

<b>1. Module identification code.</b>	
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):	Basic Microbiology
Total number of class hours-theory and practice:	80
Class hours per week:	4 hours
Independent study:	10
Course modality:	Face-to-face instruction
Module level:	Second semester
Core/elective module:	Core
Curriculum area:	ACFB
UANL credit points:	3
Create date:	August 28 <sup>th</sup> , 2017
Date of last amendment made:	January 19 <sup>th</sup> , 2022
Person(s) responsible for the design and amendment of the module:	Dr. C Miguel Ángel Becerril García

## 2. Presentation:

The module (learning unit) of basic Microbiology consists of 4 phases.

In phase 1, the fundamentals of biochemistry will be revised through which the students will learn to differentiate biomolecules and to distinguish metabolic processes, this basis will let the student understand the structural and physiological characteristics of microorganisms as well as of infectious agents. This is distributed in the following phases:

During phase 2, microbiology will be examined from its historical point of view that will let the student provide the basis for the effects it has on current practice. He will classify microorganisms according to environmental factors and nutritional requirements that influence their growth.

He will differentiate genetic characteristics of microorganisms and will relate them to their virulence.

He will describe the characteristics of saprophyte, commensal and pathogen microorganisms in order to relate them to the human being as a host.

Finally, he will identify the use of physical and chemical agents in the control of microbial growth.

In phase 3, he will distinguish the morphology, growth, genetics and ecology of viruses, bacteria, fungi, protozoa and helminths.

As a course integrative project/product (CIP), he will make a written report about a clinical case study assigned by the professor.

In this report, he will provide an adequate methodological and conceptual strategy that will let him differentiate groups of microorganisms that are causing an illness.

## 3. Purpose:

The following module (LU) contributes to the graduate profile because it develops the necessary competences

to select lab tests and provide the basis for such a choice that will let the student identify microorganisms through the analysis of the general concepts of their morphology, physiology, genetics and ecology, their impact on the environment, in human activity and their implication on the production of illnesses in the human being. All this, carried out under strict regulations of quality control that will let him make adequate and appropriate decisions to collaborate in the prevention, diagnosis, control and treatment of illnesses.

With regard to the general competences, the student will be able to apply autonomous learning strategies so that he can make adequate and appropriate decisions during sample analysis. This will also let him make a microbiological identification with accuracy and quality. Besides, he will show ethics, truth, honesty, and respect towards his classmates and professors in the classroom as well as in the laboratory.

He shows empathy when dealing with conflicts during team work in the classroom and in the laboratory, in such a way that he respects the ideas of his classmates and reaches agreements when facing different points of view during team work and in the practice laboratory.

In the LU of basic Microbiology, the student acquires competences that let him have the necessary basis for the collection and handling of samples for microbiological analysis.

Also, he handles chemical and biological materials according to national and international regulations in order to protect health and the environment.

The content of this module (learning unit) is interrelated with Cellular Biology because it describes the components and functions of cells both prokaryotes and eukaryotes; on the other hand, it provides the general aspects of the microorganisms that will be useful for their approach in depth in the modules (learning units) of Medical parasitology; Mycology and Virology; Immunology, Medical bacteriology, that contribute to the understanding of the infectious process and the behavior of microorganisms.

#### 4. Competences of the graduate profile

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

*Instrumental skills:*

1. To apply autonomous learning strategies at different levels and fields of knowledge that allow them to make timely and relevant decisions in the personal, academic and professional spheres.

*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

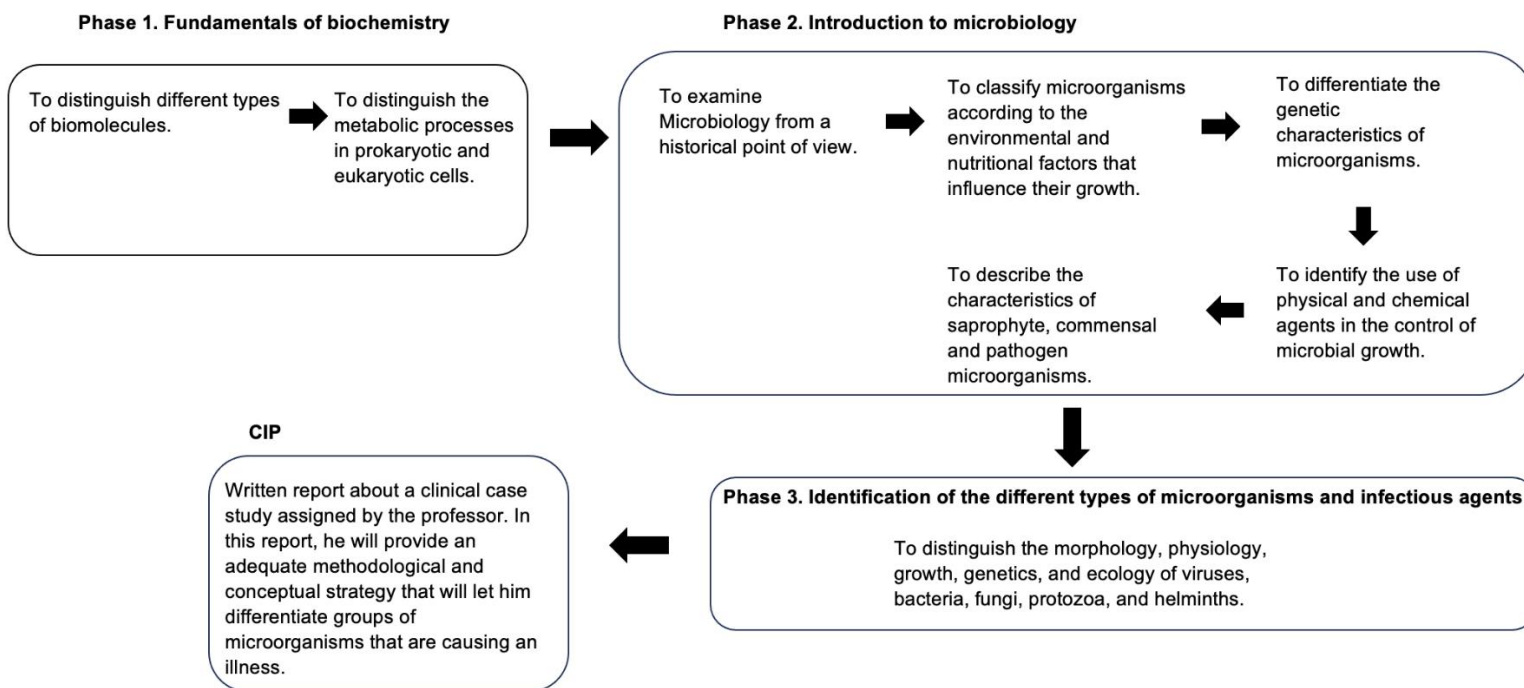
*Integrative skills:*

14. To resolve personal and social conflicts, in accordance with specific techniques in the academic field and in their profession for appropriate decision-making.

**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.

## 5. Course roadmap:



## 6. Structuring into stages or phases:

**Stage 1:** Fundamentals of Biochemistry.

**Component(s) of the competence:** To identify the biochemical basis as well as the metabolism of microorganisms and infectious agents that let the student enter into the study of microbiology.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
1. Diagram about biomolecules and cellular metabolism.	<p>Presentation: Turns in a diagram: five sheets maximum, handwritten, with an additional cover page, and complete identification data.</p> <ul style="list-style-type: none"> <li>• Content: Includes the metabolism of carbohydrates, proteins and lipids. Highlights the critical aspects of the topic.</li> <li>• Synthesis: Uses diagrams only.</li> <li>• References: Uses three or more sources of information.</li> <li>• Planning: Turns in the evidence at the time and in the day programmed.</li> </ul>	<p>-The student will read in advance the topics assigned.</p> <p>- The professor will present the topics: Biomolecules and Cellular metabolism.</p> <p>- The professor will conduct a discussion of the topics by asking questions to the students.</p> <p><b>Accredited activity No. 1</b> Practice. Demonstration of the material used in the Microbiology laboratory.</p> <p>Cleaning and sterilization of material used in the Microbiology laboratory. (accredited activity).</p>	<p><b>Biomolecules:</b></p> <ol style="list-style-type: none"> <li>1.1 Functional groups</li> <li>1.2 pH and water</li> <li>1.3 Carbohydrates</li> <li>1.4 Lipids</li> <li>1.5 Amino acids</li> <li>1.6 Proteins</li> <li>1.7 Enzymes</li> <li>1.8 Nucleic acids</li> </ol> <p><b>2. Cellular metabolism:</b></p> <ol style="list-style-type: none"> <li>2.1 Metabolism, Anabolism, and Catabolism</li> <li>2.2 Carbohydrate metabolism</li> <li>2.3 Glycogenesis</li> <li>2.4 Glycogenolysis</li> <li>2.5 Glycolysis</li> <li>2.6 Gluconeogenesis</li> <li>2.7 Krebs Cycle</li> <li>2.8 Respiratory chain</li> <li>2.9 Oxidative Phosphorylation</li> <li>2.10 Protein Metabolism</li> <li>2.11 Lipid Metabolism</li> </ol>	<p>Textbooks: Ferrier. 2017. Chapters: 1-19. Koolman. 2012. Chapters 2-3. Murray. 2013. Chapters 2-26. Alonso 2017. Chapter 1.</p> <p>Computer Projector Practice Laboratory Microscopes Laboratory glassware Reagents and lab disposables Diary Pen  Pencil.</p>

## Stage 2: Introduction to Microbiology

### Component(s) of the competence:

To examine the microbiological agents from a genetic, nutritional, environmental and historical point of view; and their relation to the host; and their control using chemical and physical agents; in order to provide the theoretical basis about their effect in humans.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
2. Diagram about historical events and factors that influence the growth of microorganisms, genetics, microbiota and antimicrobial agents.	<p>Presentation: Turns in a diagram: six sheets maximum, handwritten, with an additional cover page, and complete identification data.</p> <ul style="list-style-type: none"> <li>Content: Includes the most relevant historical processes of microbiology; environmental and nutritional factors that affect microbial growth; genetic characteristics of microorganisms; microbiota and its relationship to the host; and the impact of physical and chemical agents on microbial development.</li> <li>Synthesis: Uses diagrams only.</li> <li>References: Uses three or more sources of</li> </ul>	<p>-The student will read in advance the topics assigned.</p> <p>- The professor will present the topics: History of Microbiology, environmental factors that influence microbial growth, classification of microorganisms, nutritional factors for microorganism growth and classification, microbial genetics, normal microbiota, and antimicrobial agents.</p> <p>- The professor will conduct a discussion of the topics by asking questions to the students.</p> <p><b>Accredited activity No 2:</b> Practice. Aseptic technique used to handle test tubes. Using the bacteriological handle-rod.</p>	<p><b>3. History of Microbiology</b> 3.1 Definition of Microbiology/Microorganism. 3.2 Field of study. 3.3 Discovery of microorganisms. 3.4 Theory of spontaneous generation. 3.5 Theories of Microbial Evolution. 3.6 Microbial Diversity. Prokaryotes/Eukaryotes.</p> <p><b>4. Environmental factors that influence microbial growth:</b> 4.1 Microbial growth. 4.2 Environmental factors that influence microbial growth: oxygen consumption, pH, temperature and water. 4.3 Classification of microorganisms in terms of</p>	<p>Jawetz.2016. Chapters 1-10. Prescott. 2009 Chapters 1-7, 11-13. Alonso. 2017. Chapters 2-9. Computer Projector Practice Laboratory Microscopes Laboratory glassware Reagents and lab disposables Diary Pen Pencil Web sites: World Health Organization: <a href="http://www.who.int/en">http://www.who.int/en</a> Centers for control and disease prevention <a href="http://www.cdc.gov/">http://www.cdc.gov/</a> Dirección general de epidemiología, México:</p>

	<p>information.</p> <ul style="list-style-type: none"> <li>• Planning:</li> </ul> <p>Turns in the evidence at the time and in the day programmed.</p>	<p><b>Accredited activity No 3:</b> Practice. Demonstration of the presence of microorganisms in nature.</p> <p><b>Accredited activity No. 4</b> Effect of molecular oxygen on bacteria growth.</p> <p><b>Accredited activity No. 5</b> Practice. Preparation of culture media.</p> <p><b>Accredited activity No. 6</b> Practice. Culture of microorganisms: the transfer of bacteria from one test tube to another.</p> <p><b>Accredited activity No. 7:</b> <b>1ª Written evaluation of the content 1-5</b></p> <p><b>Accredited activity No. 8</b> Practice. Determination of the number of microorganisms from a culture.</p> <p><b>Accredited activity No. 9</b> Practice. Transmission of oral bacteria during verbal communication</p> <p><b>Accredited activity No. 10</b> Practice. Sterilization by means of physical agents. Sterilization by dry heat</p>	<p>oxygen consumption: aerobious, anaerobious, aerotolerant and facultative.</p> <p>4.4 Classification in terms of pH: acidophiles, neutrophiles and alkaliphiles.</p> <p>4.5 Classification of microorganisms in terms of the temperature they require to grow: psychrophiles, mesophiles, thermophiles and hyperthermophiles.</p> <p><b>5.- Nutritional factors for microorganism growth and classification:</b></p> <p>5.1 Nutritional factors necessary to carry out metabolism: Macroelements (C, O, H, N, S and P) from carbohydrates, lipids, proteins and nucleic acids, ions (<math>Mg^{2+}</math>, <math>Ca^{2+}</math>, <math>Fe^{2+}</math> and <math>Fe^{3+}</math>); and Micronutrients (Mn, Zn, Co, Mo, Ni and Cu).</p> <p>5.2 Classification of microorganisms in terms of their carbon source: autotroph, heterotrophs; in terms of energy source: chemotroph and</p>	<p><a href="https://www.gob.mx/salud/acciones-yprogramas/direcciongeneral-deepidemiologia">https://www.gob.mx/salud/acciones-yprogramas/direcciongeneral-deepidemiologia</a></p>
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		<p>(furnace) and humid heat under pressure (autoclave). Effect of radiation on microorganisms.</p> <p><b>Accredited activity No. 11</b> Practice. Chemical agents: Sterilization of medical instruments. Skin antisepsis.</p> <p><b>Accredited activity No. 12</b> <b>2ª Written evaluation about content 6-8</b></p>	<p>phototroph; and of electron source: lithotroph and organotroph.</p> <p><b>6. Microbial genetics:</b> 6.1. Comparison of the genetic structure of: viruses, bacteria, yeasts, fungi, protozoa, and helminths. 6.2. Definition: Operon. 6.3 Mechanisms of genetic variation: mutation and recombination. 6.4. Mechanisms of genetic recombination of the microorganisms: transformation, transduction, conjugation, and their relation to pathogenicity.</p> <p><b>7.- Normal microbiota:</b>  7.1 Classification of microorganisms related to humans: saprophytes, commensals y pathogens.  7.2 Microbiota  7.3 Location of microbiota in the organism.  7.4 Definition of: Host, vector, saprophyte, commensal and pathogen.</p> <p><b>8.- Antimicrobial agents:</b></p>	
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			<p>8.1 Concept of microbial life and death.</p> <p>8.2 Microbial control and its relation to microbial death.</p> <p>8.3 Classification of microbial control based on its nature: physical agents and chemical agents.</p> <p>8.4 Definition of: sepsis, asepsis, antisepsis, sanitation, disinfectant, antiseptic, germicide, bacteriostat, bactericidal, fungicidal, sterile, sterilization, and antimicrobial.</p> <p>8.5 Classification of the physical agents for microbial control: Dry heat, humid heat under pressure, humid heat without pressure and, ionizing radiation and non-ionizing radiation.</p> <p>8.6 Mechanisms of action of physical agents.</p> <p>8.7 Classification of chemical agents for microbial control: disinfectant, antiseptic, and antibiotic.</p> <p>8.8 Mechanisms and sites of action of disinfectant and/or antiseptic on the microbial cell.</p>	
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			<p>8.9 Tests to assess the effectiveness of a chemical agent.</p> <p>8.10 Sites of action of antimicrobial agents within the microbial cell.</p> <p>8.11 Definition of selective and nonselective toxicity.</p> <p>8.12 Definition of susceptible and resistant.</p> <p>8.13 Test to determine antimicrobial susceptibility.</p>	
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### Stage 3. Identification of the different types of microorganisms and infectious agents.

#### Component(s) of the competence:

To identify the microorganisms by means of their morphology, physiology, growth, genetics and ecology of bacteria, viruses, fungi, yeast, protozoa, and helminths that have clinical importance in order to provide the basis for the selection of the tests that let the student recognize them in the laboratory.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
3.- Comparison chart about helminths, protozoa, yeast, fungi, viruses, and bacteria.	<p>Presentation: Turns in chart: four sheets maximum, handwritten, with an additional cover page, and complete identification data.</p> <ul style="list-style-type: none"> <li>• Content: Includes the comparison among helminths, protozoa, yeast, fungi, viruses and bacteria. Highlights the specific characteristics of each group of microorganisms.</li> <li>• Synthesis: Uses charts only.</li> <li>• References: Uses three or more sources of information.</li> <li>• Planning: Turns in the evidence at the time and in the day programmed.</li> </ul>	<p>-The student will read in advance the topics assigned.</p> <p><b>Accredited activity No. 13</b> Students will give an oral presentation in teams about the following topics: viruses, bacteria, fungi, protozoa, and helminths that have clinical importance.</p> <p>The oral presentation should include the following sequence: structure, classification, physiology, pathogenicity factors, lab tests used in the diagnosis.</p> <p>- The professor will conduct a discussion of the topics by asking</p>	<p><b>9.- Bacteria that have clinical importance:</b></p> <p>9.1 Classification according to growth, physiological, and morphological characteristics; and of the mechanisms of transmission: Gram-positive (aerobic and anaerobic), Gram-negative (aerobic and anaerobic), Mycobacterias, Actinomycetes, Spirochetes, Mycoplasma, obligate. Intracellular bacteria: <i>Rickettsia</i> and <i>Chlamydia</i>.</p> <p>9.2 Virulence factors and bacterial pathogens.</p> <p>9.3 Diagnosis in the laboratory of the</p>	<p>Jawetz.2016 Chapters 11-48. Prescott. 2009. Chapters 16-23. Brock. 2009 Chapters 25-28. Alonso. 2017 Chapters 9-15. Computer Projector Practice laboratory Microscopes Laboratory glassware Reagents and lab disposables Diary Pen Pencil. Web sites: World Health Organization: <a href="http://www.who.int/en/">http://www.who.int/en/</a> Centros de control y prevención de enfermedades infecciosas EEUU: <a href="http://www.cdc.gov/">http://www.cdc.gov/</a></p>

		<p>questions to the students.</p> <p><b>Accredited activity No. 14</b> Practice. Separation of two bacterial species.</p> <p><b>Accredited activity No. 15</b> Practice. Simple staining. Preparation of extensions on microscope slides. Differential staining. Gram's staining technique 1%</p> <p><b>Accredited activity No. 16</b> Practice. Bacterial morphology. Demonstration of the bacterial capsule. Bacterial mobility.</p> <p><b>Accredited activity No. 17</b> Practice. General tests to differentiate bacterial genders.</p> <p><b>Accredited activity No. 18. 3ª Written evaluation about the content 9-12</b></p> <p><b>Accredited activity No. 19.</b> Practice. Microscopic observation of fungi and</p>	<p>illnesses caused by bacteria.</p> <p><b>10.- Virus that have clinical importance:</b></p> <p>10.1 Classification of viruses in terms of the nature of their genome: DNA and RNA.</p> <p>10.2 Morphology and identification of the structural components of viruses.</p> <p>10.3 Classification of viruses in terms of their function of the presence or absence of packaging: naked and enveloped.</p> <p>10.4 Viral replication cycle.</p> <p>10.5 Pathogenicity factors.</p> <p>10.6 Cytopathological effects and the relation to the tests used in their identification.</p> <p><b>11. Prions</b></p> <p><b>12.- Fungi that have clinical importance:</b></p> <p>12.1 Morphology</p>	<p>Dirección General de epidemiología, México:  <a href="https://www.gob.mx/salud/acciones-yprogramas/direcciongeneral-deepidemiologia">https://www.gob.mx/salud/acciones-yprogramas/direcciongeneral-deepidemiologia</a></p>
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		<p>yeast. Protozoa and helminths.</p> <p><b>Accredited activity No. 19. 4<sup>a</sup> Written evaluation about the content 13 and 14.</b></p>	<p>12.2 Pathogenicity factors.</p> <p>12.3 Physiology of growth.</p> <p>12.4 Relationship of the factors of pathogenicity with the entryway into the system; and the mechanism of the production of illnesses.</p> <p>12.5 Tests used in their identification.</p> <p><b>13.- Protozoa that have clinical importance:</b></p> <p>13.1 Classification of protozoa in terms of their mobility and way of phagocytosing.</p> <p>13.2 Morphology and microscopic identification</p> <p>13.3 Mechanism of transmission, location in humans, parasitic phase, diagnosing phase.</p> <p>13.4 Microscopic identification.</p> <p>13.5 Techniques used in the identification of protozoa.</p>	
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			<p>13.6. Species of clinical importance in each of their types: Sarcodina, Mastigophora, Ciliophora, Apicomplexa (Sporozoea)</p> <p><b>14.- Helminths that have clinical importance:</b></p> <p>14.1 Classification in terms of their adult form: nematodes, trematodes, and cestodes.</p> <p>14.2 Species of clinical importance.</p> <p>14.3 Mechanism of transmission.</p> <p>14.4 Parasitic phase, Diagnosing phase.</p> <p>14.5 Microscopic identification.</p> <p>14.6 Test used in their diagnosis.</p>	
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## 7. Summative evaluation:

Phase	Evidence	Weighing
Phase 1	<b>Evidence 1.</b> Diagram about biomolecules and cellular metabolism	<b>5%</b>
	<b>Accredited activity 1.</b> Practice. Demonstration of the material used in the Microbiology laboratory.	<b>1%</b>
Phase 2	<b>Evidence 2.</b> Diagram about the historical events and factors that influence on the growth of microorganisms, genetics, microbiota and antimicrobial agents.	<b>10%</b>
	<b>Accredited activity 2.</b> Practice. Aseptic technique used to handle test tubes. Using the bacteriological handle-rod.	<b>1%</b>
	<b>Accredited activity 3.</b> Practice. Demonstration of the presence of microorganisms in nature.	<b>1%</b>
	<b>Accredited activity No 3:</b> Practice. Demonstration of the presence of microorganisms in nature.	<b>1%</b>
	<b>Accredited activity No. 4</b> Effect of molecular oxygen on bacteria growth.	<b>1%</b>
	<b>Accredited activity No. 5</b> Practice. Preparation of culture media.	<b>1%</b>
	<b>Accredited activity No. 6</b> Practice. Culture of microorganisms: the transfer of bacteria from one test tube to another.	<b>1%</b>
	<b>Accredited activity No. 7: 1ª Written evaluation about content 1-5</b>	<b>5%</b>
	<b>Accredited activity No. 8</b> Practice. Determination of the number of microorganisms from a culture.	<b>1%</b>
	<b>Accredited activity No. 9</b> Practice. Transmission of oral bacteria during verbal communication.	<b>1%</b>
	<b>Accredited activity No. 10</b> Practice. Sterilization by means of physical agents. Sterilization by dry heat (furnace) and humid heat under pressure (autoclave). Effect of radiation on microorganisms.	<b>1%</b>
	<b>Accredited activity No. 11</b> Practice. Chemical agents: Sterilization of medical instruments. Skin antisepsis.	<b>1%</b>

	<b>Accredited activity No. 12 2nd Written evaluation about content 6-8 5%</b>	<b>5%</b>
<b>Phase 3</b>	<b>Evidence No 3:</b> Comparison chart among helminths, protozoa, yeast, fungi, viruses and bacteria.	<b>10%</b>
	<b>Accredited activity No. 13</b> Students will give an oral presentation in teams about the following topics: Viruses, bacteria, fungi, protozoa, and helminths that have clinical importance.	<b>5%</b>
	<b>Accredited activity No. 14</b> Practice. Separation of two bacterial species.	<b>1%</b>
	<b>Accredited activity No. 15</b> Practice. Simple staining. Preparation of extensions on microscope slides. Differential staining. Gram's staining technique	<b>1%</b>
	<b>Accredited activity No. 16</b> Practice. Bacterial morphology. Demonstration of the bacterial capsule. Bacterial mobility.	<b>1%</b>
	<b>Accredited activity No. 17</b> Practice. General tests to differentiate bacterial genders	<b>1%</b>
	<b>Accredited activity No. 18. 3ª Written evaluation about content 9-12</b>	<b>5%</b>
	<b>Accredited activity No. 19.</b> Practice. Microscopic observation of fungi and yeast. Protozoa and helminths.	<b>1%</b>
	<b>Accredited activity No. 20. 4ª Written evaluation about content 13-14</b>	<b>5%</b>
<b>CIP</b>	<b>Course integrative project/product</b>	<b>35%</b>
	<b>Total</b>	<b>100</b>

#### **8. Course integrative project/product:**

Written report about a clinical case study assigned by the professor. In this report, he will provide an adequate methodological and conceptual strategy that will let him differentiate groups of microorganisms that are causing an illness.

## 9. References:

- American society for microbiology*: [www.asm.org](http://www.asm.org)
- Eugene, N. W. (2007). *Microbiología humana*. CDMX: Manual Moderno.**
- Revista: Enfermedades Infecciosas y Microbiología. ISSN: 0213-005X. España S. L.: Elsevier
- Ferrier, D. R. (2017). *Biochemistry*. Philadelphia: Wolthers-Kulwer, Lippincott Williams-Wilkins.**
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- Secretaría de Salud y Asistencia (SSA): <https://www.gob.mx/salud>
- Secretaría de salud*: [www.uv.es/cect](http://www.uv.es/cect)
- US- Centers for Disease Control and prevention (CDC)*: [www.cdc.gov](http://www.cdc.gov)
- Walker, S. T. (2000). *Microbiología* (2 ed.). Madrid: McGraw Hill.
- Willey. (2009). *Prescott, Harley y Klein Micribiología* (7 ed.). Madrid: McGraw Hill.**
- World Health Organization/ OMS*: [www.who.int](http://www.who.int)