

## **CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

<b>Course title &amp; Code</b>	<b>Credits</b>	<b>Credit distribution of the course</b>			<b>Eligibility criteria</b>	<b>Pre-requisite of the course (if any)</b>
		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical/ Practice</b>		
<b>Cellular Communications (BCH-GE-7)</b>	<b>04</b>	<b>02</b>	<b>0</b>	<b>02</b>	<b>Class XII with Science and Biology</b>	<b>Basic course in cell biology</b>

### **Learning Objectives**

- Explain the concept of Cell-cell communication.
- Describe the various types of receptors, signal transduction pathways, second messengers and effector molecules.
- To understand how signalling pathways, regulate cell motility, metabolism, growth, organogenesis, and cell death.
- Discuss the crosstalk between signal transduction pathways crosstalk and are auto- regulated.
- To know about various diseases associated with cellular communication pathway defects.

### **Learning outcomes**

On successful completion of the course, students will be able to:

1. Describe various types of cell - cell communication.
2. Discuss the various types of receptors and signal transduction pathways in bacteria, plants and animal system.
3. Explain the importance of various signalling pathways in the regulation of metabolism, growth, organogenesis and cell death.
4. Discuss the cellular communication defects that lead to various types of diseases including cancers.

## **SYLLABUS OF GE-7**

### **BCH-GE-7 : CELLULAR COMMUNICATIONS SEMESTER - IV**

#### **2.2 Course Contents**

##### **Theory (Credit 2)**

**Total Hours : 30**

##### **Unit: 1 Introduction to cell- cell communication. (2 Hours)**

Chemical signalling - endocrine, paracrine, autocrine, intracrine and neuroendocrine mechanisms. Cognate signalling.

##### **Unit: 2 Receptors and Signal transduction pathways (16 Hours)**

Hormone receptors - extracellular and intracellular. Receptor - hormone binding, Scatchard analysis. G-Protein-coupled Receptors: Heterotrimeric G proteins, Second messengers: cAMP, cGMP, Lipid-derived Second Messengers (IP<sub>3</sub>, DAG) NO, Calcium Signalling. Effector systems - adenylyl cyclase, guanylyl cyclase, PDE, PLC. Protein kinases (PKA, PKB, PKC, PKG).

Enzyme linked receptors: Receptor Tyrosine Kinases: EGF, insulin and erythropoietin.

Ras - MAP kinase cascade, and JAK - STAT pathway.

Ion-channel linked receptors; Neurotransmitter receptors (Acetylcholine receptor). Nerve transmission.

Intracellular receptors: Cytoplasmic and nuclear receptors. Steroid hormone, thyroid hormone receptors. Gene regulation.

Integrin receptors. Integrin signalling. Cell matrix communication Receptor Regulation. Cross talk.

**Unit 3: Photoreceptors and signal transduction in plants (4 Hours)**

Phytochromes, cryptochromes and phototropins signalling.

**Unit 4: Cell death signalling (4 Hours)**

Apoptosis, Autophagy

**Unit 5: Bacterial signalling (4 Hours)**

Quorum sensing, autoinducers, chemotaxis.

**2.3 Practical**

**Credit: 2  
60**

**Total Hours :**

1. Yeast response to mating pherohormones .
2. Study of Chemotaxis response in Tetrahymena/ paramecium/ dictostylium
3. Study change in heart rate (sympathetic response) on exposure to caffeine (cAMP mediated) in zebrafish larvae.
4. Chemotaxis/ motility assay in microbes.
5. Effect of plant hormones on plant growth or photomorphogenesis in response to light. (Phytochrome effects on lettuce germination/ Gibberellic acid effect on  $\alpha$ -amylase secretion in barley seeds)

**Essential readings:**

1. Lodish, U. H. (2016) Molecular Cell Biology. W.H. Freeman, 2016.
2. Nelson, D. L., & Cox, M. M. (2021). Lehninger principles of biochemistry (8<sup>th</sup> ed.). W.H. Freeman. ISBN:9781319230906
3. Lim, W., Mayer, B., & Pawson, T. (2015). Cell signaling: principles and mechanisms. New York: Garland Science, Taylor & Francis Group.

4. Kocher, S. L., and Gujral, S. K. (2020). Plant Physiology Theory and Application. Cambridge University Press DOI: <https://doi.org/10.1017/9781108486392.018>
5. Demuth, D., & Lamont, R. (Eds.). (2006). Bacterial Cell-to-Cell Communication: Role in Virulence and Pathogenesis (Advances in Molecular and Cellular Microbiology). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511541506

**Suggested readings:**

1. ZFIN protocols
2. Harris UM. A., McGee, S. A., and Batzi J. M. (2018). Uncooking Yeast: Cells Signalling a Rise to Inquiry. Tested Studies for Laboratory Teaching. Proceedings of the Association for Biology Laboratory Education. 38 (9) 1-48
3. Plant physiology and biotechnology laboratory manual. Compiled by: David Law, Lada Malek and JoAnne Henderson. 2006. <https://old.amu.ac.in/emp/studym/99997510.pdf>

**3. Keywords**

Chemical signaling, Receptors, signal transduction, GPCRs, RTKs, Photoreceptors, cell death signaling, bacterial signalling

**Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.**