1. Module identification code:	
Name of the institution:	Universidad Autónoma de Nuevo León
Name of the school:	School of Medicine
Name of the degree program:	Clinical Chemistry
Name of the course (learning unit):	Medical bacteriology
Total number of class hours-theory and practice:	120 h
Class hours per week:	6 h
Independent study:	30 h
Course modality:	Face-to-face instruction
Module level:	Sixth semester
Core/elective module:	Core
Curriculum area:	ACFP-F
UANL credit points:	5
Create date:	18/01/2017
Person(s) responsible for the design and amendment of the module:	Dr. C. José Prisco Palma Nicolás

2. Presentation:

The Medical bacteriology learning unit (LU) is divided into three phases; the first will address the main groups of cocci and bacteria with atypical cell walls that cause disease in humans, their microscopic characteristics, their epidemiology at national and international level, as well as the most appropriate methods for their isolation and identification in the microbiology laboratory. Likewise, in phase 2, Gram-negative bacilli and spirochetes will be addressed, while in phase 3, Gram-positive bacilli and acid-alcohol-resistant bacilli.

In each stage, the student will be able to describe the bacteria of medical importance, the disease they cause, epidemiology, prevention and control mechanisms; explain their morphology, virulence factors, pathogenesis and immunity, as well as their transmission mechanisms. Finally, the student will select the most appropriate methods, techniques or laboratory tests for the isolation and identification. For each of the different bacterial groups, students will make an oral presentation in teams, and at the end of each phase, students will demonstrate their learning through a theoretical exam. At the end of the course, students will individually solve a practical case of microbiological diagnosis in which they propose and execute one of the learned methodologies to solve one case of medical bacteriology.

3. Purpose of the learning unit

To contribute to achieving the graduate profile in the field of medical bacteriology, by developing the necessary skills for the study of the causal agents of bacterial infectious diseases, through the design, validation, selection and/or execution of laboratory tests, under strict quality control, and using a methodology that favors self-learning focused on problem solving.

In relation to general competencies, students will be able to use traditional and cutting-edge research methods and techniques to develop their academic work in the laboratory, with the aim of finding the necessary answers in the exercise of their profession, by making decisions individually or jointly with their colleagues. The knowledge generated will allow them to intervene critically and with human commitment in the face of contemporary challenges to consolidate the general well-being of society and contribute to sustainable development.

At the LU Medical bacteriology course, students acquire specific skills to select and perform the laboratory tests necessary to identify bacteria in a clinical sample. They know and handle biological agents responsibly in accordance with national and international regulations. They also interpret the results of microbiological tests that allow them to make timely decisions in the diagnosis of infectious diseases.

The LU of Medical bacteriology integrates the skills acquired in LUs such as: Basic microbiology, where the classification of the different types of biological agents, their general properties, as well as the physical-chemical methods for their eradication and control are studied; the LU of Biochemistry applies various tests that allow the identification of bacteria based on characteristics of their metabolism and/or energy requirements; the LU of Immunology applies knowledge to select microbiological diagnostic tests based on the patient's immune response against infectious agents.

It provides fundamental bases for the development of Social Service, Professional Practices and for the General Graduation Exam for the Bachelor's Degree in Clinical Chemistry.

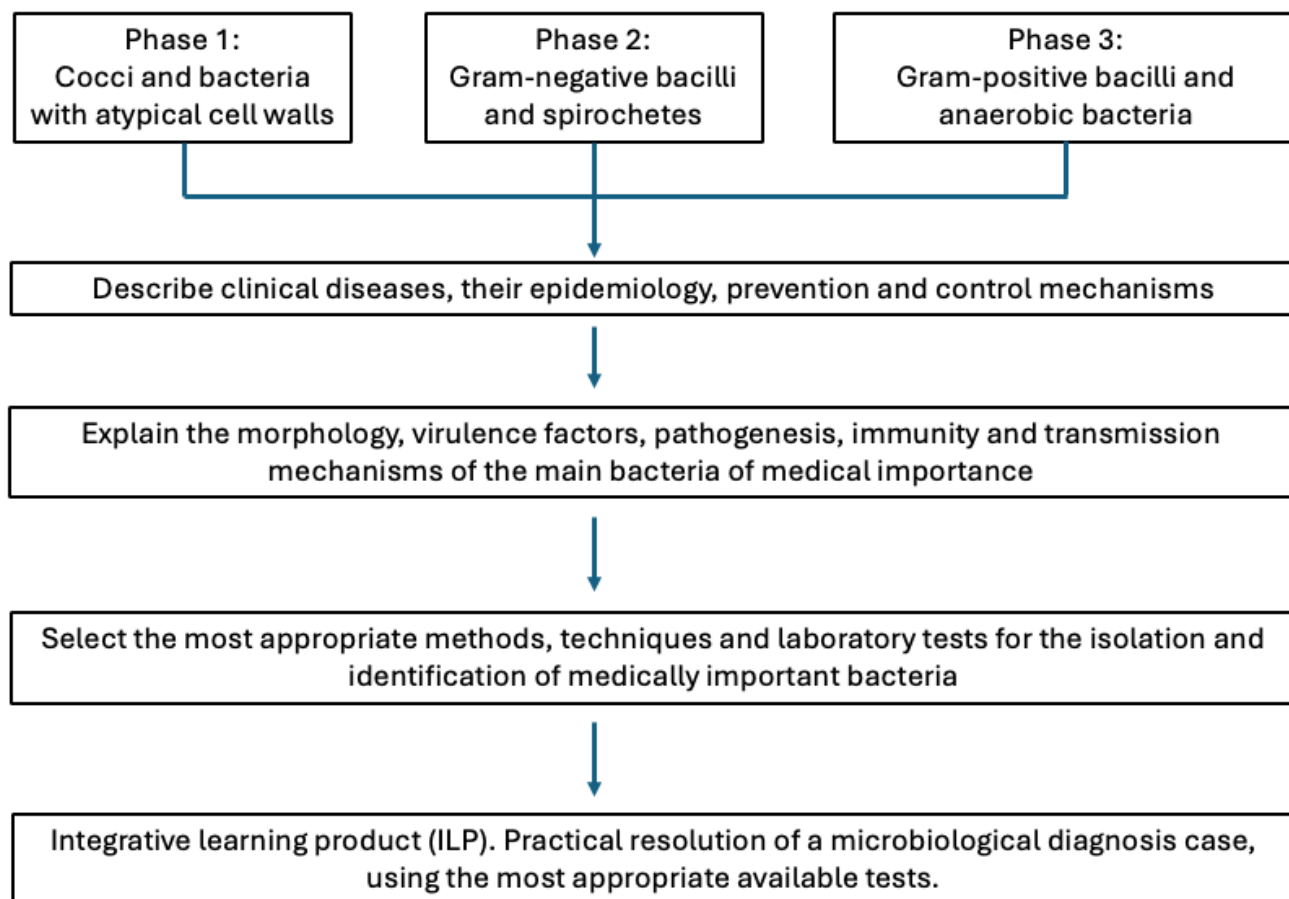**4. Competences of the graduate profile:**

General competences to which this module (learning unit) contributes:

- *Instrumental skills:*

  3. Manage information and communication technologies as a tool for accessing information and its transformation into knowledge, as well as for learning and collaborative work with cutting-edge techniques that allow for constructive participation in society.

- *Personal and social interaction skills:*

  11. To practice the values promoted by the UANL: truth, equity, honesty, freedom, solidarity, respect for life and others,

  peace, respect for nature, integrity, ethical behavior and justice, in their personal and professional environment to

  contribute to building a sustainable society.

- *Integrative skills:*

  13. Assume leadership committed to social and professional needs to promote relevant social change.

Specific competences of the graduate profile to which this module (learning unit) contributes:

2. To execute physical, chemical and/or biological procedures in the collection, handling, storage and analysis of samples to contribute to a reliable clinical, toxicological, chemical, food, forensic and environmental diagnosis.

3. To handle chemical and biological materials following official Mexican and/or international standards that guarantee their correct use and disposal to preserve health and the environment.

6. Interpret the results of analysis based on established criteria that allow for timely and pertinent decision-making in clinical, toxicological, chemical, food, forensic and environmental diagnosis.

5. Course roadmap:

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┌─────────────────────┐   ┌─────────────────────┐   ┌─────────────────────┐
│     Phase 1:        │   │     Phase 2:        │   │     Phase 3:        │
│ Cocci and bacteria  │   │ Gram-negative bacilli│   │ Gram-positive bacilli and│
│ with atypical cell walls│ │ and spirochetes    │   │ anaerobic bacteria  │
└─────────────────────┘   └─────────────────────┘   └─────────────────────┘
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Describe clinical diseases, their epidemiology, prevention and control mechanisms

Explain the morphology, virulence factors, pathogenesis, immunity and transmission mechanisms of the main bacteria of medical importance

Select the most appropriate methods, techniques and laboratory tests for the isolation and identification of medically important bacteria

Integrative learning product (ILP). Practical resolution of a microbiological diagnosis case, using the most appropriate available tests.

6. Structuring into phases:

Phase 1. Cocci and bacteria with atypical cell walls

Phase 2. Gram-negative bacilli and spirochetes

Phase 3. Gram-positive bacilli and anaerobic bacteria

Phase 1: Cocci and bacteria with atypical cell walls

Component(s) of the competence:

1.1 Selects the culture media, as well as the physiological and biochemical tests useful in the isolation and identification of cocci and bacteria with atypical cell walls, to generate an accurate diagnosis of the causative agent of the disease.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
Evidence 1. Written evaluation about content (1 - 5).	• At the end of the stage. • Individually • Using an exam on the ExamSoft platform • Respecting the date and time indicated • Using a computer or a personal tablet • Complete a multiple-choice exam with 40 questions on the theory topics (Topics	• The teacher presents the UA using a Power Point presentation. • To review the content of the phase, the following dynamic sequence will be used: • The teacher outlines the topic corresponding to the session using resources such as conceptual maps or infographics.	1. ***Staphylococcus****. S. aureus, S. saprophyticus, y S. epidermidis.* 2. ***Streptococcus.*** *S. pyogenes, S. pneumoniae y S. agalactiae.* ***Enterococcus.*** *E. faecalis* 3. ***Neisseria****. N. meningitidis, N. gonorrhoeae.* ***Moraxella.*** *M. catarrhalis*	• Personal computer or electronic tablet • Broadband internet connection • Institutional email account with access to Microsoft TEAMS • ExamSoft Platform • Faculty of Medicine Distance

	1 to 5) within a period of 40 minutes. • The evaluation includes cocci and bacteria with atypical cell walls (Topics 1-5) • Physiology and structure • Pathogenesis and immunity and virulence factors • National and international epidemiological information • Clinical diseases • Isolation methods and microbiological identification tests • Treatment, prevention and control options.	• The students are organized into teams and prior to the date of the session, submitting a presentation with slides through the TEAMS platform in which they summarize, structure and organize the information on the topic assigned to them (WEIGHTED ACTIVITY 1.1). • The presentation contains the following sections: • a) Identification Data [Topic and Session Number, Team Members, Session Date] • b) Introduction [history of microorganism identification] • c) Physiology and structure • d) Pathogenesis and Immunity • e) Epidemiology in Mexico and in the world • f) Clinical diseases	4. **Mycoplasma:** *Mycoplasma pneumoniae, Mycoplasma hominis y Ureaplasma urealyticum.* **Chlamydia:** *Chlamydia trachomatis y Chlamydophila pneumoniae* 5. **Rickettsia and Coxiella:** *Rickettsia rickettsi, Rickettsia prowazekii, Rickettsia typhi y Coxiella burnetti*	Education Platform (Moodle) • **Textbooks:** - Koneman, 2008 - Murray P.R., 2017 • **Additional resources** • Computer • Projector

		g) Laboratory diagnostic methods [tests of choice and alternative tests] h) Treatment, Prevention and Control. - The teacher reviews the team's work and provides feedback, highlighting, complementing, or correcting, if necessary, prior to the date of the presentation of the corresponding session. - On the session date, the students in the team clearly present the topic within a 45-60 minute time frame, using technical-scientific vocabulary. - The student uses images, models and/or videos from the reference material provided corresponding to the assigned topic. • The student correctly uses information management and cites		

		references at the end of his presentation.		
		• At the end of the presentation, the professor summarizes the most important parts of the topic and provides a clinical case of microbiological diagnosis to reinforce the knowledge acquired. • The results of the evaluations of the slide presentation as well as the partial theoretical evaluation will be announced through the Distance Education Platform (Moodle). •		
Evidence 2. Laboratory practice report (1 - 5)	• In the Microbiology laboratory (Practices that require it, as indicated) • On the Microsoft TEAMS platform (Practices that	• Before each session, the student must have read the practice in his/her laboratory manual, where the theoretical bases of the procedures to be carried	**Laboratory practice:** 1. Primary tests 2. Isolation and identification of *Staphylococcus* species	• Personal computer or tablet • Broadband internet connection

	require it, as indicated) • Record in a practical manual the information and methodologies necessary to identify Cocci and bacteria with atypical cell walls (Topics 1 to 5). • By hand • Individually • Respecting the morphology and colors of the staining of the material observed under the microscope • Mark the structures observed under the microscope • Wearing the necessary protective equipment to carry out the practices assigned as face-to-face (gown, face	out are explained (extra-class activity). • The professor will give the framework of the methodology corresponding to the UA topic. • The student performs the activities established in the practice corresponding to the session. • The student will record all the methodological steps of the practice and will make diagrams and drawings of the bacteria identified in the practice in his/her manual. • The professor will provide feedback on the results of the practical activities during the laboratory session. • The professor will supervise the practical activities during the sessions that are indicated as face-to-face. • The student will complete the practice	3. Isolation and identification of *Streptococcus* and *Enterococcus* species 4. Identification of *Neisseria gonorrhoeae* and *Moraxella catarrhalis*	• Institutional email account with access to Microsoft TEAMS • Manual of Practices for the Medical Bacteriology Course • Physical infrastructure of the Department of Microbiology • Materials and equipment of the Undergraduate Practice Laboratory of the Department of Microbiology **Reference material** • Koneman, 2008 • Murray P.R., 2017

	mask, gloves and glasses) • For the practice report, you will illustrate, using colored drawings, the type of microorganism seen during the laboratory practice. • You will digitize the evidence generated in your practice manual and send it in a timely manner for review through the TEAMS platform.	and prepare the learning evidence with the findings obtained during it. • The student will digitize the evidence and deliver it in PDF format through the TEAMS platform on the date and time indicated by the teacher. • The student will clean his/her workspace at the end of the laboratory session.		

Phase 2: Gram-negative bacilli and spirochetes

Component(s) of the competence:

2.1 Selects the culture media, as well as the physiological and biochemical tests useful in the isolation and identification of Gram-negative bacilli and spirochetes, to generate an accurate diagnosis of the causative agent of the disease.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
Evidence 3. Written evaluation about content (6 - 10).	• At the end of the stage. • Individually • Using an exam on the ExamSoft platform • Respecting the date and time indicated • Using a computer or a personal tablet • Complete a multiple-choice exam with 40 questions on the theory topics (Topics 6 to 10) within a period of 40 minutes. • The evaluation includes cocci and bacteria with atypical cell walls (Topics 6-10) • Physiology and structure	• The teacher presents the UA using a Power Point presentation. • To review the content of the phase, the following dynamic sequence will be used: • The teacher outlines the topic corresponding to the session using resources such as conceptual maps or infographics. • The students are organized into teams and prior to the date of the session, submitting a presentation with slides through the TEAMS platform in which they summarize, structure and organize the information on the topic assigned to them (WEIGHTED ACTIVITY 3.1).	6. **ENTEROBACTERIAS: Genera:** *Salmonella, Shigella, Yersinia. Escherichia, Klebsiella* and *Proteus*. 7. **GRAM NEGATIVE NON-FERMENTING BACILLI** *Pseudomonas aeruginosa, Acinetobacter baumannii, Stenotrophomonas maltophilia* 8. **CURVED GRAM NEGATIVE BACILLI** *Campylobacter jejuni, Vibrio cholerae, Helicobacter pylori* 9. **9. GRAM NEGATIVE BACILLI WITH SPECIAL NUTRITIONAL REQUIREMENTS:** *Haemophilus influenzae, Bordetella pertussis, Brucella abortus y Legionella pneumophila* 10. **SPIROCHETES**	• Personal computer or electronic tablet • Broadband internet connection • Institutional email account with access to Microsoft TEAMS • ExamSoft Platform • Faculty of Medicine Distance Education Platform (Moodle) • **Textbooks:** - Koneman, 2008 - Murray P.R., 2017 • **Additional resources** • Computer

	• Pathogenesis and immunity and virulence factors • National and international epidemiological information • Clinical diseases • Isolation methods and microbiological identification tests • Treatment, prevention and control options.	• The presentation contains the following sections: • a) Identification Data [Topic and Session Number, Team Members, Session Date] • b) Introduction [history of microorganism identification] • c) Physiology and structure • d) Pathogenesis and Immunity • e) Epidemiology in Mexico and in the world • f) Clinical diseases • g) Laboratory diagnostic methods [tests of choice and alternative tests] • h) Treatment, Prevention and Control. • The teacher reviews the team's work and provides feedback, highlighting, complementing, or correcting, if necessary, prior to the date of the	*Treponema pallidum, Borrelia recurrentis, Borrelia burgdorferi y Leptospira interrogans*	• Projector

		presentation of the corresponding session. • On the session date, the students in the team clearly present the topic within a 45-60 minute time frame, using technical-scientific vocabulary. • The student uses images, models and/or videos from the reference material provided corresponding to the assigned topic. • The student correctly uses information management and cites references at the end of his presentation. • At the end of the presentation, the professor summarizes the most important parts of the topic and provides a clinical case of microbiological		

		diagnosis to reinforce the knowledge acquired. • The results of the evaluations of the slide presentation as well as the partial theoretical evaluation will be announced through the Distance Education Platform (Moodle).		
Evidence 4. Laboratory practice report (6 - 10)	• In the Microbiology laboratory (Practices that require it, as indicated) • On the Microsoft TEAMS platform (Practices that require it, as indicated) Record in a practical manual the information and methodologies necessary to identify **Gram-negative**	• Before each session, the student must have read the practice in his/her laboratory manual, where the theoretical bases of the procedures to be carried out are explained (extra-class activity). • The professor will give the framework of the methodology corresponding to the UA topic. • The student performs the activities established in the	**Laboratory practice:** 5. Study of the *Enterobacteriaceae* Family 6. Identification of the *Salmonella* and *Shigella* genera 7. Non-glucose-fermenting Gram-negative bacilli 8. Identification of *Vibrio cholerae* 9. Study of the species of the *Haemophillus* and *Bordetella* genera	• Personal computer or tablet • Broadband internet connection • Institutional email account with access to Microsoft TEAMS • Manual of Practices for the Medical Bacteriology Course

		10. Observation and important characteristics of spirochetes	• Physical infrastructure of the Department of Microbiology
bacilli and spirochetes • (Topics 6 to 10). • By hand • Individually • Respecting the morphology and colors of the staining of the material observed under the microscope • Mark the structures observed under the microscope • Wearing the necessary protective equipment to carry out the practices assigned as face-to-face (gown, face mask, gloves and glasses) • For the practice report, you will illustrate, using colored drawings,	practice corresponding to the session. • The student will record all the methodological steps of the practice and will make diagrams and drawings of the bacteria identified in the practice in his/her manual. • The professor will provide feedback on the results of the practical activities during the laboratory session. • The professor will supervise the practical activities during the sessions that are indicated as face-to-face. • The student will complete the practice and prepare the learning evidence with the findings obtained during it. • The student will digitize the evidence and deliver it in PDF		• Materials and equipment of the Undergraduate Practice Laboratory of the Department of Microbiology **Reference material** • Koneman, 2008 • Murray P.R., 2017

	the type of microorganism seen during the laboratory practice. • You will digitize the evidence generated in your practice manual and send it in a timely manner for review through the TEAMS platform.	format through the TEAMS platform on the date and time indicated by the teacher. The student will clean his/her workspace at the end of the laboratory session.		

Phase 3: Gram-positive bacilli and anaerobic bacteria

Component(s) of the competence:

3.1 Selects the culture media, as well as the physiological and biochemical tests useful in the isolation and identification of Gram-positive bacilli and anaerobic bacteria, to generate an accurate diagnosis of the disease-causing agent.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources

Evidence 5. Written evaluation about content (11 - 15).	• At the end of the stage. • Individually • Using an exam on the ExamSoft platform • Respecting the date and time indicated • Using a computer or a personal tablet • Complete a multiple-choice exam with 40 questions on the theory topics (Topics 11 to 15) within a period of 40 minutes. • The evaluation includes **Gram-positive bacilli and anaerobic bacteria** (Topics 11-15) • Physiology and structure • Pathogenesis and immunity and virulence factors • National and international	• The teacher presents the UA using a Power Point presentation. • To review the content of the phase, the following dynamic sequence will be used: • The teacher outlines the topic corresponding to the session using resources such as conceptual maps or infographics. • The students are organized into teams and prior to the date of the session, submitting a presentation with slides through the TEAMS platform in which they summarize, structure and organize the information on the topic assigned to them (WEIGHTED ACTIVITY 5.1). • The presentation contains the following sections: • a) Identification Data [Topic and Session	**11. GRAM POSITIVE BACILLI:** **SPORULATED** *B. anthracis y B. cereus.* **NOT SPORULATED** *Corynebacterium diphtheriae, Listeria monocytogenes* **12. GRAM POSITIVE ANAEROBIC BACILLI:** *Clostridium perfringens, C. tetani, C. botulinum, C. difficile.* **13. GRAM NEGATIVE ANAEROBIC BACILI** *Bacteroides fragilis, Prevotella melaninogenica.* **14. GRAM POSITIVE FILAMENTOUS BACILLI** *Nocardia asteroides, Nocardia brasiliensis.*	• Personal computer or electronic tablet • Broadband internet connection • Institutional email account with access to Microsoft TEAMS • ExamSoft Platform • Faculty of Medicine Distance Education Platform (Moodle) • **Textbooks:** - Koneman, 2008 - Murray P.R., 2017 • **Additional resources** • Computer

epidemiological information • Clinical diseases • Isolation methods and microbiological identification tests • Treatment, prevention and control options.	Number, Team Members, Session Date] • b) Introduction [history of microorganism identification] • c) Physiology and structure • d) Pathogenesis and Immunity • e) Epidemiology in Mexico and in the world • f) Clinical diseases • g) Laboratory diagnostic methods [tests of choice and alternative tests] • h) Treatment, Prevention and Control. • The teacher reviews the team's work and provides feedback, highlighting, complementing, or correcting, if necessary, prior to the date of the presentation of the corresponding session. • On the session date, the students in the team clearly present the topic within a 45-60 minute time frame, using	*Actinomyces. israelli* **15. 15. ACID-ALCOHOL RESISTANT BACILLI.** *Mycobacterium tuberculosis, M. avium and M. leprae*	• Projector

		technical-scientific vocabulary.	
		• The student uses images, models and/or videos from the reference material provided corresponding to the assigned topic.	
		• The student correctly uses information management and cites references at the end of his presentation.	
		• At the end of the presentation, the professor summarizes the most important parts of the topic and provides a clinical case of microbiological diagnosis to reinforce the knowledge acquired.	
		• The results of the evaluations of the slide presentation as well as the partial theoretical evaluation will be announced through the Distance Education Platform (Moodle).	

Evidence 6. Laboratory practice report (11 a 15)	• In the Microbiology laboratory (Practices that require it, as indicated) • On the Microsoft TEAMS platform (Practices that require it, as indicated) Record in a practical manual the information and methodologies necessary to identify **Gram-positive bacilli and anaerobic bacteria** • (Topics 11 to 15). • By hand • Individually • Respecting the morphology and colors of the staining of the material observed under the microscope	• Before each session, the student must have read the practice in his/her laboratory manual, where the theoretical bases of the procedures to be carried out are explained (extra-class activity). • The professor will give the framework of the methodology corresponding to the UA topic. • The student performs the activities established in the practice corresponding to the session. • The student will record all the methodological steps of the practice and will make diagrams and drawings of the bacteria identified in the practice in his/her manual. • The professor will provide feedback on the results of the practical activities	**Laboratory practice:** 11. *Corynebacterium* spp., and *Listeria monocytogenes* 12. *Nocardia spp.* 13. *Mycobacterium tuberculosis*	• Personal computer or tablet • Broadband internet connection • Institutional email account with access to Microsoft TEAMS • Manual of Practices for the Medical Bacteriology Course • Physical infrastructure of the Department of Microbiology • Materials and equipment of the

	• Mark the structures observed under the microscope • Wearing the necessary protective equipment to carry out the practices assigned as face-to-face (gown, face mask, gloves and glasses) • For the practice report, you will illustrate, using colored drawings, the type of microorganism seen during the laboratory practice. • You will digitize the evidence generated in your practice manual and send it in a timely manner for review through the TEAMS platform.	during the laboratory session. • The professor will supervise the practical activities during the sessions that are indicated as face-to-face. • The student will complete the practice and prepare the learning evidence with the findings obtained during it. • The student will digitize the evidence and deliver it in PDF format through the TEAMS platform on the date and time indicated by the teacher. The student will clean his/her workspace at the end of the laboratory session.		Undergraduate Practice Laboratory of the Department of Microbiology **Reference material** • Koneman, 2008 • Murray P.R., 2017

7. Summative evaluation:

Phase	Evidence	Weighing
Phase 1 30%	Evidence 1. Written evaluation about content (Topics 1 - 5).	20 %
	WEIGHTED ACTIVITY 1.1. Oral presentation. (Topics 1-5)	5 %
	Evidence 2. Laboratory practice report (Topics 1 - 5)	5 %
	Evidence 3. Written evaluation about content (Topics 6 - 10).	20 %

Phase 2 30%	WEIGHTED ACTIVITY 3.1. Oral presentation. (Topics 6-10)	5 %
	Evidence 4. Laboratory practice report (Topics 6 - 10)	5 %
Phase 3 30%	Evidence 5. Written evaluation about content (Topics 11 - 15).	20 %
	WEIGHTED ACTIVITY 5.1. Oral presentation. (Topics 11-15)	5 %
	Evidence 6. Laboratory practice report (Topics 11 - 15)	5 %
CIP 10%	Course integrative project/product	10 %
	Total	100 %

8. Course integrative project/product: (10%)

Resolution of a microbiological diagnosis case. Exercise in which the student selects, executes, interprets and discusses the results of the most appropriate microbiological tests available for the isolation and identification of the causal agent of a clinical picture provided.

9. References:

Fac. de Medicina-Universidad Autónoma de Nuevo León. (n.d.). *Plataforma*. From Plataforma: http://www.medicina.uanl.mx/plataforma/

José P. Palma Nicolás, G. G. (2018). *Manual de Prácticas del Curso de Bacteriología Médica* (Segunda ed.). Monterrey, N.L., México.

Koneman, E. W. (2008). *Koneman. Diagnóstico Microbiólogico* (Sexta ed.). Montevideo, Uruguay: Editorial Médica Panamericana.

Murray P.R., R. K. (2017). *Microbiología Médica* (Octava ed.). Barcelona, España: Elsevier.

Additional resources

Anuarios de morbilidad Nacional. Dirección General de Epidemiología. Secretaría de Salud, Gobierno de México. Disponible en:

https://www.gob.mx/salud/acciones-y-programas/anuarios-de-morbilidad-1984-2019

Boletín Epidemiológico. Sistema Nacional de Vigilancia Epidemiológica. Secretaría de Salud, Gobierno de México. Disponible en:

https://www.gob.mx/salud/documentos/boletinepidemiologico-sistema-nacional-de-vigilancia-epidemiologica-sistema-unico-de-informacion-231750