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):	Cell Biology
Total number of class hours-theory and practice:	100
Class hours per week:	5
Independent study:	50
Course modality:	Face-to-face instruction
Module level:	First semester
Core/elective module:	Core
Curriculum area:	ACFB
UANL credit points:	5
Create date:	May 04th, 2017
Date of last amendment made:	July 12th, 2022
Person(s) responsible for the design and amendment of the module:	Dr.C. Salomón Alvarez Cuevas M. Sc. Gemma Guadalupe Estrada Martínez ME. Claudia Irene Sánchez Santillán

2. Presentation:

The Cell Biology course is imparted to first-semester students of the Clinical Chemistry degree program. It is a core course divided into three fundamental phases. In the first phase, students review the historical evolution of cell biology and its study techniques, additionally, they will be trained to use appropriate biological sample processing techniques and to employ the optical microscope as the main tool for cytological and histological diagnosis. In the second phase, students analyze the classification of living organisms according to their structure and function, as well as differentiate morphologically between types of eukaryotic cells using the optical microscope. In the third phase, the structure and function of the subcellular components of the eukaryotic cell are analyzed, demonstrating the presence of these subcellular components using appropriate biological and microscopic sample processing techniques, to associate structure with cellular function as a complex system.

3. Purpose:

Cell Biology, as a theoretical-practical learning unit, aims to develop competences related to the knowledge and understanding of the evolutionary processes that led to the formation of the cell, identify levels of biological organization, and position the cell as the basic unit for building tissues, organs, and systems in the human body. This will enable future graduates to apply microscopic and cytomorphological techniques used to analyze cellular structure and function. Students develop general competencies such as applying learning strategies during their daily work, expressing themselves accurately in both oral and written forms, managing information technologies, and engaging in collaborative work to research current topics related to the learning unit. They employ logical thinking when analyzing natural processes like cellular structure and function through microscopic methods, making decisions, and justifying the usefulness of clinical laboratory tests by applying research and clinical diagnostic laboratory methods and techniques.

The methodology applied in the course enables students to develop specific competencies through which they will be able to obtain, handle, and store biological samples while respecting the guidelines of Mexican and international official standards, this prepares them for subsequent analysis and interpretation of results, all while applying diagnostic and research techniques with high standards of knowledge of their fundamental, students will acquire skills and abilities in the field of microscopy and biological specimen processing techniques, as well as discuss the results of the applied methods, all while upholding professional and ethical values.

During the time the student takes the Cell Biology learning unit, they will be applying the skills they acquire simultaneously in the Technology Application learning unit. Upon completing the Cell Biology unit, the student will have introductory elements for the learning units in subsequent semesters related to the bioclinical field. For Basic Microbiology, they will have knowledge of the structure and function of prokaryotic cells and the main differences with eukaryotic cells, for morphological sciences, they will understand cellular structure and function and the mechanisms of interaction that form tissues as the next level of biological organization, for physiology, biochemistry, pathology, and molecular biology, they will complement their foundational knowledge by providing the basis for cellular structure and function as a fundamental unit of the structure and function of organs and systems. Cell Biology will, together with other basic learning units, enhance understanding of the normal functioning of biological organisms and aid in the interpretation of clinical laboratory diagnostic studies.

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.

2. To manage Digital Information, Communication, Knowledge and Learning Technologies (TICCAD), in academic, personal and professional environments with cutting-edge techniques that allow their constructive and collaborative participation in society.

3. To master their mother tongue orally and in writing with correctness, relevance, timeliness and ethics, adapting their message to the situation or context, for the transmission of ideas and scientific findings.

4. To use logical, critical, creative and proactive thinking to analyze natural and social phenomena that allow them to make relevant decisions in their sphere of influence with social responsibility.

5. To use traditional and cutting-edge research methods and techniques for the development of their academic work, the exercise of their profession and the generation of knowledge.

- *Personal and social interaction skills:*

1. 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:*

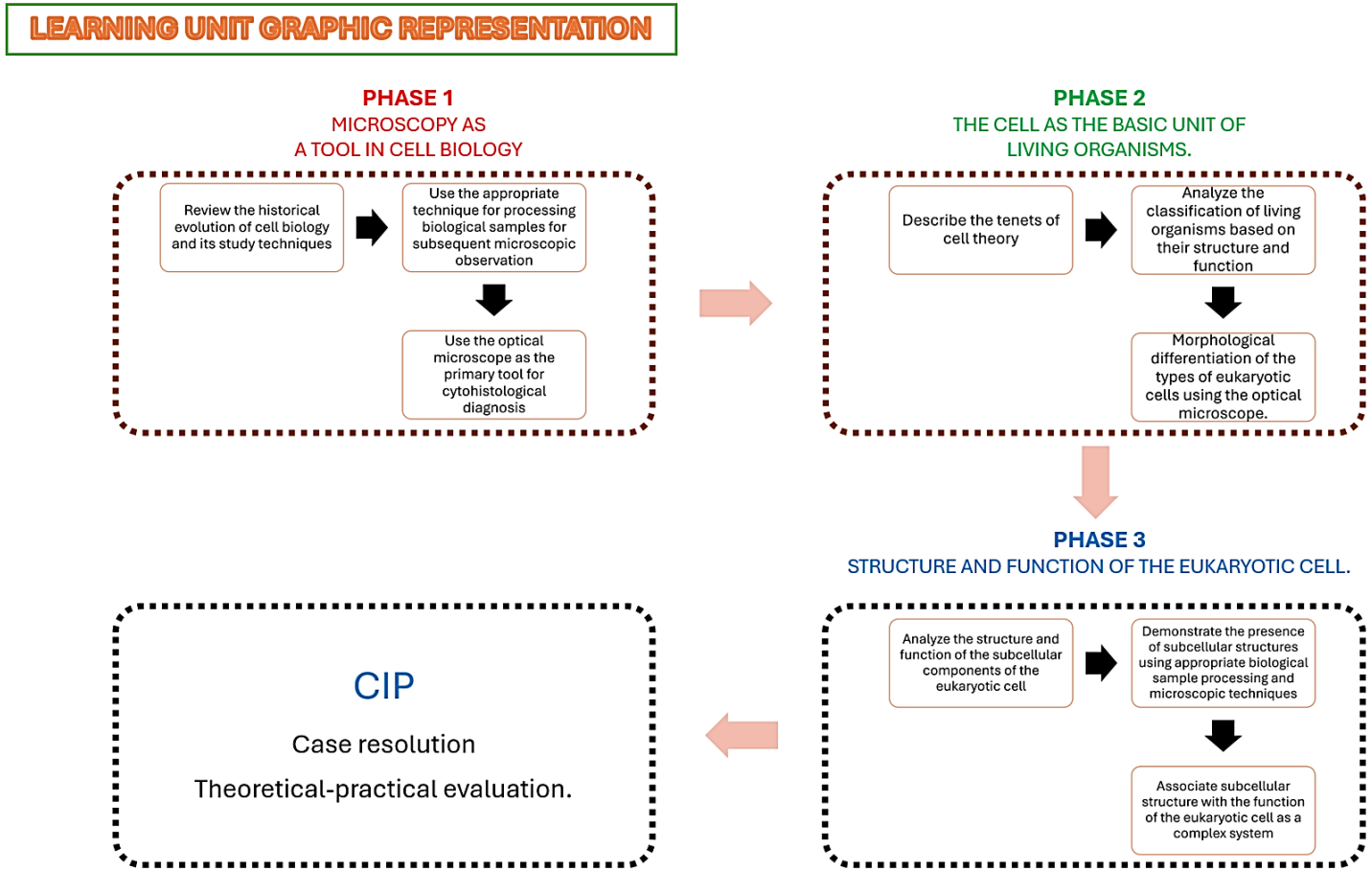
  1. To resolve personal and social conflicts, in accordance with specific techniques in the academic field and in their profession for appropriate decision-making.

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

  1. 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.

  2. 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:

Phase 1: Microscopy as a tool in Cell Biology

Component(s) of the competence: Use the appropriate method for obtaining, processing, and observing biological samples, depending on the type of sample, for subsequent identification and microscopic description according to their morphological variables

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
1.1 Practical and integrative theoretical-practical evaluation on the use of techniques for obtaining, processing, and microscopic observation of images of biological samples.	• In the laboratory on the indicated date • Individually • Use the provided guide • By hand • Respect the colors of the staining • Use colors, pencil, or pen (as appropriate) • According to the type of sample provided • To scale and respect the microscopic proportions. • Indicate all structures observed in the microscopic field. • Submit the portfolio of corrected reports for practical activities 1 to 4. • (An essential requirement for the completion and submission of the CIP).	- The teacher shows to the students the learning unit analytic program - The following teaching sequence will be used to review the content of each session: - The teacher provides the worksheets and supporting bibliographic material using the Moodle platform. - The student reads prior to each sesión - The student answers the worksheets through the Forms platform prior to each theoretical session (first attempt). - The student completes the activities outlined in the worksheet before each session and uses the	1. Historical evolution of cell biology and its study techniques. 2. Microscopic methods for studying the cell. 3. Special optical systems. 4. Electron microscopy. 5. Obtaining and processing specimens for microscopic study. 6. Cytochemistry and histochemistry - **Practical activity 1**: Microscopy: a basic tool in cell biology. - **Practical activity 2**: Cytological study of biological samples. - **Practical activity 3**: Histological study of biological samples.	• Assigned classroom. • Worksheets in forms. • Physical laboratory manual. • Electron micrographs. • Photographs of histological preparations. • Supporting technological material. • Bibliographic material: - *De Robertis-Biología Celular y Molecular, 16ª edición, 2014.* - *Ham, 1986.* - *Karp, 2014.* - *Schuchner y Pérez-Lloret. 1976.*

		supporting material through the Forms platform. - During the class session, the student engages in a group discussion guided by the facilitator on the session's content. - The teacher complements, draws analogies, and concludes the information discussed. - The student answers the worksheets through the Forms platform on the day of the corresponding session, before 11:45 PM (second attempt). - The student submits the worksheets for evaluation (**accredited activity 1.1 to 1.10**). - The teacher provides feedback on the results of the activities. - The student carries out the practical activities during the lab session, guided by the teacher and using the Manual as a work guide. - The teacher supervises the practical activities	- **Practical activity 4**: Staining of biological samples.	-*Ricardo Paniagua, Biología Celular, 3ª edición, 2007.*

		conducted during the lab session. - The student records report of the practical activities in their Manual for the lab session: ○ Practice 1: microscopy: a basic tool in cell biology. ○ Practice 2: cytological study of biological samples. ○ Practice 3: histological study of biological samples. ○ Practice 4: staining of biological samples. (**accredited activity 1.11 to 1.14**). - The teacher evaluates the reports and provides feedback.		

Phase 2: The cell as the basic unit of living organisms.

Component(s) of the competence: Differentiating cell types according to their structure and function for identification and microscopic description

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
2.1 Practical and integrative theoretical-practical evaluation on the identification and description according to the structure and function of a variety of images from cyto-histological collections.	• In the laboratory on the indicated date • Individually • Use the guide provided in the Manual • By hand • Respect the colors of the staining • Use colors, pencil, or pen (as appropriate) • According to the type of sample provided • To scale and respect the microscopic proportions • Indicate all structures observed in the microscopic field	- To review the content of each session, the following teaching sequence will be used: - The teacher provides the worksheets and supporting bibliographic material using the Moodle platform. - The student reads and comprehends the supporting bibliographic material prior to each session. - The student answers the worksheets through the Forms platform before each theoretical session (first attempt). - The student completes the activities outlined in the worksheet before each session and uses	7. Cell theory. 8. Classification of living organisms. 9. Characteristics of living matter. 10. General structure of the eukaryotic cell. 11. Cell cycle. - **Practical activity 5:** Cellular diversity in eukaryotes. - **Practical activity 6:** Seminal fluid analysis. - **Practical activity 7:** Blood analysis. - **Practical activity 8:** Urinary sediment.	• Assigned classroom • Worksheets in forms • Physical laboratory manual • Electron micrographs • Photographs of histological preparations • Supporting technological material • Bibliographic material: - *De Robertis-Biología Celular y Molecular, 16ª edición, 2014.* -*Ham, 1986.* -*Karp, 2014.* -*Schuchner y Pérez-Lloret. 1976.* - *Ricardo Paniagua, Biología Celular, 3ª edición, 2007.*

		the supporting material through the Forms platform. - During the class session, the student engages in a group discussion guided by the facilitator on the session's content. - The teacher complements, draws analogies, and concludes the information discussed. - The student answers the worksheets through the Forms platform on the day of the corresponding session, before 11:45 PM (second attempt). - The student submits the worksheets for evaluation (**accredited activity 2.1 to 2.5**). - The teacher provides feedback on the results of the activities. - The student carries out the practical activities during the lab session, guided by the teacher and using the Manual as a work guide. - The teacher supervises		

		the practical activities conducted during the lab session. - The student records report of the practical activities in their Manual for the lab session: ○Practice 5: cellular diversity in eukaryotes. ○Practice 6: Seminal fluid analysis. Sperm morphology. ○Practice 7: Morphological variability of blood cells. ○Practice 8: Urinary sediment. Analysis of cells and other formed elements. (**accredited activity 2.6 to 2.9**). - The teacher evaluates the reports and provides feedback.		

Phase 3: Structure and function of the eukaryotic cell

Component(s) of the competence: Relate the morphology and function of cellular organelles to understand the function of the cell as a complex system.

Evidence of student learning	Performance criteria	Learning activities	Content	Resources
3.1 Practical and integrative theoretical-practical evaluation on the identification and morphological description of the subcellular organelles seen in 3-a, 3-b, and 3-c, and their corresponding laboratory activities. 3.2 Practical and integrative theoretical-practical evaluation on the identification and morphological description of the subcellular organelles seen in content 3-d, 3-e, and 3-f	• In the laboratory on the indicated date. • Individually. • Use the guide provided in the Manual. • By hand. • Respect the colors of the staining. • Use colors, pencil, or pen (as applicable). • According to the type of sample provided. • To scale and respect the microscopic proportions. • Mark all the structures observed in the microscopic field.	- To review the content of each session, the following didactic sequence will be used: - The teacher provides the worksheets and supporting bibliographic material using the Moodle platform. - The student, prior to each session, reads and comprehends the supporting bibliographic material. - The student answers the worksheets through the Forms platform before each theoretical session (first attempt). - The student completes the activities outlined in the worksheet before each session and uses the supporting material through the Forms platform.	3-a. Cell Surface 12.Structure of the membrane. 13.Transport of small molecules. 14. Transport by cytosis. 15. Extracellular matrix. 16. Microvilli and cell coat. 17. Cell-cell interactions. 18.Cell-matrix interactions. 3-b. Distribution and transport of proteins 19. Endoplasmic reticulum and ribosomes. 20. Smooth endoplasmic reticulum. 21. Golgi apparatus. 22.Secretion and vesicular transport. 3-c. Intracellular digestion. 23. Lysosomes 24.Cytoplasmic inclusions. 3-d. Bioenergetics 25. Mitochondria 26. Mitochondrial cycles	• Virtual classroom via the Microsoft Teams platform. • Worksheets for online class. • Physical laboratory manual. • Electron micrographs. • Photographs of histological preparations. • Supporting technological material. • Bibliographic material: - *De Robertis-Biología Celular y Molecular, 16ª edición, 2014.* - Ham, 1986. - Karp, 2014. - Schuchner y Pérez-Lloret. 1976. - *Ricardo Paniagua, Biología Celular, 3ª*

		- During the class session, the student participates in a guided group debate led by the facilitator on the content of the session. - The teacher supplements, makes analogies, and concludes the discussed information. - The student answers the worksheets through the Forms platform on the day of the corresponding session, before 11:45 PM (second attempt). - The student submits the worksheets for evaluation (**accredited activity 3.1 to 3.27**). - The teacher provides feedback on the results of the activities. - The teacher supervises the practical activities conducted during the laboratory session. - The student prepares reports on the practical activities in the laboratory session in their Manual: o Practice 9: Cell surface and interaction with the environment. o Practice 10:	27. Peroxisomes 3-e. Cytoskeleton and cell movement 28. Actin filaments 29. Actin, myosin, and cell movement. 30. Intermediate filaments. 31.Microtubules, microtubular motors, and cell movement. 3-f. Nucleus. Control center of the cell. 32. Nuclear envelope and traffic between nucleus and cytoplasm. 33. Internal organization of the nucleus. 34. Nucleolus. 35. Human chromosomes 36. and karyotype. 37. Mitosis 38. Meiosis	*edición, 2007.*

		Synthesis, modification, and transport of proteins within the cell. ○ Practice 11: Intracellular digestion. ○ Practice 12: Bioenergetics. ○ Practice 13: Cytoskeleton, movement, and cell scaffolding. ○ Practice 14: Control center of the cell. (**accredited activity 3.28 to 3.33**). - Students are grouped into teams for collaborative work. - Students in teams designated by the teacher conduct bibliographic research, give an oral presentation, and submit a monograph of the research (**accredited activity research**).		

7. Summative evaluation:			
Phase 1	Evidence 1.1		**5%**
	10 Class Worksheets (accredited activity 1.1 to 1.10)		**10%**
	4 Practical activities reports (accredited activity 1.11 to 1.14)		**4%**
Phase 2	Evidencia de aprendizaje 2.1		**5%**
	5 Class Worksheets (accredited activity 2.1 to 2.5)		**5%**
	4 Practical activities reports (accredited activity 2.6 to 2.9)		**4%**
Phase 3	Evidence 3.1		**5%**
	14 Class Worksheets (accredited activity 3.1 to 3.14)		**14%**
	3 Practical activities reports (accredited activity 3.28 to 3.30)		**3%**
	Evidence 3.2		**5%**
	13 Class Worksheets (accredited activity 3.15 to 3.27)		**13%**
	3 Practical activities reports (accredited activity 3.31 to 3.33)		**3%**
	Research accredited activity		**4%**
	Course integrative project/product		**20%**
		Total	**100%**

8. Course integrative project/product:

Case resolution divided into two stages: in the initial stage, the student will observe a collection of biological preparations under the microscope, identifying the type of tissue, processing technique, staining method, and describing the microscopic components that constitute it; in the second stage, they will respond in writing to theoretical questions related to the cytohistological structure and function of each case.

9. Fuentes de apoyo y consulta:

- Cooper, G. M. & Haussman, R. E (2017). La Célula. Editorial Marbán. 7ª ed. ISBN 9788417184001
- Gallagher, S. & Chakavarti, D. (2008). Técnicas de biología molecular. Julio de 2018, de Jove Sitio web: www.jove.com/index/details.stp?id=759
- García Peláez, I. (2014). SOS Biología Celular y Tisular. Julio de 2018, de Universidad Autónoma de México Sitio web: http://sosbiologiacelularytisular.blogspot.com/
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- Karp, G. (2014). Biología celular y molecular. Conceptos y experimentos. Editorial McGrawHill. 7ª ed. ISBN 9786071511379
- Kierszenbaum, A. L. & Tres, L. (2016). Histología y biología celular. Elsevier España. 4ª ed. ISBN 8490229600
- Nazir. (2009). DNAtube. Julio, 2018, de DNAtube Sitio web: https://www.dnatube.com/
- Paniagua, R. (2007). Biología Celular. Editorial McGrawHill-Interamericana. 3ª ed.
- Smith, C.A. & Wood, E.J. (1997). Biología celular. Addison-Wesley Iberoamericana S.A. 1ª ed. ISBN 0-201-65379- 6
- Universidad de Arizona. (2002). Biología Celular. Julio de 2018, de Universidad de Arizona Sitio web: http://www.biologia.arizona.edu/cell/cell.html