

Basics of Stem Cell Biology (1 credit course)

The course consists of 7 one-hour introductory lectures featuring basics and frontiers of current stem cell research.

Schedule: (March 9 to March 16th 2021)

Course Description

- 1. Introduction to Stem Cells:** Basics, Types of Stem cells –Totipotent, multipotent, pluripotent and unipotent stem cells.
- 2. Basic Biology/Mechanisms:** Molecular Bases of Pluripotency, Mechanisms of Stem Cell Self-renewal, concept of naïve and primed pluripotent states.
- 3. Tissue and Organ Development:** Differentiation in Early Development, Primordial Germ Cells in Mouse and Human, Stem Cells in Extraembryonic Lineages, Cord Blood Hematopoietic Stem and Progenitor Cells, Stem Cells and the Regenerating Heart, Stem cells and pancreatic cells
- 4. Methods:** Induced Pluripotent Stem Cell Derivation, Characteristics and Characterization of Human Pluripotent Stem Cells, Isolation and Maintenance of Murine Embryonic Stem Cells, Surface Antigen Markers and in vitro differentiation of stem cells
- 5. Applications and ethics:** Stem cells in tissue engineering, Stem Cell Gene Therapy, stem cells for studying cancer and finding cures to other diseases, regenerative medicines, Ethical Considerations.

Learning objectives:

Upon successful completion of this course students will be able to...

- Explain different types of stem cells, how they are derived and the extent of their plasticity.
- Explain the specific characteristics of stem cells.
- Understand how cell-cell signaling maintains stem cells and influences differentiation of specialized cells.
- Describe how stem cells can be used for medical purposes and cite specific examples.
- Understand complex molecular, cellular, and genetic techniques used to investigate stem cell biology.
- Describe current limitations of stem cell biology applications and areas of active research.

Suggested reading:

1. Essentials of Stem Cell Biology, Third Edition 3rd Edition: By Robert Lanza
2. Stem Cells: Scientific Facts and Fiction by Christine Mummery, Ian Sir Wilmot
3. Human Stem Cell Manual by Suzanne Peterson & Jeanne F. Loring