Center for International Programs and Sustainability Studies
Course name: Introduction to genetics: Current applications
Course code: ENV 2500
Total contact hours: 60
Pre-requisites: complete a basic biology course

COURSE DESCRIPTION

This is an introductory course where the concepts and applications of genetics are analyzed. The course applies the use of basic theoretical-practical fundamentals in genetics to address problems in various fields. Students will familiarize with the Central Dogma of molecular biology, understand the processes of gene expression, and analyze mutation effects. It is a course focused in analyzing recent research topics and discussing controversial issues related to genetics. It has an essential practical complement by means of a field tour for the collection and analysis of samples. This will allow the development of several laboratory processes where the student acquires the skills to apply basic molecular techniques such as DNA extraction, polymerase chain reaction (PCR) and electrophoresis. In addition, they will be able to use specialized software for the analysis of DNA sequences. Through the analysis of specialized literature, the aim is to broaden the knowledge about the diversity of applications of genetics in different fields. During the course, we also develop skills in group work and leadership, as well as assertive communication in an oral and written form.

CLOTHING AND FOOTWEAR REQUIREMENTS

It is necessary for foreign students to have clothes both for warm climate and for cold (not extreme), as well as closed shoes (hiking shoes and rubber boots if possible) since many field trips are made to highlands, rainy zones, and sometimes to areas with the possible

presence of snakes, insects, and other animals. We've never had an accident under those circumstances, but we want our students to be as comfortable and safe as possible. The appropriate clothing and footwear also facilitate the field work of this course.

AUDIENCE

This course is structured for International Students attending the Study Abroad program at Universidad Veritas. However, courses are not exclusive to foreigners so a few native students could enroll in this course. Any person interested in molecular biology, genetics and biotechnology applications is welcome to take this course. A completed basic course of biology is recommended to enter this course.

This is a theoretical-practical course and it seeks to clarify the following question:
How to apply basic concepts and techniques in molecular biology and genetics to address various problems in the management of genetic biodiversity?

In order to respond this question, we will study the following **generative topics:**

- Basic concepts of genetics.
- Current genetic applications.
- Specialized methods in the laboratory for the use of specific molecular markers.
- Basic Bioinformatics concepts in molecular biology.

Along the course, the following **skills** will be fostered:

- Ability to understand basic concepts and processes in genetics.
- Ability to recognize techniques in molecular biology.
- Ability to analyze DNA sequences using specialized software.
- Ability to analyze critically issues related to genetics through the interpretation of scientific articles.

Among the **values** and **attitudes** that will be promoted among the students are the following:

- Critical thinking.
- Logical and communicative intelligence.
- Interest in solving problems.
- Negotiating knowing how to inspire trust and empathy.

COMPETENCIES, CRITERIA AND EVIDENCE

The competencies for the Veritas University are reflexive and integral actions that respond to the professional profile and to the problems of the context, with appropriateness and ethical commitment, integrating the knowledge of being, know-how and knowledge to know in an improvement perspective. Below are both the disciplinary and general competencies, linked to their criteria and evidence of performance for this course.

Competencies	**Key competencies**	**Evidence of learning**
Specific Applies the theoretical-practical foundations of genetics to address problems in various areas of topicality, according to modern research standards.	Comprehends the basic concepts and processes of genetics.	○ Oral presentations ○ Mind maps
	Applies techniques and methods of research in molecular biology considering the current research advances.	○ Field trip ○ Laboratory practice
	Analyzes critically current issues related to genetics according to a research question.	○ Debate ○ Oral Presentation

		○ Final Assignment: research project (summary and presentation)
Generals		
Integrates knowledge, skills and attitudes to learn continuously and through one´s life pursuing an efficient development in the knowledge-based society.	Learning to learn	○ Field trip and report ○ Laboratory practice and report ○ Oral presentations ○ Final Assignment: research project
Develops the knowledge, skills and attitudes necessary to learn how to communicate orally and in writing in the different areas.	Communicate thoughts of the discipline orally, in an iconic way, and in written form.	○ Debate ○ Oral presentations ○ Laboratory report ○ Field trip report ○ Final Assignment: research project
Integrates the necessary knowledge, skills, and attitudes to learn teamwork and leadership techniques.	Execute teamwork and leadership.	○ Debate ○ Team work during field trip and laboratory practice
	Relate well to others	○ Debate

Integrates the necessary knowledge, skills and attitudes to learn interpersonal communication techniques.	Manage and solve conflicts Negotiate reliably and empathetically	○ Field trip ○ Laboratory practice ○ Oral presentation presentation ○ Final assignment

COURSE CONTENT

Subject 1. Introduction to genetics:

- Genetics general concepts
- DNA replication and the Central Dogma
- Genes to proteins: transcription and translation

Subject 2. Genetics applications:

- Molecular markers: description and uses of microsatellites, sequencing (Sanger, next generation), SNPs, barcoding, mitochondrial and chloroplast DNA, others.
- Genetics applications to answer questions related to current topics:
    - Genetics to understand mental health
    - Genetics to understand human origins
    - Genetically Modified Organisms (GMOs)

Subject 3. Laboratory methods:

- DNA extraction
- Polymerase Chain Reaction (PCR)
- Electrophoresis
- DNA integrity Electrophoresis

Subject 4. Genetic applications:

- Sequences analysis (bioinformatics)
- Epigenetics

- Transposable elements
- Sars-Cov-2 genetics

METHODOLOGY

The course will include lectures by the professor, in order to explain main concepts, historic facts, and specific examples related to molecular biology at the national and international level. Current controversial topics will be analyzed and discussed in class. At the end of each unit, group discussions will be performed, through case studies, group activities and debates, in order to analyze specific situations from different points of view and propose solutions. Besides, students will have the opportunity to improve their skills to perform research and oral presentations, share their ideas and manage group discussions. On the other hand, field trips are the most important complement to the theory learned in class, in this way, students can see and practice some of the concepts and perform hands on activities in the field.

EDUCATIONAL RESOURCES

In order to guarantee a good development of the course, therefore to guarantee learning, the following resources are available: an updated bibliographic database, multimedia equipment that students can use for their individual presentations, whiteboards and other school equipment for weekly sessions, and readings provided by the educator. All of these complement the suggested projects and provide the students with higher possibilities of knowledge ownership. Most of the lessons will take place in the classroom.

During independent work periods students will be able to attend the institution. A campus library, study rooms, and computer labs are available for the students´ independent work time. Free Wi-Fi connection for students, educators, and staff is provided on campus, which gives students the possibility to work not only in the library or computer labs, but also around campus.

LEARNING EVALUATION

In order to make the course or program better competencies-based evaluation compiles and evaluates evidence by taking into account feedback providing pre-established criteria. The course evaluation must be aligned with the competencies and the teaching methodology. There is a rubric for each evaluation resource and the details will be provided in **CANVAS LMS**. Even though the rubric grants a grade, it is also a quantitative and qualitative description of the students´ performance. The rubrics include the core and discipline key competences.

RUBRICS	PERCENTAGE VALUE
Oral presentation: o Group or individual presentation	**10%**
Debate: o Current controversial topics on genetics	**10%**
Interview: o Ethics in genetics interviews and results presentation	**10%**
Laboratory practices: o Bioinformatics analyses. o Fieldtrip DNA extraction	**15%**
Lab report: o Hammerhead shark species genetic identification	**25%**
Final assignment: applications of genetics o Literature Review and Infographic	**30%**
TOTAL POINTS:	**100%**

LEARNING STRATEGIES

The following learning strategies will be carried out:

1. Oral presentation:

By means of digital presentations (power-point) each group of students will explain the content pertaining to a topic assigned in advance by the teacher. The students must present at the end of this presentation the bibliographic sources in APA format, Sixth Edition, with a minimum of 5 references and their respective connection link. It is intended that students through teamwork or individually can be able to formulate critical and logical ideas that can then be transmitted orally and encourage the rest of the audience (classmates) to issue different points of view.

2. Debate:

The students will organize in two groups to investigate all the information related to a current issue regarding Conservation Biology and individually, may issue their own opinion by formally interpreting and evaluating a specific topic. The objective is that the student correlates his research and his own knowledge and can clearly argue a possible application in real life. A group of students will dedicate to promote oral expression and investigation about several controversial topics in Conservation Biology, to produce ideas and points of view that either agree or disagree in order to generate new learning and discussion in the audience. The members of the group must choose a moderator. The moderator begins the discussion, informs the class about the questions from the topic, introduces the members of the roundtable group to the class, indicates when each member of the will intervene; asks previously planned questions, and takes notes that might work as conclusions. The moderator must be emotionally strong, must be unbiased, and must keep the group united. The moderator usually sits in the middle of the group to keep members focused and monitor how people work towards their goals. The group will investigate the topic and will choose a moderator. The debate should last no longer than 20 to 30 minutes to discuss the topics and 5 minutes to draw conclusions.

3. Bioinformatics analyses:

The student will develop throughout the course different skills in bioinformatics including: searching in online data repositories, analysis of chromatograms, identification of mutations and phylogeny reconstructions. These practices will be conducted during class.

4. Question method:

Students, individually, will conduct interviews to better understand opinions regarding ethical questions in genetics. The objective is that the student will explain current ethical problems regarding genetics and asks for the opinion of different people. This will allow students to develop different levels of understanding, analysis and application of the topics.

5. Laboratory practice:

This lab activity will be implemented throughout the subject of the course "Conservation Genetics". Four lab practices will focus on the activity "CIS Forensic on the illegal trade of shark fins", where the student will learn how to extract DNA, PCR, and Electrophoresis techniques to identify shark species from fin samples. Laboratory session will be performed in the Molecular Biology laboratory (BIOMOL). The laboratory session will be assessed with a value of **25%** based on the information acquires and evaluated on the understanding from application tools to prevent the illegal trade of endangered species, such as the genetic approach demonstrated during the lab sessions.

6. Final research presentation:

This work aims to confront the student to a literature review, which implies introducing and familiarizing each person with the different investigations and compilation of research information associated to a particular topic in Genetics. The research is carried out individually all of the student's findings will be presented and explained to the rest of the class through an oral presentation.

ATTENDANCE

Regarding classes:

1. Students are only allowed a total of two (2) nonconsecutive (back-to-back) class absences. A student shall fail the course if more than two absences are registered.

2. Three late arrivals to class (within the first 15 minutes) are treated as one absence. Attending class 30 minutes late without an official justification will also count as an absence.

3. In the case of an absence from any assignment evaluated in class (presentations, evaluations, field trips, etc.) a student will be given a grade zero unless an official document is presented within one week of the absence.

4. If a student presents an official document to excuse the absence, the missed assignment is to be presented on that same day.

Regarding field trips:

5. An unjustified absence on a field trip will immediately result in the loss of all points assigned to that specific trip. However, if an official document justifying the absence is presented, 50% of the assignment points may be obtained on presentation of a complementary research assignment, to be agreed upon with the professor, within one week of the field trip.

7. An absence on a field trip may be justified should two course field trips coincide. In such a case, and in order to avoid losing points, students shall be able to opt for carrying out a research assignment.

CODE OF CONDUCT

Professors have the right to expel a student from the classroom should he / she/ they:

1. Be disruptive in the classroom.
2. Behave in a disrespectful way.
3. Be under the influence of alcohol or even smells like alcohol.
4. Be under the influence of any illegal drug.
5. Shows hygiene problems that may disturb other students.

ELECTRONIC DEVICES

The use of cell phones, smart phones, or other mobile communication devices is disruptive, and is therefore prohibited during class. **Please turn all devices OFF** and put them away when class begins. Devices may be used ONLY when the professor assigns a specific activity and allows the use of devices for internet search or recording.

Those who fail to comply with the rule must leave the classroom for the remainder of the class period. If situation happens again, 10 points will be deducted from the final participation grade.

PROGRAM POLICIES

The student must comply with the provisions of the CIPSS Program Policies available on the Canvas platform.

BIBLIOGRAPHY

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CHRONOGRAM

Week	Activities	Learning strategies
1	Introduction to genetics: DNA replication and the Central Dogrma	Thematic discussions, mental maps
2	Gene Regulation: From genes to proteins	Reports and discussion, Bioinformatics practice

3	Molecular markers and their applications	Oral presentation, Reports and discussions, thematic discussions
4	Ethics of gene editing	Debate, Reports, Thematic discussions
5	Human genetic disorders	Oral presentation, Thematic discussions,
6	Conservation Genetics Lab: "CIS Forensic on illegal trade of shark fins"	Laboratory practice, Thematic discussions
7	Conservation Genetics Lab: "CIS Forensic on illegal trade of shark fins"	Laboratory practice, Thematic discussions, Research
8	Genetics aplications: Transposable elements, Epigenetics, Phylogenetics	Laboratory practice, Thematic discussions,Bioinformatics practice
9	Genetics aplications: Transposable elements, Epigenetics, Phylogenetics	Reports and discussions, Research,Oral presentations
10	Genetics aplications: Sars-Cov-2 Genetics	Laboratory Practice, Bioinformatic practice
11	Lab: "DNA extraction from non-invasive collected samples"	Laboratory practice, Thematic discussions, Research
12	Final Research Project	Research, Oral presentation

Please note that this chronogram is tentative and subject to change.