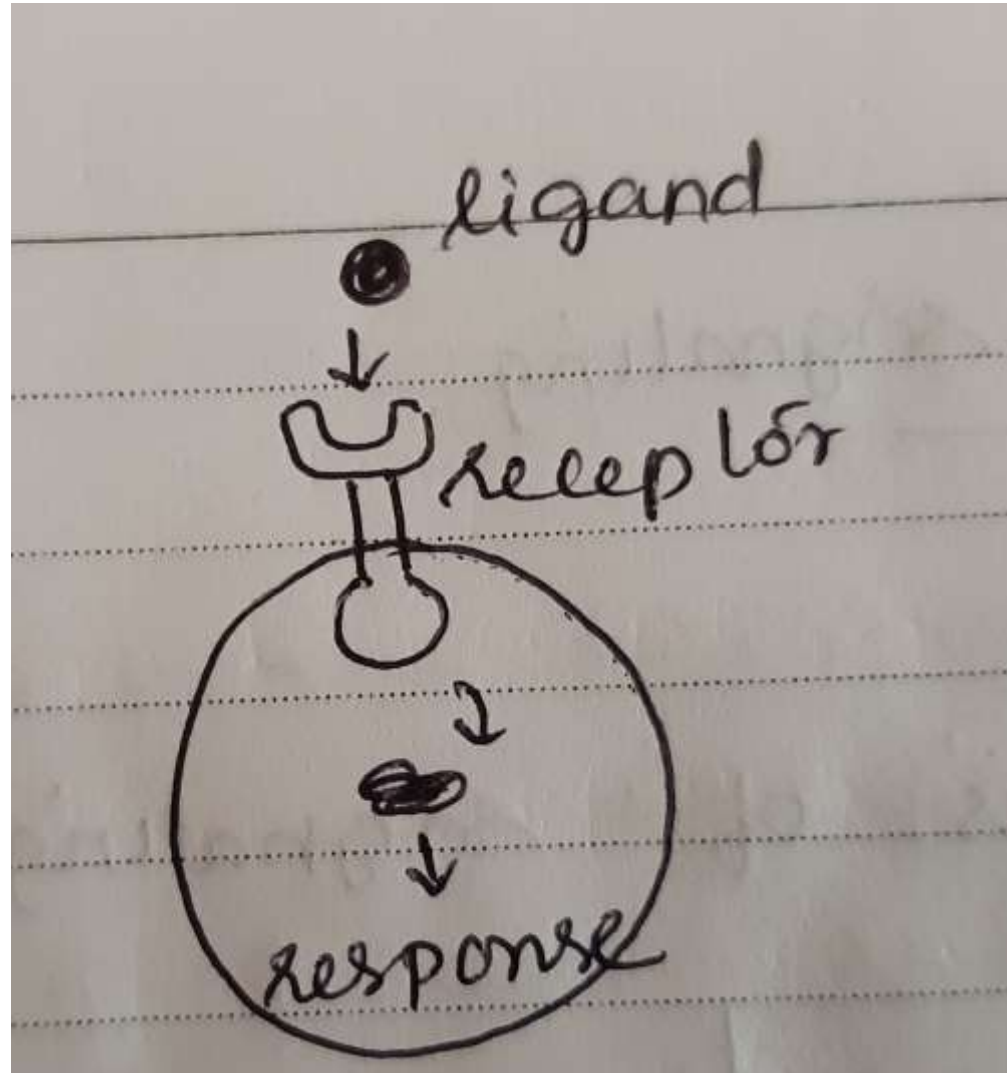
receptor

response

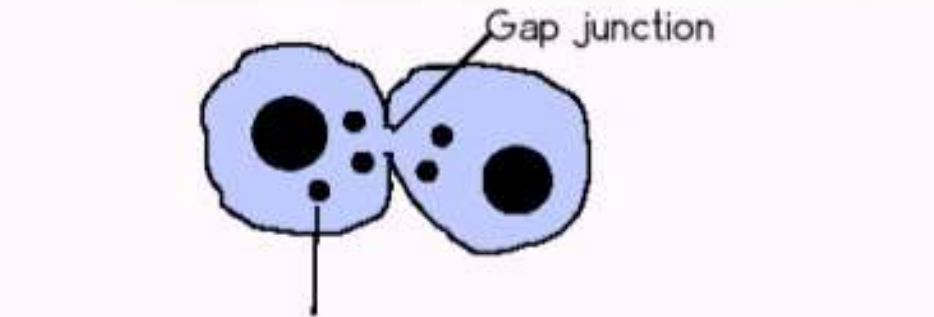
- In order to detect a signal, a neighbour cell (target cell) must have the right receptor for that signal
- When a signalling molecule binds to its receptor, it alters the shape or activity of the receptor, triggering a change inside of the cell
- Signalling molecules are often called **ligands**, a general term for molecules that bind specifically to other molecules are called **receptors**
- The message carried by a ligand is often relayed through a chain of chemical messengers inside the cell
- Ultimately, it leads to a change in the cell, such as alteration in the activity of a gene or even the induction of a whole process, such as **cell division**



- Thus, the original intercellular (between cell) signal is converted into an intracellular (within cell) signal that triggers a response

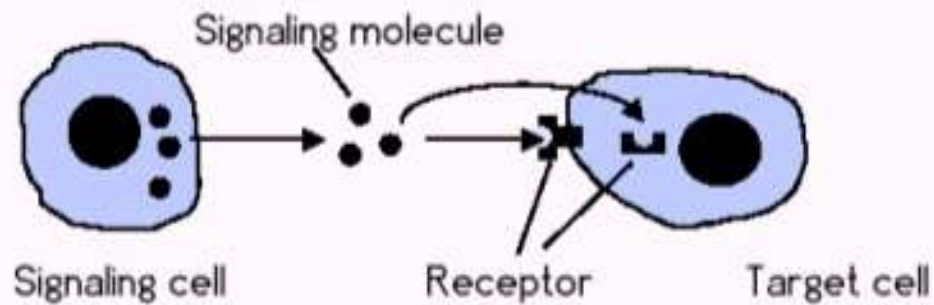


# MODES OF CELL SIGNALING



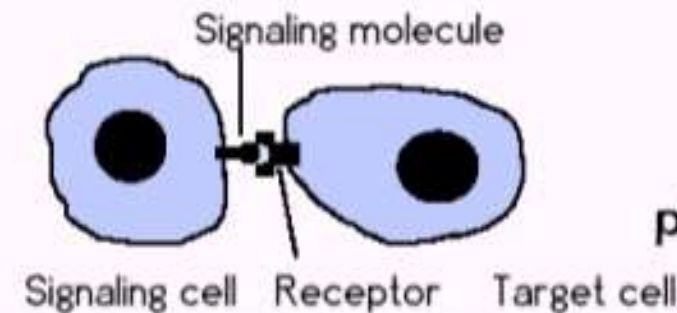
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Signaling by cytoplasmic bridge



2

Signaling by secreted molecules



3

Signaling by plasma membrane-bound molecules



# STEPS IN CELL SIGNALING

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