	Ministry of Higher Education and Scientific Research - Iraq Al-Nahrain University College of Science Applied Pathological Analysis Department	

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Pathogenic Bacteria**	**Module Delivery**	
Module Type	**CORE**	☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	APPA 3116		
ECTS Credits	7		
SWL (hr./Sem)	175		
Module Level	3	**Semester of Delivery**	5
Administering Department	Applied Pathological Analysis	**College**	College of Science
Module Leader	Dr. Zahraa Kareem Raheem	**E-mail**	zahraa.kreem@nahrainuniv.edu.iq
Module Leader's Acad. Title	**Lecturer**	**Module Leader's Qualification**	**Ph.D.**
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Review Committee Approval	**01/09/2025**	**Version Number**	**1.0**

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<tr><th colspan="4">Relation with Other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><th colspan="4">Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td colspan="3">This module aims to equip students with a foundational and advanced understanding of medically important bacterial pathogens and the mechanisms by which they cause disease. Also, aims to develop students' technical skills and applied knowledge in the laboratory diagnosis of bacterial pathogens. Through this module, students will:

1. Understand the fundamental principles of bacterial pathogenesis, including key terminology and classical concepts such as Koch's postulates.
2. Explore the interactions between host and pathogen, focusing on stages of infection, sources of infection, and transmission routes.
3. Identify and analyze major bacterial virulence factors, such as toxins, adhesion structures, immune evasion mechanisms, and biofilm formation.
4. Study the pathogenesis, clinical significance and epidemiology of pathogenic bacteria for both Gram-positive and Gram-negative groups.
5. Differentiate between various bacterial genera and species based on their growth characteristics, virulence factors and associated diseases.
6. Identify the clinical manifestations of diseases caused by different bacterial pathogens.
7. Examine specific bacteria responsible for anaerobic infections, and understand their unique growth requirements and pathogenic profiles.
8. Develop a foundation for infection control and public health aspects related to bacterial diseases.
9. Manage clinical specimens effectively by following standard procedures for collection, labeling, transportation and processing.
10. Interpret bacterial colony morphology and microscopic characteristics correlating them with specific pathogens.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td colspan="3">By the end of this module, students will be able to:

1. Define and explain the key principles of bacterial pathogenesis and host-pathogen interactions.
2. Describe the classification, growth characteristics, virulence factors, and clinical significance of major pathogenic bacteria.
3. Identify modes of transmission, portals of entry, and mechanisms of immune evasion used by bacterial pathogens.</td></tr>
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	4. Explain the basis and interpretation of antimicrobial susceptibility testing and mechanisms of resistance. 5. Analyze clinical and laboratory data to differentiate between bacterial pathogens. 6. Interpret the significance of virulence factors in disease development and clinical outcomes. 7. Apply standard microbiological techniques including aseptic handling, staining, and bacterial culture. 8. Select and use appropriate culture media and incubation conditions for isolating specific pathogens. 9. Perform and interpret results of Gram stain, Acid-fast stain, and susceptibility tests using manual and automated methods. 10. Follow laboratory safety protocols and demonstrate responsible conduct in handling infectious materials.
Indicative Contents المحتويات الإرشادية	1. Introduction to bacterial pathogenesis and terminology. 2. Koch's Postulates and the identification of disease-causing bacteria. Host–microorganism interactions and stages of infection. 3. Modes of infection transmission and portals of entry. 4. Bacterial virulence factors: Adherence mechanisms (pili, fimbriae, capsules), Toxins (exotoxins and endotoxins), Enzymes and antiphagocytic factors, Antigenic variation and immune evasion, Biofilm formation and bacterial secretion systems 5. Gram-positive spore-forming bacilli (Bacillus spp., Clostridium spp.) 6. Enteric Gram-negative rods (*Escherichia coli*, *Klebsiella* spp., *Shigella* spp., *Salmonella* spp.) 7. Gram-positive cocci (*Staphylococcus* spp., *Streptococcus* spp., *Enterococcus* spp.) 8. Non-fermenters and hospital-acquired pathogens (*Pseudomonas aeruginosa*, *Acinetobacter baumannii*) 9. Curved Gram-negative rods (*Vibrio cholerae, Helicobacter pylori*) 10. Fastidious gram-negative coccobacilli (*Haemophilus* spp*., Bordetella pertussis, Brucella* spp.) 11. *Neisseria* species (*N. meningitidis, N. gonorrhoeae*) 12. *Mycobacterium tuberculosis* and its pathogenesis 13. Anaerobic bacterial infections (e.g., *Prevotella* spp., *Gardnerella vaginalis*) 14. Strategies for the prevention and control of infectious diseases 15. Laboratory biosafety practices and standard precautions 16. Sterilization and disinfection methods (physical and chemical) 17. Handling and processing of clinical specimens, Specimen labeling, transport, and storage. 18. Staining techniques (Gram stain, Acid-fast stain)

	19. Classification and use of culture media (general, selective, differential, enriched, transport, anaerobic) 20. Cultivation and colony morphology of major bacterial pathogens, microscopic examination of stained bacterial smears. 21. Use of anaerobic culture systems (anaerobic jars, chambers) 22. Antimicrobial susceptibility testing: Conventional methods: disk diffusion, broth dilution, Automated systems: VITEK 2 (AST cards).
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. **Interactive Lectures**: To introduce fundamental concepts of pathogenic bacteria, their classification, and mechanisms of pathogenesis. 2. **Visual Aids and Animations**: To explain complex microbial structures and virulence mechanisms in an engaging and understandable manner. 3. **Laboratory Sessions**: To develop practical skills in bacterial isolation, identification, staining, and antibiotic susceptibility testing. 4. **Group Discussions**: To encourage critical thinking and collaborative learning when interpreting lab findings and discussing disease mechanisms. 5. **Problem-Based Learning (PBL):** Students work in small groups to solve diagnostic challenges using microbiological data. 6. **Student Presentations:** To enhance communication skills and deepen understanding through peer teaching. 7. **Quizzes and Formative Assessments**: To reinforce learning and provide continuous feedback on students' progress. 8. **Utilizing Learning Management Systems:** Such as Google Classroom or Moodle to share lectures, Scientific resources, and assessments. 9. **Providing Educational Videos and Interactive Digital Content:** Such as virtual simulations for specimen diagnosis.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**94**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**81**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**175**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	2,3,4,6,8, 9,10,11, 13	All
	Assignments& H. W	2	5% (5)	5, 11	All
	Projects / Lab.	1	15% (15)	Continuous	All
	Seminar	1	10% (10)	Continuous	All
Summative assessment	Midterm Exam	1 hr.	10% (10)	7	All
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Pathogenesis of Bacterial Infections**: Introduction; key terms; Identifying bacteria that cause disease (Koch's Postulates).
Week 2	**Host-Microorganism Interactions and Stages of Infection or Disease:** -The infection process; Source of Infection; Transmission of infection and modes of infection transmission; Portals of entry.
Week 3	**Bacterial Virulence Factors Part 1:** Regulation of Virulence Factors, Adherence Factors (Pili or Fimbriae, Capsules, Flagella), Toxins (Exotoxins and Endotoxins), Enzymes.
Week 4	**Bacterial Virulence Factors Part 2:** Antiphagocytic factors, Intracellular Pathogenicity, Bacterial Secretion Systems, Biofilm Formation, Antibiotic resistance genes.
Week 5	**Spore forming Gram-Positive Bacilli**: *Bacillus* spp.; *Clostridium s*pp. -Growth characteristics, Pathogenesis and pathology, virulence factors and, clinical findings, Epidemiology, Prevention and control.
Week 6	**The Staphylococci**: *Staphylococcus* spp.: Growth characteristics, Pathogenesis and pathology, virulence factors, clinical findings, Epidemiology, Prevention and control. **The Streptococci and Enterococci*:*** *Streptococcus* spp., *Enterococcus* spp.: Growth characteristics, Pathogenesis and pathology, virulence factors, clinical findings, Epidemiology, Prevention and control.
Week 7	**Mid-Term Examination**

Week 8	**Enteric Gram-Negative Rods**: *Escherichia coli, Klebsiella* spp.*, Shigella* spp. *and Salmonella* spp. -Growth characteristics, Pathogenesis and pathology, virulence factors and, clinical findings, Epidemiology, Prevention and control.
Week 9	***Pseudomonads and Acinetobacter*: *Pseudomonas aeruginosa, Acinetobacter baumannii*** -Growth characteristics, Pathogenesis and pathology, virulence factors, clinical findings, Epidemiology, Prevention and control.
Week 10	***Vibrio and Helicobacter***: *Vibrio cholera, Helicobacter pylori* -Growth characteristics, Pathogenesis and pathology, virulence factors, clinical findings, Epidemiology, Prevention and control.
Week 11	***Haemophilus* spp.*, Bordetella pertussis and Brucella* spp.*:*** -Growth characteristics, Pathogenesis and pathology, virulence factors, clinical findings, Epidemiology, Prevention and control.
Week 12	**The Neisseriae***: Neisseria meningitidis, Neisseriae gonorrhea* -Growth characteristics, Pathogenesis and pathology, virulence factors, clinical findings, Epidemiology, Prevention and control.
Week 13	**Mycobacteria:** *Mycobacterium tuberculosis* - Introduction, Pathogenesis and pathology, Clinical findings, Epidemiology, Prevention and control. - Strategies for Preventing Infectious Diseases.
Week 14	**Infections Caused by Anaerobic Bacteria:** Physiology, Growth conditions for anaerobes, key terms. -Anaerobic bacteria found in human infections: *Prevotella spp*., *Gardnerella vaginalis* - Pathogenesis of anaerobic bacterial infections
Week 15	**Preparatory Week Before Final Exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) **المنهاج الاسبوعي للمختبر**	
	Material Covered
Weeks 1-2	**Lab 1: Laboratory Safety**: Sterilization and disinfection (Physical and chemical methods) -Disposal of hazardous waste, Standard precautions, Biological Safety cabinet.
	Lab 2: Specimen Management: General concepts for Clinical specimens' collection and handling, Specimen labeling, Specimen transport and storage. -Specimen processing: Direct microscopic examination, selection of culture media, incubation conditions.

Weeks 3-4	**Lab 3: General Concepts of Culture Media**: Medical classification and functions -Media Sterilization. Basic Types of Culture Media: General purpose media (Nutrient Agar), Enriched Media (Blood Agar), Selective media (MacConkey Agar, Mannitol Salt Agar), Differential Media (MacConkey Agar, Blood Agar), Transport Media (Stuart's Medium, Cary-Blair Medium), Anaerobic Media (Thioglycolate Broth, Cooked Meat Medium).
	Lab 4: Staining Techniques for Light Microscope: Smear preparation -Gram Stain: Principle, procedure and examination. -Acid-Fast Stain: Principe, procedure. - **Preservation of Bacterial Isolates**: Short-term methods, Long-term methods. -**Inactivation or Destruction of Bacterial Isolates**.
Weeks 5-6	**Lab 5: Bacterial Colony Characteristics** - *Bacillus* spp.; *Clostridium* spp.: Laboratory diagnosis including :Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
	Lab 6: *Staphylococcus* spp., *Streptococcus* spp. and *Enterococcus* spp. Laboratory Diagnosis including: Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
Week 7	**Mid-Term Examination**
Weeks 8-9	**Lab 8: *Escherichia coli, Klebsiella* spp., *Shigella* spp. *and Salmonella* spp.** - Laboratory diagnosis including; Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
	Lab 9: *Pseudomonas aeruginosa, Acinetobacter baumannii* Laboratory Diagnosis including: Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
Weeks 10-11	**Lab 10**: ***Vibrio cholera, Helicobacter pylori*** Laboratory Diagnosis including: Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
	Lab 11: *Haemophilus* spp., *Bordetella pertussis and Brucella* spp.*:* Laboratory Diagnosis including: Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
Week 12-14	**Lab12**: ***Neisseria* spp. *and Mycobacterium Tuberculosis*** Laboratory Diagnosis including: Cultivation, Media of choice, Incubation conditions, colonial appearance, microscopic characteristics.
	Lab 13: Anaerobic Bactria Laboratory Considerations: Specimen collection and transport, Gram staining, Anaerobic Jars, Anaerobic chamber, Anaerobic media, Incubation conditions.
	Lab 14: Methods that Measure Antimicrobial Activity: -Conventional Testing Methods including; Broth dilution, Disk diffusion -Automated Antimicrobial Susceptibility Test Systems; Vitek 2 System (AST Cards).

Week 15	**Preparatory Week Before the Final Exam.**
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Tille PM. Bailey & Scott's Diagnostic Microbiology-E-Book: Bailey & Scott's Diagnostic Microbiology-E-Book. Elsevier Health Sciences; 2013 Jun 28. https://ebook.app.hcu.edu.gh/wp-content/uploads/2024/05/Bailey-Scotts-Diagnostic-Microbiology-15th-Edition-Patricia-Tille-Z-Library.pdf 2. Carroll KC, Hobden JA, Miller S, Morse SA, Mietzner TA, Detrick B, Mitchell TG, McKerrow JH, Sakanari JA. Jawetz, Melnick, & Adelberg's Medical Microbiology, 27e. McGraw-Hill; 2015. http://ndl.ethernet.edu.et/bitstream/123456789/18396/1/1700.pdf	No
Recommended Texts	Review of Medical Microbiology and Immunology, Warren Levinson	No
Websites	https://www.who.int/health-topics/bacterial-diseases https://medlineplus.gov/bacterialinfections.html	

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 بقرار	(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