



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



MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

| Module Information معلومات المادة الدراسية | | | |
|--|----------------------------------|--------------------------------------|---|
| Module Title | Nucleic Acids Chemistry I | | Module Delivery |
| Module Type | Basic | | <input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input checked="" type="checkbox"/> Practical <input type="checkbox"/> Seminar |
| Module Code | UOMU036353 | | |
| ECTS Credits | 6 | | |
| SWL (hr/sem) | 150 | | |
| Module Level | 3 | Semester of Delivery | |
| Administering Department | Biochemistry department | 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 | |
| Review Committee Approval Date | | Version Number | 1.0 |

Relationship with Other Module
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

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| Module Aims أهداف المادة الدراسية | <ul style="list-style-type: none"> • Provide a detailed understanding of the chemical structure and properties of nucleic acids (DNA and RNA). • Explore the molecular mechanisms underlying the biosynthesis, replication, and degradation of nucleic acids. • Understand the physical and chemical interactions that govern nucleic acid stability and function. • Develop foundational knowledge for future studies in molecular biology, genetics, and biotechnology. |
| Module Learning Outcomes مخرجات التعلم للمادة الدراسية | <p>By the end of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Describe the molecular structure and components of DNA and RNA. 2. Differentiate between types of nucleotides and nucleosides. 3. Explain the physical and chemical properties of nucleic acids. 4. Extract and purify nucleic acids from biological samples. 5. Use electrophoretic methods to separate and identify nucleic acids. 6. Apply safety and quality procedures in handling nucleic acid samples. |
| Indicative Contents المحتويات الإرشادية | <ol style="list-style-type: none"> 1. Introduction to Nucleic Acids; Historical background and biological significance 2. Structure of Nucleotides and Nucleosides; Purine and pyrimidine bases, ribose, deoxyribose, phosphate linkage 3. Primary, Secondary, and Tertiary Structures of DNA; Double helix, base pairing, A-DNA, B-DNA, Z-DNA 4. RNA Structure and Types; mRNA, tRNA, rRNA, structural features and modifications 5. Chemical Synthesis of Oligonucleotides; Solid-phase synthesis, protecting groups, phosphoramidite chemistry 6. Thermodynamic and Kinetic Properties; Melting temperature (Tm), hydrogen bonding, base stacking 7. DNA Supercoiling and Topology; Linking number, topoisomerases, DNA packaging 8. Nucleic Acid-Protein Interactions; DNA-binding proteins, RNA-binding motifs 9. Mutagenesis and Chemical Modifications; Depurination, deamination, alkylation, UV damage 10. Analytical Techniques in Nucleic Acid Chemistry; UV spectroscopy, electrophoresis, chromatography, hybridization |

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

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|------------|--|
| Strategies | <p>This course introduces the chemistry of nucleic acids, focusing on the structure, properties, and biological significance of DNA and RNA. Topics include nitrogenous bases, nucleotides, phosphodiester linkages, and structural conformations of genetic material.</p> <p>The practical component involves DNA/RNA extraction, separation techniques (e.g., electrophoresis), and analysis of nucleic acid purity and concentration.</p> |
|------------|--|

| <h3 style="text-align: center;">Student Workload (SWL)</h3> <h4 style="text-align: center;">الحمل الدراسي للطالب</h4> | | | |
|---|-----|---|-----|
| Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل | 65 | Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا | 4.3 |
| Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل | 85 | Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا | 6.5 |
| Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل | 150 | | |

| <h3 style="text-align: center;">Module Evaluation</h3> <h4 style="text-align: center;">تقييم المادة الدراسية</h4> | | | | | |
|---|-----------------|-------------|------------------|------------|---------------------------|
| | | Time/Number | Weight (Marks) | Week Due | Relevant Learning Outcome |
| Formative assessment | Quizzes | 2 | 20% (10) | 5, 10 | LO #1, 2, 10 and 11 |
| | Assignments | 5 | 5% (5) | 2, 12 | LO # 3, 4, 6 and 7 |
| | Projects / Lab. | 1 | 5% (5) | Continuous | |
| | Report | 1 | 10% (10) | 13 | LO # 5, 8 and 10 |
| Summative assessment | Midterm Exam | 2 hr | 10% (10) | 7 | LO # 1-7 |
| | Final Exam | 3hr | 50% (50) | 15 | All |
| Total assessment | | | 100% (100 Marks) | | |

Delivery Plan (Weekly Syllabus)
المنهاج الأسبوعي للنظر

| | Material Covered |
|----------------|--|
| Week 1 | Nitrogenous bases and nucleosides |
| Week 2 | Nucleotides and phosphate linkages |
| Week 3 | DNA double helix: structure and properties |
| Week 4 | RNA: types and structures |
| Week 5 | DNA vs RNA comparison |
| Week 6 | Denaturation and renaturation of nucleic acids |
| Week 7 | DNA topology and supercoiling |
| Week 8 | Properties of prokaryotic vs. eukaryotic genomes |
| Week 9 | Functions of DNA and RNA in cells |
| Week 10 | Chromosomal DNA and extrachromosomal elements |
| Week 11 | Review of nucleic acid analytical techniques |
| Week 12 | Practical exam |
| Week 13 | Theoretical review |
| Week 14 | Final written exam |

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الأسبوعي للمختبر

| | Material Covered |
|------------------|---|
| Week 1 -2 | Preparation of nucleotide standards |
| Week 2 -4 | DNA model construction and structure analysis |
| Week 3 | Extraction of genomic DNA from animal tissues |
| Week 4 | Extraction of total RNA from plant cells |
| Week 5 | Spectrophotometric analysis of DNA and RNA |
| Week 6 | Temperature effect on nucleic acid stability |
| Week 7 | Agarose gel electrophoresis (DNA) |

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|----------------|--|
| Week 8 | Discussion + Case study-based quiz |
| Week 9 | Observation of RNA integrity on gels |
| Week 10 | Mini-prep DNA extraction (plasmid isolation) |
| Week 11 | Final practical project preparation |

| Learning and Teaching Resources مصادر التعلم والتدریس | | |
|---|--|----------------------------------|
| | Text | Available in the Library? |
| Required Texts | 1. <i>Molecular Biology of the Gene</i> – James D. Watson 2. <i>Lehninger Principles of Biochemistry</i> – Nelson & Cox 3. <i>Biochemistry</i> – Berg, Tymoczko, Stryer | Yes |
| Recommended Texts | <ul style="list-style-type: none"> • Lab manuals and protocols from the department • Peer-reviewed articles on nucleic acid analysis • Handouts and instructional videos prepared by the instructor | |
| Websites | https://en.wikipedia.org/wiki/Nucleic_acid | |

APPENDIX:

GRADING SCHEME مخطط الدرجات

| Group | Grade | التقدير | Marks (%) | Definition |
|--|-------------------------|------------|-----------|---------------------------------------|
| Success Group (50 - 100) | A - Excellent | امتياز | 90 - 100 | Outstanding Performance |
| | B - Very Good | جيد جدا | 80 - 89 | Above average with some 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 | مقبول بقرا | (45-49) | More work required but credit awarded |
| | F – Fail | راسب | (0-44) | Considerable amount of work required |
| Note: | | | | |
| NB 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. | | | | |



ملاحظة: هذا النموذج تم وضعه وتقديمه من قبل مديرية ضمان الجودة في وزارة التعليم العالي والبحث العلمي