1. Datos de identificación:

Name of the learning unit:	**Biologic diversity**
Guided time (theory and practice):	**80 hours**
Guided time per week:	**4 hours**
Total autonomous time:	**10 hours**
Modality:	**Scholarized**
Number and type of academic period:	**2do. Semester**
Type of learning unit:	**Mandatory**
Cycle:	**First**
Curricular area:	**Introductory to the profession initial training (ACFI-IP)**
UANL credits:	**3**
Elaboration date:	**23/04/2021**
Responsible for elaboration:	**Dra. Alina Olalla Kerstupp** **Dr. Juan Antonio García Salas**
Date of last actualization:	**Does no apply**
Responsible for actualization:	**Does not apply**

2. Presentation:

The Biodiversity Learning Unit provides the Student of Biological Sciences with the necessary tools to understand the importance of biodiversity, classify living beings and understand the functioning of ecosystems. The UA is made up of 3 elements of competence distributed in 3 Phases of knowledge. During the first Phase, the student will know the importance of biodiversity and the tools to classify it. In the second Phase you will be able to identify the existing taxonomic biodiversity. In the third Phase, it will analyze the relationships that organisms have with their environment. Through this sequence of knowledge acquisition and as an Integrative Learning Product, the student will be able to classify and postulate a hypothesis about the effect that overpopulation or elimination of a species would have within ecosystems.

3. Purpose:

The purpose of the Learning Unit is that the student is able to categorize organisms and understand the interconnection they have with each other and with their environment to understand the importance they exert in ecosystems. This will allow you to make decisions about the current and potential use of species for better use of biological resources.

The UA of Biological Diversity affects the obtaining of three general competences of the UANL. The UA promotes logical and analytical thinking (5-1.3), because by inferring probable consequences in relation to the presence or absence of species in an ecosystem (10-2.2), the student will be able to intervene in the face of the challenges of contemporary society and thus contribute to the paradigm of sustainable development. By working on evidence in a group way, the student assumes roles and respect is fostered among the team members to establish agreements and present works in a consensual manner (13-1.3).

The content of the course collaborates with the acquisition of two specific competences of the educational program of Biology, because it gives the student the tools not only to classify the organisms, but also to understand the role that they play in the ecosystems and thus be able to influence the making of future decisions with a view to the paradigm of sustainable development in our country (E1-B, E2-B).

With the UA of Biological Diversity contributes to the development of two specific competences of the educational program of Chemistry, Bacteriology and Parasitology, since to understand the characteristics of the different groups of organisms and their importance for the ecological balance, the student will be able to eventually design experimental protocols according to the microscopic organism of his interest, and that contribute to solve problems of diverse natures without affecting the availability of environmental resources (E1-QBP, E2-QBP).

The UA contributes to the development of two specific competences of the educational program of Degree in Food Science, because it provides the student with knowledge about the characteristics and ecological functions of the organisms that will allow him during his working life, to manage and optimize processes involved in the transformation of food without leaving aside the sustainable development (E1-LCA , E2-LCA).

The topics addressed within the UA Biological diversity contribute to the development of three specific competences of the educational program of Bachelor in Genomic Biotechnology, since it will be able to design experimental protocols (E1-LBG) to develop molecular diagnoses from the specific characteristics of organisms (E2-LBG) with the aim of designing drugs and clinical treatments, as well as viral genomes of biotechnological application in various sectors (E2-LBG, E4-LBG).

During the previous UA of Structural Biology, the student examined the fundamental principles of structure and physiology that affect the biological processes that maintain the perpetuity of life, the constancy of species and the formation of new ones. Due to the above, the UA Biological Diversity is a direct continuation because it allows you to know the great diversification of current life forms and how each of them fulfills an ecological function. By providing tools to know the characteristics of the existing biodiversity and the role it plays, this UA prepares the student to directly address the UA of Microbial Biodiversity(Biology),Economic Botany (LCA), General Microbiology (LBG) and Protozoology (QBP).

4. Competencies of the graduation profile:
General competences to which this Learning Unit contributes:

Instrumental competences:
5. Use logical, critical, creative and purposeful thinking to analyze natural and social phenomena that allow you to make relevant decisions in your sphere of influence with social responsibility.

Personal and social interaction skills:
10. Intervene in the face of the challenges of contemporary society locally and globally with a critical attitude and human, academic and professional commitment to contribute to consolidating general well-being and sustainable development.

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

Specific competences to which the Learning Unit contributes:

Biology:

To record biological diversity, through the classification of living beings at their different levels of organization, their dynamics and interrelations in ecosystems to enrich the catalogues of species at the local, regional and national level to assess the knowledge of the state of environmental health and degree of threat in which they are.

To estimate the ecological impact of ecosystems at the local, regional and national levels through the investigation of the biological mechanisms involved in the evolution of species and populations in relation to the environmental risk factors that affect the dynamic populations within ecosystems in order to ensure that conservation programs lead to their persistence as viable and self-sustaining populations in nature.

Chemistry, Bacteriology and Parasitology:

1. Design experimental protocols related to biological chemistry, using theoretical, methodological and instrumental knowledge, traditional and cutting-edge, of the exact sciences, biology and chemistry, which are applied in the study of natural phenomena and

biodiversity, in a logical, creative and purposeful way, in order to conserve biotic resources and the environment for the benefit of society.
2. Implement analytical methodologies in chemical-biological, microbiological and biotechnological laboratories that are applied to biomedical, agricultural, industrial and/or environmental problems, to provide results supported by the validation of the processes used, for the benefit of the health and economy of the community.

Food Science:

1. Manage the conservation of food proactively, through the use of physicochemical and microbiological techniques of food analysis with a comprehensive view of its composition and the modifications that these present as a result of the handling and storage conditions to guarantee its quality and safety.
2. Optimize processes involved in food processing, by monitoring and evaluating the effect of process conditions on the physical, chemical and biological characteristics of raw materials and products, working in a multidisciplinary way, with respect for the environment to contribute to the improvement of the productivity of companies in the food industry.

Genomic Biotechnology:

1. Design experimental protocols related to biological chemistry, using theoretical, methodological and instrumental knowledge, traditional and cutting-edge, of the exact sciences, biology and chemistry, which are applied in the study of natural phenomena and biodiversity, in a logical, creative and purposeful way, in order to conserve biotic resources and the environment for the benefit of society.
2. Develop molecular diagnostics through the identification of pathogenic organisms, applying traditional and cutting-edge techniques effectively, as well as the use of innovative tools in their detection, which allow the study and treatment of genetic diseases in the health, economic and social fields.
4. Design drugs and clinical treatments, through the selection of microorganisms with productive metabolic pathways in the market of prebiotics, probiotics and additives, as well as viral genomes of biotechnological application in the agricultural, livestock, industrial and environmental sectors that allow it to develop products and processes in the prevention of diseases.

5. Phase structuring:

Phase 1. Biodiversity Classification.
Element of competence: Define biodiversity levels and classification tools to understand the place of different organisms within ecosystems.

Evidence	Performance criteria	Learning activities	Content	Resources
Evidence 1. Phylogenetic tree from DNA sequences.	It uses the interactive activity of the HHMI Biointeractive platform: "Building phylogenetic trees from DNA sequences" to make inferences about the phylogenetic relationships between different organisms and how these relationships position them within ecosystems. Interpret a phylogenetic tree using the interactive tree.	The professor performs the framing of the UA presenting the analytical program. Through images the student categorizes the levels of biodiversity. Through a comparative table, the student observes the changes over time in the biodiversity classification systems.	Concept of Biodiversity Biodiversity levels • genetics • species • ecosystem Biodiversity classification systems. Linnaeus (binomial system of nomenclature)	• Computer equipment with audiovisual system • Internet access • Digital libraries and repositories • Presentation Power Point or Sway • Plataforma Nexus • Teams Platform • Instructional guides • Evaluation tools • Book Audesirk et al. (2008) • Book Clark et al. (2018) • Book Fawler et al. (2013)

	Meets the performance criteria set forth in the instructional guide. Delivery by team a document with the questions resolved in the hour, day and a half that the teacher indicates.	Using a pyramid of hierarchies, the student identifies the levels of taxonomic classification in which organisms are included. Through a presence/absence classification matrix, the student identifies the characteristics of organisms included in the realms of life. The student uses dichotomous keys as a tool for classifying organisms. The student compares the use of phylogenetic trees and cladograms as tools to show the evolutionary relationships between different organisms.	Whittaker Woese Concept of taxonomy, systematics and phylogeny. Taxonomic classification levels. • domain • phylum • class • order • family • gender • species Domain Archaea Archaea Kingdom Bacteria Domain	• Libro Miller & Levine (2010) • Book Solomon et al. (2013) • Interactive video HHMI (s.f.-a) "Building phylogenetic trees from DNA sequences".

		• The student presents the first multiple reagent exam that evaluates the learning of all the contents of the phase (weighted activity 1.1).	Bacterial Kingdom Eukarya Domain Protista Kingdom Fungi Kingdom Plantae Kingdom Animalia Kingdom Tools for classifying organisms.	

Phase 2. Taxonomic Biodiversity
Element of competence: Distinguish the existing taxonomic biodiversity, as well as the characteristics and functions of organisms to recognize how the variety of life forms affects the dynamics of ecosystems.

Evidence	Performance criteria	Learning activities	Content	Resources
2. Exercises of application of the knowledge "Biodiversity of microorganism	• Solves the exercises of application of knowledge to correctly identify the distinctive	1. The professor relies on the animated short film of the HHMI Biointeractive platform: "Animated life: seeing the invisible" so that the student knows	**Diversity of microorganisms** • Virus • bacteria • protists • fungi	**Diversity of microorganisms** ○ Virus ○ bacteria ○ protists ○ fungi

s, plants and animals"	characteristics of each group of organisms.
	
	• Answer a questionnaire.
	
	• Prepares and delivers a document by team with the exercises resolved in the hour, day and a half that the teacher indicates.
	
	• Meets the performance criteria set out in the instructional guide.
		about the life of Antoine van Leeuwenhoek and how it was the discovery of the first microorganisms.
		
		2. The student analyzes a graph of results of an experiment to interpret and evaluate the role of the maternal microbiota in the development of the immune system.
		
		3. The student completes synoptic and comparative tables based on the characteristics of the different organisms.
		
		4. The student performs a monitoring in a natural site of the locality to observe and identify different taxonomic groups.
		
		• The student presents the second multiple reagents exam that evaluates the learning of all the contents
			Plant diversity
			• General characteristics of the plants
			
			• Non-vascular plants (Bryophytes)
			
			• Vascular plants
			
			• Seedless vascular plants
			
			• Vascular plants with seed
			
			• Gymnosperms
			
			• angiosperms
			
			Animal diversity
			• General characteristics of animals
			
			• Adaptations to ocean, freshwater and terrestrial habitats
			
			• Classification and characteristics of non-arthropod invertebrates
			  • sponges
			  • Cnidarians
			  • Flatworms
			  • Nematodes
				○ **Plant diversity**
				○ General characteristics of the plants
				
				○ Non-vascular plants (Bryophytes)
				
				○ Vascular plants
				
				○ Seedless vascular plants
				
				○ Vascular plants with seed
				
				○ Gymnosperms
				
				○ angiosperms
				
				○ **Animal diversity**
				○ General characteristics of animals
				
				○ Adaptations to ocean, freshwater and terrestrial habitats

		of the phase (weighted activity 2.1).	• Annelids • mollusks • Echinoderms • Classification and general characteristics of arthropod invertebrates • Myriapods • Crustaceans • arachnids • insects • Classification and characteristics of chordates • Pieces • amphibians • Reptiles • poultry ○ mammals	○ Classification and characteristics of non-arthropod invertebrates ○ sponges ○ Cnidarians ○ Flatworms ○ Nematodes ○ Annelids ○ mollusks ○ Echinoderms ○ Classification and general characteristics of arthropod invertebrates ○ Myriapods ○ Crustaceans ○ arachnids ○ insects ○ Classification and characteristics of chordates ○ Pieces ○ amphibians ○ Reptiles ○ poultry ○ mammals".

Phase 3. Principles of Ecology
Element of competence: Understand the role that each organism plays in maintaining the ecological balance from the interaction of these with their environment to understand the bases of sustainable development.

Evidence	Performance criteria	Learning activities	Content	Resources
3. Didactic presentation "Ecological interactions in a biome".	○ Integrates a work team. ○ Establishing roles based on the roles of each team member. ○ They design the presentation in an attractive way and without text saturation. ○ They expose (the members) in equal parts during the presentation. ○ The presentation contains the following information: geographical location and characteristics of the biome, representative	With the help of a flowchart, the student understands the different ecological levels. The student uses a mind map to capture the characteristics of a population. The student will complete the video of the HHMI Interactive platform and: "Distribution of niches and coexistence of species" to answer the corresponding questionnaire. The student analyzes different factors and identifies whether they are biotic or abiotic. The student uses cards provided by the HHMI Biointeractive platform to build models of food webs and assess how ecological	○ Concept of ecology ○ Ecological levels ○ individual ○ population ○ community ○ ecosystem ○ biome ○ biosphere ○ Characteristics of a population ○ dispersion ○ density ○ growth ○ Characteristics of a community ○ Ecological niche ○ Interactions (predation, symbiosis, competition) ○ Ecological succession ○ Characteristics of ecosystems ○ Biotic and abiotic factors ○ Limiting factors	○ Computer equipment with audiovisual system ○ Internet access ○ Digital libraries and repositories ○ Presentation Power Point or Sway ○ Plataforma Nexus ○ Teams Platform ○ Instructional guides ○ Evaluation tools ○ Book Audesirk et al. (2008) ○ Book Clark et al. (2018) ○ Book Fawler et al. (2013) ○ Book Fernandez Gama (2017) ○ Libro Odum & Barret (2008) ○ Book Solomon et al. (2013)

	species, examples of species-species and species-habitat interactions, alterations of the biome by human activities. ○ They master the subject they are talking about. • Meet the performance criteria set out in the instructional guide.	disturbances affect each trophic level. The student evaluates the global impact of human activity on coastal ecosystems through the interactive activity of the HHMI Biointeractive platform. The student presents the third exam of multiple reagents that evaluates the learning of all the contents of the phase (weighted activity 3.1).	○ Energy flow ○ Food chains, wefts and pyramids ○ Biogeochemical cycles ○ water ○ carbon ○ nitrogen ○ phosphorus ○ sulfur ○ Biomes ○ Factors that alter diversity ○ Human activity ○ Landscape transformation ○ Habitat fragmentation ○ Introduction of exotic species	○ Book Starr et al. (2018) ○ Video HHMI (s.f.. -(d) "Distribution of niches and the coexistence of species". ○ Interactive activity HHMI (s.f.-b)"Creating chains and food webs to model ecological relationships". ● Interactive activity HHMI (s.f.-f) "Dead zones in coastal ecosystems".

6. Comprehensive evaluation of processes and products (weighting / summative evaluation).

Global scheme of evaluation of the Apprentice Unit:

Aspect to Evaluate	percentage
Diagnostic Evaluation	Prerequisite
Learning Evidence Portfolio: -First Phase (10%)	30%

-Second Phase (10%) -Third Phase (10%)	
Multiple reagent test: -First Phase (12%) -Second Phase (13%) -Third Phase (15%)	40%
Integrative Learning Product (PIA)	30%
Final grade	100%

Assessment scheme of the Learning Unit broken down by Stages and Evidence of Learning:

Fase	Evidencia de aprendizaje	Ponderación
Diagnostic Evaluation		requirement
First Phase (22%)	Evidence 1. Phylogenetic tree from DNA sequences.	10 points
	Examination of multiple reagents (weighted activity 1.1).	12 points
Phase Two (23%)	Evidence 2. Exercises of application of the knowledge "Biodiversity of microorganisms, plants and animals".	10 points
	Examination of multiple reagents (weighted activity 2.1).	13 points
Third Phase (25%)	Evidence 3. Didactic presentation "Ecological interactions in a biome".	10 points
	Examination of multiple reagents (weighted activity 3.1).	15 points
Learning product		30 points
		TOTAL 100 points

7. Integrative Learning Product:
Written and illustrated monograph on the taxonomic classification of two organisms of different taxonomic group and the possible effects of their potential overproduction or elimination within an ecosystem.

8. Literature:

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- Bases de datos UANL (s.f.). *Biblioteca Digital*. (s. f.). Recuperado de https://www.dgb.uanl.mx/?mod=bases_datos el 15 de Julio de 2020.
- Clark, M.A., Douglas, M., and Choi, J. (2018). *Biology 2e.* Open Stax. Recuperado de https://openstax.org/details/books/biology-2e el 14 de Septiembre de 2020.
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- Fowler, S., Roush, R., & Wise, J. (2013). *Concepts of Biology*. Open Stax. Recuperado de https://openstax.org/details/books/concepts-biology el 14 de Septiembre de 2020.
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Annex 1. Instructional Guide to the Integrative Learning Product **Written and illustrated monograph on the taxonomic classification of two organisms of different taxonomic group and the possible effects of their potential overproduction or elimination within an ecosystem.**	
Instructions:	**Of the two chosen organisms:** **Information related to the contents of Phase 1:** ○ Indicate the taxonomic classification to which they belong.

	○ Mention the physical characteristics they have to belong to each of the levels of this classification. **Information related to the contents of Phase 2:** ○ Perform field monitoring at a local natural site. Site suggestions: Gran parque San Nicolás, Parque Niños Héroes, La Estanzuela, Chipinque, Fundidora, La Huasteca. ○ Mention the site visited, date(s), time(s), weather, briefly describe the characteristics of the site. ○ Include a listing of the biological diversity found with the highest degree of taxonomic identification possible, as well as photographs taken by the student. ○ **Information related to the contents of Phase 3:** ○ Describe the type of habitat where it is found. ○ Describe your ecological niche. ○ Indicate the level they occupy within the food chains and argue why they occupy that level. ○ Investigate factors that limit them within the ecosystem they inhabit. ○ Present a hypothesis on the probable ecological effects of the overpopulation or elimination of such organisms in an ecosystem.
Valoe:	30%
Evaluation criteria:	Format: ○ *Word, Power Point o PDF.* ○ *Cover with personal data, subject, teacher and delivery date.* ○ *Free format for the presentation of information.* ○ *Review the evaluation rubric that is attached to this guide.*
Mode:	Individual
Medium:	Educational platform