

نموذج توصيف مقرر
Course Description Form

Name of College\Faculty: College of Science
Name of Department: Biological Sciences

اسم الكلية: كلية العلوم
اسم القسم العلمي: العلوم البيولوجية

Course name	Stem Cell Biology	اسم المقرر
Course No.	0493-480	رقم المقرر
No. of Credits	3	عدد الوحدات
Theoretical Hours	3	عدد الساعات النظرية
Practical Hours	0	عدد الساعات العملية
Prerequisites	Biology III 0490-103 + Introduction to molecular biology 0490-281 + completion of 90 credits.	متطلبات المقرر
Course topics		مواضيع المقرر
This course elucidates the importance of stem cells in developmental biology and regenerative medicine. It explains the different types of stem cells including adult, cancer and placental derived stem cells. It introduces the master transcriptional regulatory network of genes that maintains pluripotency. The course also describes how stem cells can be both maintained or manipulated <i>in vitro</i> by the addition of exogenous factors, genes and/or altering their microenvironment. The importance of controlling stem cell differentiation in understanding the normal developmental process and cancer and its impact in regenerative medicine will be clarified. Finally, challenges of stem cell research and ethical concerns will be discussed. Course content: 1. Introduction and the importance of stem cells in developmental biology and regenerative medicine: Defining stem cells, developmental biology and explaining how regenerative medicine evolved. [2h] 2. Types of stem cell and their properties: Pluripotent stem cells (embryonic stem cells, germ cell-derived stem cells, induced pluripotent stem cells, multipotent stem cells (hematopoietic stem cells, mesenchymal stem cells). Properties of stem cells including self-renewal and giving rise to multiple specialized cell types. [4h] 3. Pluripotent stem cells and the transcriptional regulatory network underlying their pluripotency: Generating pluripotent stem cells from different developmental stages by cellular reprogramming. Key transcriptional factors of pluripotency regulatory network including NANOG, SOX2 and OCT4. Cell surface markers and gene expression profile defining pluripotency. Limitations of stem cell identification. [6h] 4. Progenitor stem cells and their asymmetrical cell division: Describing asymmetrical cell division and its importance in generating cellular diversity whilst maintaining stem cells. Asymmetrical stem cell		

division in different systems (eg: hematopoietic stem cells, mammalian epidermal progenitor cells). [3h]

5. Stem cell differentiation and microenvironment modulation: Stem cell differentiation *in vitro* follows embryological processes. Embryoid bodies. Induction of differentiation by defined factors. Late stages of differentiation. Current limitations to *in vitro* differentiation. Assessing differentiation. Multifactorial stem cell microenvironment including intracellular interaction, physical and chemical cues. [6h]

- This section will be supplemented with papers that describe current research in β -cell differentiation elucidating the role of exogenous factor in stem (progenitor) cell differentiation.
- Students will have to look for a current paper of their choice and briefly explain what and why a specific factor was used in that study to induce stem cell differentiation as part of their assessment in the homework/assignment grade.

6. Adult stem cells and their role in regeneration and disorders: Skin stem cells and their role in skin regeneration. Intestinal stem cells niche and its regulation by growth factors. Liver stem cells and progenitor cells in development, disease and regenerative medicine. Lung mesenchymal stem cells and FGF signaling in lung and progenitor cells. Heart regeneration and repair. [6h]

- Current examples on utilizing adult stem cells in regenerative medicine will be introduced.

7. Cancer stem cells: Isolation and characterization of cancer stem cells. Impact of environmental pollutants on stem cell development and function (endocrine disrupting chemicals and air pollution such as tobacco smoke). [2h]

8. Placental derived stem cells and applications for regenerative medicine: Origin of placenta-derived stem cells. Amniotic epithelial cells and amniotic mesenchymal stem cells. Therapeutic potential of placenta-derived stem cells. [2h]

9. Challenges of stem cell research and related ethical concerns: Limitations of stem cell research (including feeder dependent and feeder free human pluripotent stem cells hPSC cultures). Regulation requirement associated with hPSC. Ethical issues related to human embryonic stem cells research and manipulation. [4h]

Text book:

(Name, Author, Year, Publisher)

1. Essentials of stem cell biology. 2025. Editor: Robert Lanza and Anthony Atala. *Academic Press*.

References:

(Name, Author, Year, Publisher)

عنوان المرجع:

(الاسم، المؤلف، سنة الطبع، دار النشر)

1. Tissue Engineering in Regenerative Medicine. 2011. Editor: Bernstein H.
2. Stem cells and Regenerative Medicine. 2008. Editors: Low W. C. and Verfaillie C. M.
3. Stem Cells, Tissue Engineering and Regenerative Medicine. 2015. Editor: Warburton D.



Grading		آلية رصد المقرر		
Exams	30	%		الاختبارات
Quizzes	-	%		امتحانات قصيرة
Oral presentation	10	%		تقديم
Project	20	%		مشاريع (دراسة ميدانية)
Final	40	%		الاختبار النهائي
100%				

أهداف مخرجات المقرر				
الرقم	أهداف مخرجات المقرر	أمثلة من المقرر لتحقيق هذه الأهداف	المستوى المطلوب من عضو هيئة التدريس لتحقيق الهدف	
			عالي (ع)	متوسط (م)
1	اكتشاف أهمية الخلايا الجذعية في علم الأحياء التنموي والطب التجديدي.	البدايات المبكرة من الخروف دولي إلى هندسة الأنسجة.		م
2	التعرف على أنواع وقدرات الخلايا الجذعية المختلفة.	التوزيع المكاني والقوة المتغيرة لأنواع مختلفة من الخلايا الجذعية	ع	
3	تحديد الشبكة التنظيمية النسخية التي تشكل الأساس لتعدد القدرات لبعض الخلايا الجذعية.	الجينات التي تسبب تعدد القدرات بما في ذلك SOX2 و NANOG و OCT4 وعلامات الخلايا الأخرى التي تحدد الخلايا الجذعية المختلفة..	ع	
4	تقييم تأثير البيئة المحيطة على سلوك الخلايا الجذعية (التمايز).	دور البيئة المحيطة والعوامل الخارجية في تحفيز التمايز من خلال تغيير التعبير الجيني. مثال: العوامل الكيميائية، والعوامل الفيزيائية (كثافة الخلايا)، ونوع المصفوفة، والجينات.	ع	
5	إدراك إمكانات الخلايا الجذعية البالغة من خلال فهم دورها في تجديد الأنسجة.	موقع ودور الخلايا الجذعية البالغة في تجديد الأعضاء بما في ذلك ذلك الأنسجة الوعائية والكبد والقلب والجلد والأمعاء والرئتين.	ع	
6	فهم التحديات والقضايا الأخلاقية التي تواجه أبحاث الخلايا الجذعية.	الحصول على الخلايا الجذعية وحفظها في المختبر. التحديات الأخلاقية المتعلقة بالخلايا الجذعية الجنينية.		ن
منسق المقرر (اسم عضو هيئة التدريس المشرف على توصيف المقرر وتوقيعه)			د. أماني مصطفى العدساني	
الرتبة الأكاديمية			استاذ مساعد	
تاريخ إعداد النموذج				

Course objectives					
No:	Course Objectives (Learning Outcomes)	Example(s) of relevant (Topics and Activities)	Recommended Level to satisfy the objectives		
			High	Medium	Low
1	Discover the importance of stem cells in developmental biology and regenerative medicine.	Early beginnings from Dolly the sheep to tissue engineering.		M	
2	Recognize the types and abilities of different stem cells.	Spatial distribution and variable potency of different stem cell types	H		
3	Determine the transcriptional regulatory network underlying the pluripotency of some stem cells.	Genes rendering pluripotency including NANOG, SOX2 and OCT4 and other cell markers identifying various stem cells.	H		
4	Asses the effect of the microenvironment on stem cells behavior (differentiation).	The role of the microenvironment and external factors in inducing differentiation through the alteration of gene expression. Example: chemical factors, physical factors (cell density), matrix type and genes.	H		
5	Realize the potential of adult stem cells by understanding their role in tissue regeneration.	Location and role of adult stem cells in organ regeneration including vascular tissue, liver, heart, skin, intestine, and lungs.	H		
6	Understand the challenges and ethical issues that face stem cell research.	Acquiring and maintaining of stem cells in the lab. Ethical challenges related to embryonic stem cells.			L
Coordinator (Name and Rank):		Dr. Amani Mustafa Al-Adsani, Assistant Professor			
Signature:		<i>Dr. Amani Mustafa Al-Adsani</i> Biological Sciences Department	Date:	20- Nov. -2025	