	وزارة التعليم العالي والبحث العلمي **جامعة المستقبل** كلية العلوم قسم الكيمياء الحياتية	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information **معلومات المادة الدراسية**			
Module Title	Energy and Membrane Biology		**Module Delivery**
Module Type	Basic		☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**
Module Code	UOMU036243		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	2	**Semester of Delivery**	2
Administering Department	Dpt. Of Biochemistry	**College**	College of Science
Module Leader		**e-mail**	
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims **أهداف المادة الدراسية**	1. Explore the principles of bioenergetics and their application to cellular processes. 2. Investigate the structure, function, and dynamics of biological membranes. 3. Examine transport mechanisms and signaling pathways across membranes. 4. Apply knowledge of energy and membrane biology to real-world problems in biochemistry, medicine, and biotechnology.
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	By the end of this module, students will be able to: *Knowledge and Understanding:* 1. Explain the fundamental principles of bioenergetics, including thermodynamics, energy coupling, and ATP production. 2. Describe the structure and composition of biological membranes and their role in cellular function. 3. Analyze the mechanisms of membrane transport, including passive and active transport, and their regulation. 4. Integrate knowledge of metabolic pathways with membrane biology and energy transduction. 5. Discuss the role of membranes in cellular signaling and communication. **Intellectual Skills:** 1. Critically evaluate scientific literature related to energy and membrane biology. 2. Apply thermodynamic principles to analyze biological energy transformations. 3. Interpret experimental data from membrane and energy-related studies. 4. Solve problems related to membrane transport and bioenergetics.

	Transferable Skills: 1. Communicate complex scientific concepts effectively through oral and written presentations. 2. Develop time management and organizational skills to meet deadlines. 3. Apply critical thinking and problem-solving skills to real-world scenarios.
Indicative Contents **المحتويات الإرشادية**	1- Foundations of Bioenergetics and Membranes: i. Introduction to energy transduction, thermodynamics, and ATP. ii. Structure, composition, and dynamics of biological membranes. 2- Transport and Signaling Mechanisms: i. Passive and active transport across membranes. ii. Membrane potential, electrical signaling, and receptor-mediated signal transduction. 3- Energy Transduction Pathways: i. Mitochondrial electron transport chain and oxidative phosphorylation. ii. Photosynthesis: light-dependent reactions and the Calvin cycle. 4- Integration and Dysfunction: a. Coordination of metabolic pathways with membrane biology. b. Pathologies: mitochondrial diseases, transport disorders, and metabolic syndromes. 5- Applications and Advanced Concepts: a. Techniques: spectrophotometry, electrophysiology, and imaging. b. Real-world applications in biotechnology, medicine, and synthetic biology.

Learning and Teaching Strategies **استراتيجيات التعلم والتعليم**		
Strategies	**Strategy**	**Purpose**

	Interactive Lectures	Engage students and clarify complex topics.
	Flipped Classroom	Promote self-directed learning and deeper discussions.
	Problem-Based Learning (PBL)	Develop critical thinking and problem-solving skills.
	Collaborative Learning	Enhance teamwork and communication skills.
	Formative Assessments	Provide feedback and reinforce learning.
	Technology and Online Tools	Support diverse learning styles and accessibility.
	Guest Lectures	Inspire students with real-world applications and research perspectives.
	Reflective Learning	Deepen understanding and self-awareness.
	Visual and Conceptual Tools	Simplify complex processes and improve retention.
	Final Project/Presentation	Encourage independent research and synthesis of knowledge.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	61	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	64	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	5% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	1	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects /	1	10% (10)	Continuous	

	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي	
	Material Covered
Week 1	**Introduction to Energy and Membrane Biology**
Week 2	**Structure and Composition of Biological Membranes**
Week 3	**Membrane Transport Mechanisms**
Week 4	**Bioenergetics and Thermodynamics**
Week 5	**Electron Transport Chains and Oxidative Phosphorylation**
Week 6	**Photosynthesis and Light Energy Conversion**
Week 7	**Membrane Potential and Electrical Signaling**
Week 8	Mid Exam.
Week 9	**Membrane Receptors and Signal Transduction**
Week 10	**Membrane Trafficking and Vesicular Transport**
Week 11	**Metabolic Integration and Membrane Biology**
Week 12	**Membrane Biogenesis and Repair**
Week 13	**Pathologies Related to Energy and Membrane Dysfunction**
Week 14	**Advanced Techniques in Energy and Membrane Biology**
Week 15	**Applications in Biotechnology and Medicine** and Comprehensive review

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Non
Week 2	Non
Week 3	Non
Week 4	Non
Week 5	Non
Week 6	non

Week 7	non

Learning and Teaching Resources **مصادر التعلم والتدريس**		
	Text	**Available in the Library?**
Required Texts	**1- "Lehninger Principles of Biochemistry"** by David L. Nelson and Michael M. Cox. Eighth Edition ©2021 **2- Molecular Biology of the Cell, 4th edition** by Alberts et al.	Yes No
Recommended Texts	**1- Bioenergetics"** by David G. Nicholls and Stuart J. Ferguson **2- Membrane Structural Biology: With Biochemical and Biophysical Foundations"** by Mary Luckey **3- Biochemistry"** by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer	No
Websites	**Khan Academy (https://www.khanacademy.org)** **MIT OpenCourseWare (https://ocw.mit.edu).** **Coursera** (https://www.coursera.org)	

Grading Scheme **مخطط الدرجات**				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group	**A** - Excellent	**امتياز**	90 - 100	Outstanding Performance
	B - Very Good	**جيد جدا**	80 - 89	Above average with some

(50 - 100)				errors
	C - Good	**جيد**	70 - 79	Sound work with notable errors
	D - Satisfactory	**متوسط**	60 - 69	Fair but with major shortcomings
	E - Sufficient	**مقبول**	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	**راسب (قيد المعالجة)**	(45-49)	More work required but credit awarded
	F – Fail	**راسب**	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.