

## **Syllabus of the course “Stem Cells in BioMedicine” (GS04 1081), Fall, 2021**

**Course Director:** Yong-Jian Geng, MD, PhD, Professor of Medicine and Bioengineering

**Course Description:** Stem cells are a type of undifferentiated cells that niche in fetal and adult tissues, capable of self-renewal and giving rise to mature, differentiated and functional cells. Stem cells have the potential to develop into specialized cells types important for organ or tissue development, reproduction, growth. They particulate in a variety of tissue repair, regeneration, such as wound healing and homeostasis. Stem cells become dysfunctional when disease occurs. In this course, we will explore several aspects of stem cell biology, including the methods and protocols of stem cell preparation technology and applications in both basic research and clinical care. The course will explore concepts of stem cell microenvironments important for maintaining the niche of stem cells, asymmetric cell division, the genes and epigenetic factors required for stem cell fate, reprogram or trans-differentiation, and the use of stem cells for medical diagnosis, prevention and therapy. The course will also discuss the ethical considerations in stem cell research and therapy. The course will present examples of stem cell usage and application will be provided in different organs and tissues. Updated literature in stem cells will be provided and critically discussed. Finally, the information on stem cell research facility and equipment will be provided. Students will have the opportunity of touring stem cell research facilities at the University of Texas MD Anderson Cancer Center and UTHealth.

**Prerequisites:** Both degree and non-degree students at GSBS are eligible to attend. Registration is needed but no pre-approval is needed. Limited number of students: 20.

**Required Course Materials:** No textbook is required. All readings will be from primary research articles, review articles, selected book chapters and will be posted or emailed as pdf or links. The course director or lecture-presenters will also post the syllabus, schedule, lecture slides, lab information, short movies or animations, etc..

Optional reading:

Stem cell Biology.

Marchak D R., Garner R and David Gottlieb. Cold spring harbor laboratory press 2001, Cold Spring harbor, New York

Molecular Cell biology (5<sup>th</sup> ed)

Lodish H et al, W. E Freeman and Company

Embryonic Stem Cells (methods and protocols)

Kursad Turksen 2002, Methods in Molecular Biology, Humana Press, volume 185,

Handbooks of Stem cells part I and part II

Robert Lanza 2004, Elsevier Academic press

**Major Learning Objectives:** Upon successful completion of this course students will be able to.....

- Explain the specific characteristics, progeny, and sources of different types of stem cells.
- Relate the importance of stem cells to the development and maintenance of multicellular organisms.
- Describe how a niche can regulate stem cell biology and cite some specific examples.
- Understand how cell-cell signaling maintains stem cells and influences differentiation of specialized cells.
- Describe how asymmetric cell division contributes to stem cell behavior and cite specific examples.
- Describe how stem cells can be used for medical purposes and cite specific examples in different organs and tissues.
- Understand how defects or malfunction in stem cell behavior can lead to medical problems under various disease conditions.
- 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

**Expectations:**

After the course, students are expected to know basic concepts and different isolation techniques of both embryonic as well as adult stem cells. Furthermore, the students should exhibit a better understanding about basic molecular mechanisms during proliferation and differentiation. Also, students are also expected to gain better insight into the different technologies and latest advancements in the treatment of a variety of diseases.

**Assignments.**

To be announced when class starts

**Policies:**

The class is a 1-hour credit class spanning September 7 – December 14, 2021. Each student will be evaluated from both a written test and the assignment given. The grading scale consists of A, B, C or F: A=75-100%, B= 50-75 %, C=25-50 %: Fail= 0-25%. All materials given out during classes are protected by copyright and should therefore not be used for distribution outside the class room.

All registered students must attend at least 70 % of class time to be considered eligible for grading. If a student miss a class, he/she is responsible to contact the class coordinator as soon as possible. During the course all students are expected to arrive early to ensure an enjoyable and noninterruptive environment for the other participants.

**STEM CELLS IN BIOMEDICINE (GS04 1081 )**  
**The University of Texas MD Anderson/UTHealth Graduate School of Biomedical Sciences**  
 Course Director: Professor Yong-Jian Geng, MD, PhD  
 Tuesdays from 10:00AM-11:00AM, September 7 – December 14, 2021,  
 WeBex Online Lecture

Month	Day	Lecture	Lecture Title	Lecturer
September	7	1	Introduction – Basics of stem cell biology and regenerative medicine	Yong-Jian Geng
September	14	2	Stem cell isolation, culture, preparation and facility	Harnath Shelat
September	21	3	Stem cell niching and tissue repair	Yong-Jian Geng
September	28	4	Growth factors for stem cell proliferation and differentiation	Yong-Jian Geng
October	5	5	Stem cell delivery and transplantation to diseased Sites	Yong-Jian Geng
October	12	6	Genetics and epigenetics of stem cells in disease	Yong-Jian Geng
October	19	7	Stem cells in bone marrow, blood and blood vessels	Yong-Jian Geng
October	26	8	Mesenchymal , myogenic and bone morphogenic stem cells	Yong-Jian Geng
November	2	9	Immunology of stem cells in regenerative medicine	Yong-Jian Geng
November	9	10	Abnormal and malignant stem cells in cancer and other diseases	Huamin Wang
November	16	11	Stem cells for disease modeling and drug screening	Yong-Jian Geng
November	23	12	Stem cells for rare diseases	Yong-Jian Geng
November	30	13	Stem cells in wound healing	Song Gao
December	7	14	Reprogram of stem cells for therapy	Yong-Jian Geng
December	14	15	<b><u>Final examination</u></b>	