Philadelphia University Faculty: Science Department: Biotechnology and Genetic Engineering	**PHILADELPHIA UNIVERSITY** THE WAY TO THE FUTURE	Approval date: Issue: Credit hours: 2
Academic year 2023-2024	**Course Syllabus**	Bachelor

Course information

Course#	Course title	Prerequisite
0240370	**Human cell technology**	240233

Course type		Class time	Room #
☐ University Requirement ☐ Faculty Requirement ☒ Major Requirement ☐ Elective ☒ Compulsory		**9:45-10:35 am** **MW**	**2901**

Instructor Information

Name	Office No.	Phone No.	Office Hours	E-mail
Prof. Raida Khalil	**914**	**ext. 2250**	SM 11:00-12 am	**R_khalil@philadelphia.edu.jo**

Course Delivery Method

Course Delivery Method		
☒ **Physical**	☐ **Online**	☐ **Blended**
Learning Model		
Precentage	**Synchronous**	**Asynchronous**	**Physical**
			100%

Course Description

Stem cells are undifferentiated cells that are capable of self-renewal and have the potential to develop into specialized cells types. Stem cells are important for development, reproduction, growth, healing, and homeostasis. We will explore several aspects of stem cell biology including the microenvironments that are required to maintain stem cells, asymmetric cell division, the genes required for stem cell fate, and the use of stem cells for medical applications. This course aims to provide a comprehensive overview of pluripotent stem cell biology, advanced techniques of cellular reprogramming, transdifferentiating and genome editing and how these technologies can be applied to model human diseases and to develop new therapeutics. Furthermore, we will discuss briefly the ethical considerations in stem cell research and therapy. Additionally, We will read and critically discuss primary research articles.

Course Learning Outcomes

Number	Outcomes	Corresponding Program outcomes
Knowledge		
K1	Account for the basics of stem cells function in the body and for their usage in medical contexts.	K_P1
K2	List the properties that define a stem cell and Compare and contrast tissue-specific stem cell types (e.g., blood, skin), and the basic mechanisms that regulate them	K_P3
K3	Explain how stem cells are derived for scientific research;	K_P1
Skills		
S1	Understand how cell-cell signaling maintains stem cells and influences differentiation of specialized cells.	S_P1
S2	Understand how defects in stem cell behavior can lead to medical problems;	S_P3
S3	Understand complex molecular, cellular, and genetic techniques used to investigate stem cell biology; such as Gene Therapy and CRISPER and Gene Editing	S_P2
Competencies		
C1	Develop informed opinions of the science, policy, and ethics of modern applied stem cell biology.	C_P2
C2	Analyze a body of research including primary literature, explain the applications and relevance of the findings, and describe potential future directions of the research topic.	C_P3

Learning Resources

Course textbook	The Science of Stem Cells **Author(s): Jonathan M. W. Slack, 2018** **ISBN:9781119235156 |Online ISBN:9781119235293** **Publisher : John Wiley & Sons, Inc.** CRISPR Gene Editing : Methods and Protocols **Authors:** Aarhus, Denmark and Yonglun Luo ISSN 1064-3745 ISSN 1940-6029 (electronic) **Publisher:** Springer , part of Springer Nature 2019
Supporting References	**Most of readings will be from primary research articles, review articles, selected book chapters and will be posted on Microsoft teams channel.** **Recent literature(suggested readings and web sites required for assignments through Philadelphia library resources)**
Supporting websites	**https://stemcells.nih.gov/info/basics/1.htm** https://www.clinicaltrials.gov/

	https://www.fda.gov/
Teaching Environment	☒**Classroom** ☐ **laboratory** ☒**Learning platform** ☐**Other**

Meetings and subjects timetable

Week	Topic	Learning Methods	Tasks	Learning Material
1	**Introduction to cell Biology-Stem cells facts and fiction** **Over view:** • Promise of stem cells in mitigating human disease, syndromes and injuries, modeling disease states, gene/cell therapies, tissue regeneration and bioengineering	lectures + learning platform + Discussion + flipped Class	Revision Background related to topic Assessment	Chapter 1 Related e - supplement material + articles
2	**History of stem cells** Definition of stem cell terminology, stem cells in embryonic and adult tissues • Hierarchy of molecules-genes-cells-tissues-organisms	lectures + learning platform + Discussion + flipped Class	**Assessment**	Chapter 4 Related e - supplement material + articles
3	• Regulatory signals that alter gene expression, cell structure, function, differentiation and cell division Student seminar + **discussion** **Genome Structure, Chromatin and the Nucleosome**	**Lecture** problem solving based learning	**Assessment Article assigned**	Chapter 4 Related e - supplement material + articles
4	Human Embryonic Stem Cells Student seminars+ **discussion**	**Lectures+**, problem solving based learning	**Presentation According to assigned schedule**	(https://stemcells.nih.gov/info/basics/1.htm
5	**Paper presentation** **Inducing pluripotency** Reprogramming / Transdifferentiation: History and technology:	**Lectures+**, problem solving based learning **Flipped class**	**Assessment Article assigned**	Related e - supplement material + articles
6	Differentiation from Stem Cell Niches: Skin, Hair follicle and Intestinal Stem Cells • Overview of skin and hair follicle cell biology and physiology • Skin/hair stem cells and experimental manipulation to treat disorders • Overview of intestinal organ structure, villi, intestinal cell locations and differentiation pathway.			Related e - supplement material + articles

	• Relationship of intestinal stem cells to the normal microbiome and to physiological dysfunction such as bowel disorders. Student seminars+ **discussion**			
7	Epigenetic Student seminars+ **discussion**	**Lectures+ , problem solving based learning**	**Assessment**	Scudellari, Megan "A decade of iPS cells" *Nature*, 534: 310-312.
8	Hematopoietic Stem Cells Stem Cell Therapies: Hematopoietic and Bone Stem Cells **Midterm**	**Lectures+ , problem solving based learning**	**Assessment Article assigned**	Reardon, Sara "Leukaemia success heralds waves of gene-editing therapies" *Nature*, 527: 146-147.
9	Hematopoietic stem cells, differentiation Pathways • Lymphoid vs myeloid cell pathways and stem cells • Mesenchymal stem cells • Current practices using patient's own cells for gene therapy • Leukemia therapies with stem cells • Ethics of gene therapy Student seminars+ **discussion**			
10	Therapeutic Prospects and Tissue Engineering Student seminars+ **discussion**	**Lectures+ , problem solving based learning**	**Assessment Article assigned**	Related e - supplement material + articles
11	Advances in genome editing: - Historical development of genome editing methods/genome editing with targeted nucleases (CRISPR)**::** **G**enetic Engineering of Stem Cells			
12	• Molecular genetic strategies to regulate gene expression in stem cells • Loss vs additional of expressed genes • Replacing mutated genes with wild type versions • Use of CRISPR/Cas9 genomic editing • Ethics of gene editing and changing cell genotypes Student seminars+ **discussion**			
13	Tissue Regeneration and Bioengineering of Tissues and Organs • Overview of regeneration and bioengineering of tissues • Role of stem cells in controlling tissue regeneration • Experimental strategies to bioengineer tissues and organs from cultured stem cells • 3-D organoid cultures and tissue scaffolds • Characterization of functional bioengineered organs	**Lectures+ , problem solving based learning**	**Assessment Article assigned**	Knoblich, Juergen "Building a brain in the lab" *Scientific American,* Jan 2017. Bredenoord, AL, Clevers, H, Knoblich J (2017) "Human

				tissues in a dish: The research and ethical implications of organoid technology" *Science* 355.
14	Use and Bioengineering of Cardiac and Muscle Stem Cells • Overview of cardiac and muscle cell biology and physiology • Cardiac stem cell markers, role in injury repair and potential use after heart attacks • Reprogramming induced pluripotent stem cells to generated cardiomyocytes	**Lectures+, problem solving based learning**	**Assessment Article assigned**	
15	• Treatment of heart injuries with normal or reprogrammed stem cell • Skeletal muscle stem cells and involvement of satellite cells in generating new muscle fibers and building of stronger muscles. • Stem cells and treatment of muscle disorders			bioethics and the yuck factor" *Scientific American blog*, Sept 21, 2016. e- web resources related to topic
16	**Final Exam**			

* includes: Lecture, flipped Class, project- based learning, problem solving based learning, collaborative learning

Course Contributing to Learner Skill Development

Using Technology
Data show, ppt Educated videos, Links related to topics ; **Learning Analysis Journals** ; presentations prepared by students,
Communication skills
Discussion assigned articles by collaborative learning Disucssion the latest technology
Application of concepts learnt
At the end of each topics students will expose to the medical and pharmaceutical applications of different concepts of Human cell technology

Assessment Methods and Grade Distribution

Assessment Methods	Grade Weight	Assessment Time (Week No.)	Link to Course Outcomes
Mid Term Exam	**% 30**	**Week 8**	**K1, S1 and C1**
Various Assessments *	**% 30**	**Each week**	**All**
Final Exam	**% 40**	**Week 16**	**All**
Total	**%100**		

* includes: quiz, in class and out of class assignment, presentations , reports, videotaped assignment, group or individual projects.

Alignment of Course Outcomes with Learning and Assessment Methods

Number	Learning Outcomes	Learning Method*	Assessment Method**
Knowledge			
K1	Account for the basics of stem cells function in the body and for their usage in medical contexts.	Lecture problem solving based learning	Quiz videotaped assignment
K2	List the properties that define a stem cell and Compare and contrast tissue-specific stem cell types (e.g., blood, skin), and the basic mechanisms that regulate them	Lecture problem solving based learning collaborative learning	Quiz videotaped assignment
K3	Explain how stem cells are derived for scientific research;	Lecture problem solving based learning collaborative learning	Quiz videotaped assignment
Skills			
S1	Understand how cell-cell signaling maintains stem cells and influences differentiation of specialized cells.	Lecture problem solving based learning collaborative learning	Quiz videotaped assignment
S2	Understand how defects in stem cell behavior can lead to medical problems;	Lecture problem solving based learning collaborative learning flipped Class	Quiz videotaped assignment
S3	Understand complex molecular, cellular, and genetic techniques used to investigate stem cell biology; such as Gene Therapy and CRISPER and Gene Editing	Lecture problem solving based learning collaborative learning	Quiz videotaped assignment
Competencies			
C1	Develop informed opinions of the science, policy, and ethics of modern applied stem cell biology.	Lecture problem solving based learning collaborative learning flipped Class	Quiz videotaped assignment

C2	Analyze a body of research including primary literature, explain the applications and relevance of the findings, and describe potential future directions of the research topic.	Lecture problem solving based learning collaborative learning flipped Class	Quiz videotaped assignment

* includes: Lecture, flipped Class, project- based learning , problem solving based learning, collaborative learning

** includes: quiz, in class and out of class assignment , presentations , reports, videotaped assignment, group or individual projects.

Course Polices

Policy	Policy Requirements
Passing Grade	The minimum passing grade for the course is (50%) and the minimum final mark recorded on transcript is (35%).
Missing Exams	• Missing an exam without a valid excuse will result in a zero grade to be assigned to the exam or assessment. • A Student who misses an exam or scheduled assessment, for a legitimate reason, must submit an official written excuse within a week from the an exam or assessment due date. • A student who has an excuse for missing a final exam should submit the excuse to the dean within three days of the missed exam date.
Attendance	The student is not allowed to be absent more than (15%) of the total hours prescribed for the course, which equates to six lectures days (M, W) and seven lectures (S,T,R). If the student misses more than (15%) of the total hours prescribed for the course without a satisfactory excuse accepted by the dean of the faculty, s/he will be prohibited from taking the final exam and the grade in that course is considered (zero), but if the absence is due to illness or a compulsive excuse accepted by the dean of the college, then withdrawal grade will be recorded.
Academic Honesty	Philadelphia University pays special attention to the issue of academic integrity, and the penalties stipulated in the university's instructions are applied to those who are proven to have committed an act that violates academic integrity, such as: cheating, plagiarism (academic theft), collusion, and violating intellectual property rights.

Program Learning Outcomes to be Assessed in this Course

Number	Learning Outcome	Course Title	Assessment Method	Target Performance level
Kp3	Understand the molecular techniques including: immunological techniques, gene cloning, polymerase chain reaction, DNA sequencing, gene editing, blotting and nucleic acids hybridizations along with the basic skills of laboratory organization and management.	**Human cell technology**	Comprehensive exam	100% students will achieve 68% and more based on assessment rubric

Description of Program Learning Outcome Assessment Method

Number	Detailed Description of Assessment
Kp3	Comprehensive questions (10 marks included in the final exam)

criteria	score			
	4	**3**	**2**	**1**
Concept	The answers given indicate a thorough understanding of the concept	The answers given indicate a less comprehensive understanding of the concept	The answers given indicate misconceptions	The answers given indicate the student are not understand the concept
Comprehensive	The answers given indicate the ability to relate one information to another , comprehensively	The answers given indicate the ability to relate one information to another , partly	The answers given indicate less ability to relate one information to another	The answers given indicate not comprehensive
Language structure	The answers given in accurate ,short ,and clear sentences	The answers given in accurate and short sentences ,but clear	The answers given in short sentences , but not accurate nor clear	The answers are not given in accurate , short , and clear sentences