



**University of Kerala**

Discipline	<b>BOTANY</b>				
Course Code	<b>UK5DSCBOT303</b>				
Course Title	<b>CELL BIOLOGY AND EVOLUTIONARY BIOLOGY</b>				
Type of Course	<b>DSC</b>				
Semester	<b>V</b>				
Academic Level	<b>300 - 399</b>				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	04	04 Hours	-	-	04 Hours
Pre-requisites	UK3DSCBOT201				
Course Summary	This course gives the basic idea of the cell and its ultrastructure which help to establish the relationship between the structure and function of the different cell organelles/compartments. Cellular communication gives an idea about how cells communicate to function as an organism and interact with the environment. It also deals with the origin and evolution of life which explains the basic principles governing the adaptations to changes in environment.				

Module	Unit	Content	Hrs
<b>I</b>	<b>Cell ultrastructure</b>		<b>10</b>
	1	A brief account of the structural and functional organization of the cell and cell organelles - chloroplast, mitochondria and nucleus (detailed account)	
	2	Structure of chromosomes-Nucleosome model, structure, and function of the kinetochore, NOR, and other secondary constrictions, satellites, heterochromatic segments, and telomeres. <b>Learning Activity:</b> - Study of Cell ultrastructure and cell organelles using 3D models	
<b>II</b>	<b>Cell Division, Differentiation, and Cell Death</b>		<b>13</b>
	3	Cell Division- Stages in cell cycle, mitotic phases, mitotic apparatus, and cytokinesis. Meiosis – General description, synaptonemal complex, stages of meiosis I and II, molecular mechanism of crossing over. <b>Learning Activity:</b> - 1. Identification of different stages of Mitosis using Onion root tips. 2. Demonstration of Meiosis using Allium cepa Chlorophytum flowers	
	4	Cell differentiation and death - Molecular mechanism of cell differentiation, Stem cells. Apoptosis; Cancer- carcinogens, oncogenes, tumor suppressor genes.	
<b>III</b>	<b>Signaling pathways in plants</b>		<b>10</b>

	5	Plant hormones and signaling pathways, light signaling and photomorphogenesis, signaling in plant growth and development.	
	6	Signal perception and transduction in plant responses to environmental stimuli, crosstalk between signaling pathways in plants. Cell polarity (brief account only)	
<b>IV</b>	<b>Origin and Evolution of life</b>		<b>12</b>
	7	Introduction with the aspects of pre-biotic and molecular evolution; brief outlook on the classical theories of evolution, modern theory of synthesis.	
	8	Forces of evolution- Mutation, genetic drift, natural selection; speciation-allopatric, peripatric, parapatric and sympatric.	
	9	Evolution above species level: Brief account of molecular evolution citing the role of chromosome number, genome size and structure and organelle DNA; origin of new genes by gene duplication, chimeric genes and the role of viruses in directing evolution.	
<b>V</b>	<b>Cellular communication</b>		<b>15</b>
	10	Introduction to cell signalling, cell surface receptors and ligands, signal transduction pathways, secondary messengers, and regulation of signalling pathways.	
	11	Bacterial and two-component systems, bacterial chemotaxis and quorum sensing.	
	12	Regulation of hematopoiesis, general principles of cell communication, gap junctions, extracellular matrix, cell adhesion, and role of different adhesion molecules.	

## Suggested Readings

1. De Robertis and De Robertis (2017) Cell and Molecular Biology. 8 Edn., B. I. Waverly Pvt Ltd. New Delhi.
2. J.D. Watson et. al., (2017) Molecular biology of the gene. 7th Edn. Cold Spring Harbor Laboratory, Tania, MIT
3. Janet Iwasa and Wallace Marshall (2020) KARP'S Cell And Molecular Biology 9th Edn., John Wiley & Sons, Inc.
4. Harvey Lodish et.al. (2016) Molecular Cell Biology 8th Edn. W. H. Freeman and Company
5. Strickberger MW (2013) Evolution, 5th Edn., Jones and Bartlett Publishers, New York.
6. Graur, D. & Li, W.-H. (2000). Fundamentals of molecular evolution., 2nd Edn., Oxford University Press. Sinauer.
7. Cooper G. M (2013) The Cell – A Molecular approach,. 6th Edn., Sinauer Associates Inc, Sunderland, USA.

## References

1. Jocelyn E. Krebs, E. S. Goldstein & S. T. Kilpatrick (2017) Lewin's Genes XII, 12th Edn., Jones & Bartlett Learning, Burlington, USA
2. Bruce Alberts et.al., (2014) Molecular Biology of the Cell 6th Edn. Garland Science, Taylor & Francis Group, LLC

3. Sproule A (2022) Charles Darwin (Scientists who have changed the world.) Crabtree Publishing Co, USA.
4. Bergstrom CT & Dugatkin L.A (2023) Evolution, 3rd Edn., WW Norton & Co, New York.
5. James A. Shapiro (2011) Evolution A View from the 21st Century. Prentice Hall, New Jersey, USA

### Web link

1. <https://plato.stanford.edu/entries/cell-biology/>
2. <https://education.nationalgeographic.org/resource/resource-library-cell-biology>
3. <https://learn.genetics.utah.edu/content/basics/>
4. <https://evolution.berkeley.edu/evolution-101/an-introduction-to-evolution/>
5. [https://bio.libretexts.org/Bookshelves/Botany/Botany\\_\(Ha\\_Morrow\\_and\\_Algiers\)/](https://bio.libretexts.org/Bookshelves/Botany/Botany_(Ha_Morrow_and_Algiers)/)
6. [Unit 0%3A Introduction to Botany/01%3A Introduction/1.03%3A Intro to Evolution](#)

### Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the ultrastructure of cells, and the function of different cell organelles and help to correlate their structure and function.	U, An	PSO-2
CO-2	Understanding the principles regulating cell multiplication and death; helps to recognise the reason for various diseases associated with the malfunctioning of the processes.	U, An	PSO-2
CO-3	Identify different stages of cell division.	Ap	PSO-2
CO-4	Understand basic principles of cellular and extracellular communication and help to realise how cells coordinate to function as an organism and how they interact with the environment.	U, An	PSO-2
CO-5	Understand the basic principles of evolution and apply them to analyze the adaptations developed in plants	U, An	PSO-2,4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

**Name of the Course: Cell biology and Evolutionary biology**

**Credits: 4:0:0 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	2	U, An	F,C	L,T	

2	2	2	U, An	F,C	L,T	
3	3	2	Ap	F,C	L,T	P
4	4	2	U, An	F,C	L,T	P
5	5	2,4	U, An	F,C	L,T	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics :**

	<b>Internal Exam</b>	<b>Assignment</b>	<b>Project Evaluation</b>	<b>End Semester Examinations</b>
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓