

## **Stem Cell and Therapeutics (MMD-897)**

**Credit Hours 3 (3-0)**

### **Course Description**

Stem cells provide enormous potential for the field of regenerative medicine. Their ability to become any type of cell—blood, heart, brain, bones, skin, muscles, etc.—offers hope for effective treatments, or perhaps even reversal of, a disease.

This course will advance the understanding of cell-based therapies and show what is being done today to develop and deliver them. Discover new ways to restore organ and tissue function for the treatment of chronic diseases, genetic disorders and serious injuries. Get a glimpse inside the laboratory of medical researchers who are pioneering stem cell therapeutics.

### **Educational Objective**

- This course will introduce the unique concept and importance of stem cells.
- The contents will elaborate the different types of stem cells with their therapeutic potential.
- The course will update the knowledge regarding the stem cell based current therapies in use.

### **Course Outcomes**

After completing this course the students should be able to:

- Appreciate the uniqueness and diversity of stem cells
- Understand the basic types of stem cells and comprehend their possible therapeutic uses
- Explain the differences between the stem cell based and regular drug based therapies

### **Course Contents**

1. Introduction to stem cells; (Definition, history and types)
2. Concept of the stem cells
3. Self-renewal and differentiation potential of stem cells

4. Maintaining Stemness: Interaction between HSCs and the cellular microenvironment
5. Stem cells and their specific molecular markers
6. Cell signaling in stem cells
7. Stem cells; Embryogenesis; Differentiation
8. Stem cells models, past, present and future
9. Immunobiology of stem cell transplantations
10. Types of stem cells and their clinical potential: Embryonic and non-embryonic stem cells; Adult stem cells; Induced pluripotent stem cells
11. Stem cells in regenerative medicine
  - Regenerative medicine and reprogramming; Limitations in reprogramming and differentiation fields
  - Hematopoietic stem cells and their therapeutic potential
  - Use of stem cells in burns and wounds, ocular diseases, diabetes, etc
  - Generation of specific cells from pluripotent stem cells: some examples from human medicine like use of neural stem cells, hepatocyte like cells, insulin producing beta cells, cardiac repair, etc
  - Commercial opportunities for iPSCs
12. Cancer stem cells and tumorigenesis
13. Stem cells and aging
14. Bioreactors of pluripotent stem cells and future challenges
15. Ethical issues in stem cell research

### **Recommended Books**

1. Oliveira, Á., da Cruz Corrêa-Velloso, J., Glaser, T., & Ulrich, H. (2016). Stem Cells: Principles and Applications. In *Working with Stem Cells* (pp. 1-13). Springer, Cham.
2. Regad, T., Sayers, T., & Rees, R. (2015). *Principles of stem cell biology and cancer: future applications and therapeutics*. John Wiley & Sons.
3. Totey, S. (2009). *Stem Cells: Basics And Applications*. Tata McGraw-Hill Education.
4. Knoepfler, P. (2013). *Stem cells: an insider's guide*. World Scientific.

5. Ho, A. D., Hoffman, R., & Zanjani, E. D. (Eds.). (2006). *Stem Cell Transplantation: Biology, Processes, Therapy*. John Wiley & Sons.
6. Vertes, A. A., Qureshi, N., Caplan, A. I., & Babiss, L. E. (2015). *Stem Cells in Regenerative Medicine*. Wiley-Blackwell.
7. Panno, J. (2014). *Stem cell research: Medical applications and ethical controversy*. Infobase Publishing.