Study Plan

School: School of Sciences and Technology
Degree: Bachelor
Course: Biology (cód. 143)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO0500	Basic Ecology	Ecology	4	Semester	104
FIS0690	Physics	Physics	5	Semester	130
BIO0312	Introduction to Biology Studies	Biology	2	Semester	52
MAT0931	Mathematics	Mathematics	7	Semester	181
QUI1090	General Chemistry	Chemistry	6	Semester	156
BIO10917	Cell Biology	Biological Sciences	6	Semester	156

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO0289	Plant Anatomy and Morphology	Biology	3	Semester	78
BIO0297	Invertebrate Biology	Biology	5	Semester	130
QUI1041	General Biochemistry	Chemistry	6	Semester	156
MAT0915	Statistics	Mathematics	6	Semester	162
BIO0310	Animal Histology and Embryology	Biology	3	Semester	78
BIO0408	Microbiology	Biological Sciences	6	Semester	156
BIO0316	Field Trip B01	Biology	1	Semester	26

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO0293	Communities and Ecosystems Biology	Biology	3	Semester	78
BIO0295	No-Seed Plants Biology	Biology	6	Semester	156
BIO0296	Populations Biology	Biology	3	Semester	78
BIO0298	Vertebrates Biology	Biology	6	Semester	156
BIO0305	Animal Physiology	Biology	6	Semester	156
BIO0309	Genetics	Biology	6	Semester	156

2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO0294	Biology of Seed Plants	Biology	6	Semester	156
BIO0301	Human Biology	Biology	6	Semester	156
BIO0302	Molecular Biology	Biology	6	Semester	156
BIO0307	Plant Physiology	Biology	6	Semester	156
GEO0741	Geology	Geosciences	6	Semester	156

3rd Year - 5th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO0292	Conservation Biology	Biology	6	Semester	156
BIO0299	Biology and Society	Biology	4	Semester	104
BIO0300	Evolutionary Biology	Biology	2	Semester	52
BIO0303	Biosystematics	Biology	2	Semester	52
BIO0314	Project in Biological Sciences I	Biology	6	Semester	156
GEO1218	Paleonthology	Geosciences	2	Semester	52

3rd Year - 5th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Group of Free Options					

3rd Year - 6th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO0334	Project in Biological Sciences II	Biology	6	Semester	156

Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO0288	Aerobiology	Biology	4	Semester	104
BIO0318	Water Biology	Biology and Environment	4	Semester	104
BIO0337	Toxic Plants Biology	Biology	4	Semester	104
BIO0319	Soil Biology	Biology and Environment	4	Semester	104
BIO0320	Marine Biology	Biology and Environment	4	Semester	104
BIO0321	Fisheries Biology	Biology and Environment	4	Semester	104
BIO0335	Biotechnology	Biology	6	Semester	156
BIO0338	Plant Ecophysiology	Biology	4	Semester	104
BIO0325	Entomology	Biology	4	Semester	104
BIO0339	Ethnobotany	Biology	4	Semester	104
BIO0326	Ethology	Biology	4	Semester	104
BIO0327	Iberian Fauna	Biology	4	Semester	104
BIO0306	Plant Developmental Physiology	Biology	6	Semester	156
BIO0340	Phytosociology	Biology	4	Semester	104
BIO0341	Flora of Portugal	Biology	4	Semester	104
BIO0328	Herpetology	Biology	4	Semester	104
BIO0329	Ichthyology	Biology	4	Semester	104
BIO0311	Immunology	Biology	6	Semester	156
BIO0342	Introduction to Plant Biotechnology	Biology	4	Semester	104
BIO0330	Marine Invertebrates	Biology	4	Semester	104
BIO0331	Mammalogy	Biology	4	Semester	104
BIO0332	Nematology	Biology	4	Semester	104
BIO0333	Ornithology	Biology	4	Semester	104
BIO0343	Palynology	Biology	2	Semester	52
BIO0322	Marine Pollution and Conservation	Biology and Environment	4	Semester	104
BIO0323	Principles of Environmental Microbiology	Biology	4	Semester	104
BIO0324	Ecological Quality and Inland Water Monitoring	Biology and Environment	4	Semester	104
BIO0315	Virology	Biology	6	Semester	156
BIO0336	Introduction to Biological Anthropology	Biology	6	Semester	156

Conditions for obtaining the Degree:

*** TRANSLATE ME: Biologia

Para obtenção do grau de licenciado em Biologia é necessário obter aprovação a 148 ECTS em unidades de curriculares obrigatórias e 32 ECTS em unidades curriculares optativas (24 ECTS na Área da Biologia e 8 ECTS em outras áreas livres), distribuídas da seguinte forma:

1º Ano

1º Semestre:

6 UC Obrigatórias num total de 30 ECTS

2º Semestre

7 UC Obrigatórias num total de 30 ECTS

2º Ano

3º Semestre

6 UC Obrigatórias num total de 30 ECTS

4º Semestre

5 UC Obrigatórias num total de 30 ECTS

3º Ano

5º Semestre

6 UC Obrigatórias num total de 22 ECTS

UC Optativas num total de 8 ECTS livres

6º Semestre

1 UC Obrigatórias num total de 6 ECTS

UC Optativas num total de 24 ECTS ***

Program Contents

Back

Basic Ecology (PAO0500)

Structure and function of ecosystems: circulation of matter and energy; energy to control entropy.
Biogeochemical cycles: global and local, impacts of human activities.
Limiting factors: Leibig's and Shelford's Laws. Factors of production and decomposition. Implications: distribution of organisms, success of introductions Production and trophic structure: Energy fluxes between trophic levels and ecological efficiencies. Predominant paths.
Population: characteristics and vital rates. Models of growth. Selection strategies r and K. Predator-prey interactions, population cycles. Competitive interactions, competitive exclusion. Models of population regulation.
Community: Structure, stability, environmental quality. Resistance and resilience.
Succession: Primary and secondary. Natural and Cultural. Climax theories

Back

Physics (FIS0690)

1. Mechanics
1.1 Newton?s laws of motion. Applications.
1.2. Energy and conservation of energy.
1.3. Linear momentum and collisions.
1.4 Angular momentum.
1.5 Static equilibrium and elasticity.
1.6 Fluid mechanics
2. Oscillations and mechanical waves
2.1 Oscillatory and wave motion.
2.2 Sound waves.
3. Thermodynamics.
3.1 Laws of thermodynamics
3.2 Kinetic theory of gases.
33. Heat transfer
4. Electricity and magnetism
4.1 Electric field. Current and resistance.
4.2 Magnetic field. Electromagnetic waves.
5. Light and optics
5.1 The nature of light and propagation.
5.2 Laws of geometric optics
5.3 Mirrors and lenses

Laboratory:
Laboratory:
1 - Measurement and uncertainty, graphical representation
2 – Free fall
3 - The simple gravity pendulum
4 – Verification of Hagen-Poiseuille equation.
5 - Geometric Optics.

Back

Introduction to Biology Studies (BIO0312)

1. What is Life? 2. Theories on the origin and diversity of life 3. The cell as a unit of living beings. 4. Functional systems for Life: respiration and photosynthesis. 5. The hereditary mechanism: DNA and RNA as basic molecules of life. 6. The microbial world ("masters of the biosphere"). 7. The plant world. 8. The animal world. 9. Evolution as a unifying theme in Biology. 10. Biotechnology and relevant social issues.

Back

Mathematics (MAT0931)

Matrices and determinants. Operations with matrices. Properties of the determinant. Inverse matrix. Solving a system of linear equations.
Functions, limits and continuity. Characterization of functions. Inverse function. Composition of functions. Limits. Continuity. Fundamental theorems of continuity.
Differential calculus and applications. Derivative od a function. Derivatives of implicit, compose and inverse functions . Differential. Theorems about differentiable functions. Taylor's formula.
Integral calculus and applications. Primitives. Primitives by substitution and by parts. Primitives of rational functions. Riemann?s integral and its properties. Fundamental theorem of integral calculus. Applications of integrals.
Series. Series of numbers. Power series.
6. Ordinary differential equations. Autonomous and separable differential equations. First order linear equations. Applications: mathematical models with ordinary differential equations.

Back

General Chemistry (QUI1090)

1. Constitution of matter
2. Periodic table
3. Chemical bonding
4. States of aggregation of matter
5. Solutions
6. Chemical thermodynamics
7. Chemical equilibrium
8. Equilibrium in heterogeneous systems
9. Ionic equilibria in homogeneous systems: acid-base
10. Electrochemistry
11. (Optional Chapter)

Chemistry of life
Chemical corrosion
Chemical kinetics

Back

Cell Biology (BIO10917)

Methods and Techniques used in cell study. Biomolecules. Origin of life. Cells: paradigms and diversity. Cellular organization: cell membrane; membrane-bound organelles; semi-autonomous organelles; cytosol and its inclusions. Cytoskeleton. Extracellular structures: cell wall, extracellular matrix. Transmembrane transport and metabolism: Functional order. Energy: thermodynamics in the cell; redox reactions; energy conversion. Information: genomic information; intercellular and intracellular communication; cell recognition. Cell Reproduction: Mitosis; mitotic chromosomes; the mitotic cycle. Meiosis. Cell proliferation and differentiation: growth factors; mechanisms of differentiation. Cell death (apoptosis). Applications of cell biology.

Back

Plant Anatomy and Morphology (BIO0289)

1 - Concept of development, growth, differentiation, dedifferentiation, specialization, totipotency, polarity and asymmetric division. Embryonic development in Magnoliophyta.
2 - Systems meristematic tissues, dermal, and Vascular Fundamental or Basic. Types of meristems. Fabric Coating: Epidermis and periderm. Fundamental tissues: parenchyma, collenchyma and sclerenchyma. Vascular system: xylem and phloem. Secretory structures.
3 - Radical System: Primary and secondary growth. Formation of lateral roots. Specialized roots.
4 - Origin, Function, Structure and Growth of the Stem. Primary and secondary growth of the stem. Specialized stems.
5 - Origin and leaf development. Morphology and histo-anatomical structure of leaves. Specialized leaves. Leaf abscission.
6 - Origin, Function and development of reproductive organs. Histo-anatomical structure of the flowers (sepals, petals, stamens and gynoecium), fruits and seeds.

Back

Invertebrate Biology (BIO0297)

The first six lectures aim to achieve the following objectives: (1) Set some basic terminology, (2) introduce some new concepts, (3) Present some of the subjects to be developed over the course. During these six first classes, the three topics mentioned above, and in which the program is based, are used as a link between phyla as a whole. In other classes, these issues continue to be present, but now in a comparative inter-and intra taxa. General ecology of several groups of invertebrates will also be addressed, particularly when discussing their Bauplan. As mentioned above, the practical lessons run for 15 sessions (2 hours each). The laboratory practical classes and their sequence follow the thematic development of the program of lectures, reinforcing and complementing the learning process on the morphology and functional anatomy of the major invertebrate taxa.

Back

General Biochemistry (QUI1041)

Introduction to Biochemistry and its correlation with the other sciences. The importance of water and inorganic ions in biosystems. Biological buffer systems. Methods and techniques used in biochemistry. Nomenclature, structure and properties of biomolecules: carbohydrates, lipids, amino acids, peptides, proteins and nucleic acids. Lipoproteins. Biomembranes. Enzymes and enzyme kinetics. Bioenergetics and bioelectrochemistry. The importance of ATP in metabolism. Anabolism and catabolism. The main metabolic pathways. Introduction to the metabolism of carbohydrate, fat and protein. Integration and metabolic regulation.

Back

Statistics (MAT0915)

Descriptive Statistics
Basic Probability Notions
Conditional Probability and Independence
Discrete and Continuous Random Variables
The Most Important Families of Discrete and Continuous Probabilities Distributions
Point and Interval Estimation
Hypothesis testing
Analysis of Variance (one-way)
Non-parametric Tests
Simple Linear Regression
Use of statistical software.

Back

Animal Histology and Embryology (BIO0310)

1. Introduction to the study of animal embriology and histology
2. Morphological features related to the main stages in the embryology of amphibians, fishes, reptiles, birds and mammals.
3. Basic histology: the five basic tissues (epithelial; connective; muscular; blood and nervous); histogenesis and cytological and funcional characteristics. Integration of tissues in the structure of organs.

Back

Microbiology (BIO0408)

Theoretical:
1. Historical context and Ubiquity
2. Diversity of the Microbial World
3. Microbial Growth and Death
4. Metabolism
5. Basics of Molecular Microbiology: Microbial genetics, Virology, Immunology
6. Microbes and disease; Normal flora, Pathology, infection and disease, Mechanisms of pathogenicity, Principles of epidemiology
7. Food microbiology: Hygiene and concept of indicator. Processing and storage of food.
Foodborne diseases
8. Ecology and environmental microbiology: Soil and water, Biogeochemical cycles, Agricultural applications, Wastewater treatment, Biotechnology applications

Lab Practice:
Aseptic practice
Observation of bacteria, fungi and protists.
Demonstration of Ubiquity
Preparation and sterilization of culture media.
Isolation of pure culture.
Colonial and cellular morphology. Gram Staining
Microbial counts
Environmental conditions for growth (pH, temp., O2)
Anaerobic Culture
Antibiograms

Back

Field Trip B01 (BIO0316)

Patterns of distribution, abundance, diversity and morphology of aquatic invertebrates at different scales (mainly spatial), and physico-chemical (e. g. water movement, desiccation, thermal stress, anaerobiosis) and biological (e. g. competition, predation, facilitation, recruitment, reproduction) processes that generate these patterns.
Sampling methods and techniques for the scientific study of aquatic invertebrates.

Back

Communities and Ecosystems Biology (BIO0293)

Biological communities : general features, definitions and concepts; properties of communities, richness, diversity and evenness; resilience and stability; models of distribution of abundances; key species in communities; temporal patterns at different scales (daily, seasonal, annual, historical and geological); allogenic, autogenic, primary and secondary successions; the climax concept; habitat selection.
Ecosystems: concepts, structure and processes; types of ecosystems and biomes; flows of energy and matter; primary production; species as modifiers of ecosystems.
Structure and functioning of freshwater and brackish ecosystems. Coastal and marine ecosystems. Ocean ecosystems.

Back

No-Seed Plants Biology (BIO0295)

1.The evolution in the plant kingdom - Diversity and characteristics morfo-functional of major groups. Life cycles and ecological and economic importance.
2. Monera: Cyanophyta - blue-green algae
3. Protists: Chlorophyta, Euglenophyta, Rhodophyta, Dinophyta, Bacillariophyta, Phaeophyta, Chrysophyta, Xanthopyta, Myxomycota, Acrasiomycota and Oomycota.
4. Fungi: Ascomycota, Basidiomycota, Zygomycota, Deuteromycota and lichenes.
5. Colonization of Earth. Comparison between aquatic and terrestrial enviroments.
6. Antocerophyta, Hepatophyta and Bryophyta; General characteristics. Morpho-anatomical aspects. Diversity and occurrence. Assexual and sexual reproduction. Importance in ecosystems.
7. Evolution of Tracheophyta. Fossil records.
8. Psilotophyta, Lycophyte, Sphenophyta and Pteridophyta: Characterization of the sporophyte and gametophyte. Lifecycle. Filogenetic relationships. Ecology, distribution and economic and ecological importance.

Back

Populations Biology (BIO0296)

1. Population Ecology
1.1. Isolate population Exponential growth model
1.2. Isolate population Logistic growth model
1.3. Allee effects in population growth
1.4. Connectivity and population growth
1.5. Logistic growth applied to fisheries or applied to stock regulation of populations in natural parks
1.6. Two populations growth under biotic relation of Competition and Predation (Lotka-Volterra models)
1.7. Biogeographic islands Model
1.8. Metapopulations

2. Genetic population
2.1. Hardy-Weinberg equilibrium model
2.2. Frequency genetic variation models based on evolution forces: Mutation, Migration, Natural selection, Genética drift and Inbreading.

Back

Vertebrates Biology (BIO0298)

1. General characteristics and classification of the vertebrates.
2. Agnatha. Systematics; Biology of hagfish and lampreys.
3. Chondrichthyes: Systematics; Morphology of the Elasmobranchii and of the Holocephali.
4. Osteichthyes: Systematics and diversity; Morphology; Urogenital system and reproduction; Osmotic regulation; Biology of the Coelacanthimorpha and Dipnotetrapodomorpha.
5. Amphibia: Sistematics and phylogeny. Skeleton. Integument. Ear and audition. Respiratory, digestive, circulatory and urogenital systems. Reproduction.
6. Reptilia: Sistematics; Integument; Skeleton; Circulatory and respiratory systems; Sense organs; Urogenital system and reproduction.
7. Aves Systematics; Morphology; Integument; Skeleton; Circulatory, respiratory, digestive and urogenital systems; Reproduction;
8. Mammalia: Sistematics and phylogeny; Dentition; Horns and antlers;. Digestive and nervous systems. Biology of the Monotremata;. Urogenital system and reproduction (Methateria and Eutheria).

Back

Animal Physiology (BIO0305)

1. Definitions and concepts in animal physiology.
2. Neuron physiology.
3. Information flow between neurons (synapses and neural networks).
4. Sensory physiology.
5. Nervous system.
6. Muscle physiology and movement.
7. Glands and endocrinology.
8. Circulatory system.
9. Gas exchange and acid-base balance.
10. Ionic and osmotic balance.
11. Feeding and digestion.
12. Metabolism and energy.
13. Experiment simulations using dedicated software simulators as tools for problem-solving based acquisition of knowledge and competences.

Back

Genetics (BIO0309)

Part I. Basic concepts

Chapter 1 Genetic material

Gene, chromosome, mutation

Chapter 2 Meiosis

The work of Mendel
Chromosome linkage
Tetrad analysis
Heterossomes
Cytoplasmic heredity

Chapter 3 Phenotype

Types of dominance
Interactions between non-alleles
Maternal effect
developmental genetics

Chapter 4 Populations

Gene frequencies
Concept of equilibrium
Evolution forces

Part II. Chromossomes

Chapter 5 Karyotypes

Ploidies
Number vriations
Structure varitions
Infertilities

Chapter 6 Maps

Diploids, haploids, prokaryonts
Genomics

Part III. Genetic Analysis

Chapter 7 Mendelian analysis

Study of proportions
Pedigree analysis
Chi-square test

Chapter 8 Continuous variation

Polygenes
Components of phenotypic variance
Heritability, artificial selection
QTLs

Part IV: Genetics and Evolution

Chapter 9 Evolution

Back

Biology of Seed Plants (BIO0294)

LECTURES: 1. The seed plant body - structural and architectural patterns; 2. Adaptations to different environments; 3. Taxonomy and evolution of seed plants; 4. Diversity and evolution of seed plants; 5. Distribution of the seed plants.
LAB: 1. Review of plant morphology; Comparative study of seed plant adaptations; 2. Collecting, pressing, drying and mounting plant specimens.

Back

Human Biology (BIO0301)

Introduction to the Study of Human Biology: Concept, importance and relationship with other disciplines.
Primatology: Man as a primate. Biogeography of primates: comparative anatomy of locomotion and dentition. Social and behavioral structures.
Human Evolution: hominoids, hominids and hominins; characterization and geographic distribution. The bipedalism: ecological framework and anatomy. The genus Homo and the output of Africa. Our species. Current populations and some polymorphisms.
Structure and Function of cell: cellular homeostasis, cell cycle, signaling and cellular interactions, cell adhesion and communication, extracellular matrix; cell death, stress and cellular adaptation; carcinogenesis and cancer.
Stem cells: the concept, embryonic and adult stem cells, stem cell types. Cloning: types of cloning.
Blood: components (plasma, serum). Elements in the mammalian blood. Hematopoiesis.
Muscle-skeletal apparatus: bones, cartilage, joints,

Back

Molecular Biology (BIO0302)

Part I. DNA REPLICATION
1. Genes and chromosomes
2. Replication of DNA
3. Recombination and transposition
4. Mutation and repair mechanisms
Part II. GENE EXPRESSION
5. Transcription
6. Translation
7. Regulation of gene expression
Part III. TECHNIQUES AND APPLICATIONS
8. Analytical and preparative methods in Molecular Biology
9. Techniques in molecular biology. Recombinant DNA techniques. Bioinformatics.
10. Applications in genetic engineering

Back

Plant Physiology (BIO0307)

WATER RELATIONS: Functions and water movement. Responses to water stress. TRANSPORT IN PHLOEM: Input and output of metabolites in phloem and transport. Distribution of assimilates. MINERAL NUTRITION: Essential elements. Criteria of essentiality. Absorption of minerals. Ion movement in roots. Ion transport in membranes. PHOTOSYNTHESIS: Reactions directly dependent on light. CO2 reduction. Metabolism C3, C4 and CAM. Photorespiration. Abiotic factors that affect photosynthesis. RESPIRATION: Pentose phosphate pathway. Abiotic factors that affect respiration. DEVELOPMENT AND PHYTOHORMONES: Growth and differentiation. Auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, salicylic acid and estrigolactonas. PIGMENTS and Photo-Morphological Characteristics: The pigments of blue light receptors. The family of Phytocrome. PHOTOMORPHOGENESIS AND FLOWERING

Back

Geology (GEO0741)

Rocks and main mineral constituents.; Soil physical, chemical and biological properties.Magmatism, metamorphism and sedimentogenesis. The lithospheric plates, their boundaries and the asthenosphere. Cycles of formation, fragmentation and dispersal of supercontinents. Current distribution of sedimentary environments and their relation to climate and life forms. The Geological Time: relative dating and isotopic dating (absolute). The principles of stratigraphy and stratigraphic succession. Environments in Archaic, Paleoproterozoic, "Snowball Earth"in the Neoproterozoic and Cambrian Explosion of Life; Extinction and dispersal of organisms, colonization of the continents in Paleozoic: plants and animals;
Mass extinctions in the lower Paleozoic, Paleozoic-Mesozoic transition;
Nuna/Columbia, Gondwana and Pangaea supercontinents;
The Paleogeography of Paleozoic, Mesozoic and Cenozoic.
The significance of the stratigraphy of Portugal: the formation of supercontinents Gondwana and Pangaea.

Back

Conservation Biology (BIO0292)

THEORETICAL
1. Specificity of the Iberian fauna
- Biogeography and determinants of faunal diversity
- Geological History
- Climate and Topography
- Human Presence
- Endemism Iberian
2. Conservation of Iberian Fauna.
- Arguments for the Conservation
- Characteristics and population processes that enhance the rarity and threat
- Red Book of Vertebrates of Portugal and Spain
- The Birds and Habitats Directives
- Hunting and Fishing in inland waters
3. Species of terrestrial vertebrates, including freshwater species occurring in the Iberian Peninsula
- Diagnosis
- Fundamentals of Ecology
- Phenology and Distribution
- Conservation
- Native and introduced species
4. Methods and techniques for wildlife census
- Direct. Direct observation, trapping and electric fishing
- Indirect. Presence signs, analysis of diet of predators, scent stations; automatic cameras, acoustic detection, molecular analysis
5. Observation and handling of specimens in the field

Back

Biology and Society (BIO0299)

1. History of Biology, main landmarks 2. Theories on the origin and diversity of life 3. Science and Religion 4. Biology of cancer 5. Biology of ageing 6. Stem cells and their potential therapeutic use 7. Tissue engineering 8. Bioethics: cloning 9. Impacts and use of genetically modified organisms10. Medically assisted reproduction and genetic counselling; ethical implications.

Back

Evolutionary Biology (BIO0300)

1. Microevolutionary concepts (adaptive evolution; neutral evolution; the genetic impact of selection on populations; the origin and maintenance of genetic variations; the expression of evolution)
2. Design by selection for reproductive success (the evolution of sex; genomic conflict)
3. Principles of macroevolution (speciation; phylogeny and systematic; comparative methods)
4. The history of life
5. Integrating micro and macroevolution (coevolution, human evolution)
6. Nucleotide diversity and phylogenetic analysis of sequences, Neutral theory of molecular variation.
7. Intraspecific analysis with genetic markers.
8. Classification and Phylogeny.

Back

Biosystematics (BIO0303)

1 THEORY OF EVOLUTION

1.1. Brief history of systematic and evolutionary thought. The novelty of Mendelism. The implications of Darwinism and the theory of natural selection. The modern synthesis.

1.2 Evidence of evolution: fossils, comparative anatomy, embryology, molecular genetics; biogeography.

1.3 The wrong or false conceptions about Evolution.

2 CATEGORIES AND taxa

2.1. intrapopulation variation.

2.1.2 Genetic variation and evolutionary mechanisms.

2.2.2 Genetic Variation no confusion as to the Systematic: individual; time; social; ecological; traumatic.

2.2. The taxon species.

2.3. The category species.

2.4 Mechanisms of genetic isolation.

2.5 Speciation and taxonomic decisions.

3 CLASSIFICATION AND PHYLOGENY

3.1 Functions of a review of indexing information stored; Heuristics properties; make generalizations; explanatory power.

3.2. Phenetics / Numerical Taxonomy.

3.3. Cladistics.

3.4 Evolutionary Classification.

Back

Project in Biological Sciences I (BIO0314)

1 Scientific method and logical design in research in Biology: from observations and problems to interpretation of results. 2 Biological hypotheses: finding them in scientific work and suggestions to biological problems. From biological to statistical hypotheses and why we need statistics. 3 Fundamentals of sampling and experimental design. 4 Solving simple biological questions using statistic tools obtained in Statistics courses. 5 Planning scientific projects in Biology. Communication of scientific results: paper writing, oral and poster presentations (assembling information, presenting results as figures and tables, scientific writing).

Back

Paleonthology (GEO1218)

History: Definition and applications of paleontology; Fossils (definition and types); Development of paleontological studies and its influence on human thinking; Paleontology in Portugal. TAPHONOMY: biological and geological factors; Formation and types of sites. Reference to some types of bearing layers celebrated deposits Exceptional sites (lagerstätten). FOSSILIZATION: main types of fossilization; Ichnology. Techniques used in Paleontology: prospecting, sampling and preparation; Molding and reconstruction; Study of fossils. PALEONTOLOGICAL taxonomy and Systematics: SYSTEMATICS; Taxonomic hierarchy; Main naming rules. PALEOBOTANY: plant Fossils; Fragments and or plant organs; Main groups of plants, General characteristics and stratigraphic importance. PALEOZOOLOGY: Major phyla of invertebrates with palaeontological interest; General characteristics; Systematic study and stratigraphic distribution; Phylogenetic relations scheme; Vertebrates, stratigraphic and evolutionary importance.

Back

Project in Biological Sciences II (BIO0334)

According to students choice given the Objectives (6.2.1.4).

Back

Aerobiology (BIO0288)

I - An Introduction to the Study of Bioaerosols
II - Methodologies and Technologies for Bioaerosol Monitoring and Analysis
III - Characterization of Main Classes of Bioaerosols
1. The Microbiological Fraction (Bacteria and Microalgae)
2. Mites and Animal Dander
3. Airborne Molds
4. Airborne Pollen
IV - Pollen Aerobiology of Portugal
V - Aerobiological Applications:
1. Aerobiology and Climatic Changes
2. Aerobiology and Health: the Impact of Exposure to Bioaerosols

Back

Water Biology (BIO0318)

1. The Integration of freshwater ecosystems in the context of the Biosphere
2. Lotic ccosystems
3. lentic ecosystem
4. Primary producers (algae and macrophytes)
5. Consumers (zooplankton and macroinvertebrates)
6. Consumers (ictofauna)
7. Riparian corridors and morphology of inland waters
8. Subterranean aquatic ecosystems
9. Cycles of matter and energy (decomposition of organic matter and trophic structure of macroinvertebrate communities)
10. Drift and colonization as vectors on the formation of aquatic communities (macroinvertebrates)
11. Consequence of natural disturbances and human disturbances on inland waters
12. Water Framework Directive and ecological quality assessment of inland waters

Comparison, on a planetary scale, of different types of inland waterss (environmental gradients across a global scale)

Back

Toxic Plants Biology (BIO0337)

1. Biology of poisonous plants: an introductory approach; 2. Taxonomic and chemical characterization of toxigenic plant families and species; 3. Toxicoses symptoms associated with plant ingestion; 4. Treatment adequacy to clinical symptoms.

Back

Soil Biology (BIO0319)

T Soil as support and environment for biological activities. Diversity of living organisms in soil, adaptations to restrictions impinged by three-dimensional and multi-scale environments (namely available volume, light availability and light quality) and role of biological entities in creation, change and structure of soil.
Theoretical
T1 Introduction to soil science.
T2 Major taxonomic groups (e.g. microbes, protozoa, nematodes and arthropods), their relationships and roles in symbiosis, parasitism and natural soil tillage.
T3 Roots and soil seed banks.
T4 Relationships among morphology, size, biological activity and soil porosity.
T5 Chemical signalling in biological relationships in soil.
Experimental
P1 Methods in Soil Science studies.
P2 Planning, design and execution of experiments supervised by teachers belonging or not to this curricular unit.

Back

Marine Biology (BIO0320)

Marine biodiversity: concepts, spatial and temporal patterns; comparison between marine and terrestrial biodiversity.
Spatial and temporal patterns and processes (biological and non-biological) at different scales of distribution and abundance of planctonic, nectonic and benthonic organisms. Structure and functioning of marine communities: estuaries, oceanic shores, open and deep sea.
Biology and management of marine resources.
Pollution and marine conservation.

Back

Fisheries Biology (BIO0321)

1. Main Portuguese halieutic resources: algae, molluscs, crustaceans and fish. 2. Fishing technology used in Portugal. 3. Aquaculture: aquaculture techniques, production of aquatic organisms in Portugal. 4. Fish transformation industry. 5. Population dynamics: distribution and abundance, growth, reproduction and recruitment, mortality. 6. Introduction to the yield models. 7. Assessment and monitoring of halieutic resources. 8. Impact of fisheries in the aquatic ecosystems.

Back

Biotechnology (BIO0335)

1 Theoretical programme
i. Introduction
j. Fundaments of Molecular Cloning and DNA analysis
k. Microbial Systems in Genetic Engineering
l. Eukaryotic Systems in Genetic Engineering
m. Applications of Genetic Engineering for the development of new products and services
n. Official Regulation

7. Laboratorial programme
a. Training on pipeting. Solutions and dilutions.
b. Plasmidic DNA extraction (MiniPrep)
c. Restriction digestion of plasmidic DNA
d. Agarose gel electrophoresis
e. Preparation of competent bacteria
f. Transformation of competent bacteria
g. Screening of recombinants
h. Autonomous laboratorial work: Identification of unknown DNA sample

Back

Plant Ecophysiology (BIO0338)

1. Concept of "stress"and "strain": Plant responses to "stress".
2. Radiation: its characteristics. The qualitative and quantitative changes through the vegetation. Its use by plants and adaptation to ambient light.
3. Water: water potential and its components. Water balance in plants: Absorption and its translocation to the places of evaporation. Perspiration. Water balance in plants. Resistance to drought and waterlogging.
4. The absorption of mineral elements. Excess salts stress. Plants and calcicoles calcifuges.Saline habitats and regulation of salt content.Soils rich in heavy metals.
Air pollution and water.
5. Energy balance: Energy balance in plants. The equation of energy balance. The physiological limits of temperature. The physiological effects of extreme temperatures. The mechanisms of resistance to extreme temperatures.
6. Gas exchange, photosynthesis and respiration, internal and environmental factors affecting photosynthesis (C3, C4 and CAM) and photorespiration.

Back

Entomology (BIO0325)

1. Arthropods and insects within bybiodiversity.
Population dynamics and ecological parameters. Methods of observation of insects.
2. Insects manipulation, preservation and preparation for taxonomic purposes.
3. Morphology, anatomy and biology of insects. Behavior and communication.
5 Techniques for creating insects in the laboratory.
6. Pre-social and social insects.
7. Ecology of insects in the trophic web.
8. Applied Entomology: Agricultural.
9. Forest Entomology.
10. Pests in stored food.
11. Aspects of Entomology, Veterinary, Human Medicine, Forensic Medicine.
12. Insects as objects of study in genetics, molecular biology.
13. Entomology and employability. Areas in society in which entomology matters.
Tours
14. Exercising, after an introduction, study skills of subjects taught in the form of review of the subjects taught, and clarification of doubts.

Back

Ethnobotany (BIO0339)

Theoretical contents:
C1. Concept of Ethnobotany. C2. Features of the relationship Man-Plant World. C3. Nomenclature and ethnological classifications. C4. The domestication of plants, birth of agriculture, cultivated plants and their spread throughout the world. C5. Ethnobotany and alimentation. Food and condiments. Luxury and necessity. C6. Ethnobotany and Medicine. Herbal medicines, drugs and practices. C7. Psychoactive plants and their importance. C8. Plants as the basis of the material world. C9. Textile plants and dyes. C10. The gardens, botanical and ethnobotanical gardens.
Practical contents:
C11. Working methods in Ethnobotany. Introduction to research anthropological methods. C12. Brief references to methods of collection, preservation and identification of plant material and methods of characterization of vegetation and habitat already covered in other disciplines. C13. Methods for analyzing ethnobotanical data.

Back

Ethology (BIO0326)

1. Theory
1.1. The history of ethology as scientific discipline
1.2. Proximate causes of behaviour: neural mechanisms
1.3. Development of behaviour: genes, environment and learning
1.4. Organization of behaviour: neural and endocrine mechanisms
1.5. Behaviour adaptation for survival
1.6. Evolution of feeding behaviour
1.7. Evolution of communication
1.8. Evolution of reproductive behaviour
1.9. Evolution of mating systems
1.10. Evolution of parental care
1.11. Evolution of social behaviour
1.12. Evolution of human behaviour
2. Practice - Training on ethological methods
2.1. Objective description of behaviour
2.2. Behavioural categories and ethogram
2.3. Recording of behavioural observations, including computer-based methods; methods for recording and sampling of behaviour
2.4. Sampling methods in behavioural observation
2.5. Assessment of inter-observer variability

Back

Iberian Fauna (BIO0327)

THEORETICAL
1. Specificity of the Iberian fauna
- Biogeography and determinants of faunal diversity
- Geological History
- Climate and Topography
- Human Presence
- Endemism Iberian
2. Conservation of Iberian Fauna.
- Arguments for the Conservation
- Characteristics and population processes that enhance the rarity and threat
- Red Book of Vertebrates of Portugal and Spain
- The Birds and Habitats Directives
- Hunting and Fishing in inland waters
3. Species of terrestrial vertebrates, including freshwater species occurring in the Iberian Peninsula
- Diagnosis
- Fundamentals of Ecology
- Phenology and Distribution
- Conservation
- Native and introduced species
THEORETICAL-PRACTICAL
4. Methods and techniques for wildlife census
- Direct. Direct observation, trapping, bird banding and electric fishing;
- Indirect. Presence signs, analysis of diet of predators, scent stations; automatic cameras, acoustic detection, molecular analysis
5. Observation and handling of specimens in the field

Back

Plant Developmental Physiology (BIO0306)

Theoretical Part:
I. Introduction Plant Physiology:
1. Water Relations;
2. Mineral Nutrition;
3. Photosynthesis
4. Phloem Transport;
II. Introduction to Plant Development:
1. Basic Concepts in Plant Development
2. Signal transduction
3.Plant Phytorhomones;
4. Secondary Metabolism;
5. Photomorphogenic Pigments;
6.Photoperiodism and Flowering;
Practical Part:
I.Introduction to Plant Anatomy and Morphology:
Root; Stem; Leaves; Flowers and Fruits
II. Topics on Advanced Plant Physiology:
Phytorremediation; Plant Cell Death; Movements; Plant-Plant Interactions; Plant-Animal Interactions; The non pathogenic Plant-Microbe Interactions; Plant Immunology; Plant Behaviour.

Back

Phytosociology (BIO0340)

Phytosociology an introduction.
Phytosociological methodology.
Bioclimatology notions.
Biogeographic classification of mainland Portugal.
Species Distribution (biotic and abiotic factors, species and plant communities distribution concepts).
Phytosociological typology of mainland Portugal.
Species and habitats conservation.
Environmental impact assessment.
Legislation.

Back

Flora of Portugal (BIO0341)

1. Biophysical Characterization of Portugal;
2. The Flora of Portugal;
- Historical Context;
- Taxonomical and Ecological Characterization of Main Plant Families and Genera;
- Exotic, Ruderal, Ornamental Plants, Plants from Agricultural and Forestry Ecosystems

3. The Conservation of Portuguese Flora
- Analytical Methodologies and Reproductive Biology;
- IUCN Categories;
- Conservation Status: hot-spots for the conservation of threatened populations;
4. The Impact of Climatic Changes on Plants.

Back

Herpetology (BIO0328)

I [Biology and ecology of amphibians]
Module 1 - Tailed amphibians (salamanders, newts) and legless amphibians (caecilians)
Module 2 - Anurans (frogs and toads)
Module 3 - Conservation of amphibians
II [Biology and ecology of reptiles]
Module 4 - Turtles
Module 5 - Saurians (lizards) and amphisbaenia (worm-lizards)
Module 6 - Snakes
Module 7 - Crocodiles, dinosaurs and tuataras
Module 8 - Conservation of reptiles
Field work:
Field identification of amphibians and reptiles. Field trips to assess suitable habitats and ecotypes.

Back

Ichthyology (BIO0329)

1. Introduction to the study of fishes. 2. Form and Movement. 3. Circulation and respiration. 4. Excretion and osmoregulation. 5. Sensory perception. 6. Age and growth. 7. Reproduction. 8. Feeding ecology. 9. Distribution and migration. 10. Behaviour and biotic interactions.

Back

Immunology (BIO0311)

Theoretical programme
1. Introduction to the immune system. General aspects.
2. Components of the immune system
3. Antigens and antibodies
4. Gene organisation and expression of immunoglobulin?s
5. Immune responses
6. Effector mechanisms of the immune response
7. The immune system in the health and disease
8. Monoclonal antibodies
9. Experimental immunology

Laboratory programme
1. Introduction. Programming of the course
2. Experimental immunisation
3. Purification of immunoglobulin's
4. Test to the students natural immunity
5. Immunoprecipitation techniques
6. Observation of blood cells
7. ELISA
8. Autonomous laboratory work: goat immunisation and its characterisation

Back

Introduction to Plant Biotechnology (BIO0342)

1. Plant Biotechnology: Definition, objectives and theoretical and basic concepts.
2. laboratory infrastructure and equipment: specifics of a plant biotechnology laboratory; major equipment and its use.
3. The culture techniques "in vitro"; Micropropagation; Hploidização; Somatic embryogenesis; Suspension cell culture; Protoplast culture.
4. Genetic transformation: genetically modified organisms; the notion of genetically modified organisms; Gene transfer methods; Selection procedures of the transformed plants; estabilidadde of transferred gene; ethical dilemmas associated with the production of transgenic.
5. Genetic markers and molecular markers: marker types and their use; the particular case of markers - DNA.

Back

Marine Invertebrates (BIO0330)

Giving special attention to benthic taxa of the Portuguese coast and to the groups of crustaceans, molluscs and nematodes, the following subjects will be taught: 1) abundance and distribution; 2) life cycle: reproduction, growth, settlement and recruitment; 3) genetics; 4) behaviour; 5) biogeography; 6) interactions between and among species; 7) impact of fishing, pollution and other human disturbances; 8) management, conservation, restoration, monitoring and cultivation.

Back

Mammalogy (BIO0331)

THEORY

1. Introduction to the study of mammals and general characteristics.
2. Origin and evolution;
3. Locomotion.
4. Food habits and foraging strategies;
5. Physiology.
6. Reproduction.
7. Behavior and communication.
8. Demography.
9. Mammal diversity.
10. Zoogeography.

PRACTICE: METHODS AND TECHNIQUES FOR CENSUS OF MAMMALS

1. The planning of an inventory of mammals
2. Direct methods. Direct observation and trapping;
3. Indirect methods. Presence signs; scent stations; automatic triggering video and photo camera; acoustic detection; owl pellet analysis; molecular analysis;
4. Estimates of abundance, density and other parameters. Indices of abundance; points, linear transects and band sampling ; direct counting; capture / marking / recapture; distance sampling distance;
5. Sampling of rare or elusive species.

Back

Nematology (BIO0332)

Introduction and History of Nematology. Contributions to Biology and importance of the group. Functional organization (I). General morphology; external and internal structures; digestive system. Functional implications. Locomotion; secretions and feeding. Functional organization (II). Reproductive system, gametogenesis; life cycle. Modes of reproduction. Genetics. Embryology and developmental biology; C. elegans: importance as the biological model of the XXIth century. Evolution. Taxonomy. Ecology of soil nematodes. Trophic relationships. Ecology of free-living nematodes: biotic and abiotic factors. The estuarine and marine communities. Parasitism: plants Types of phytoparasitism; histopathology; resistance. Interactions with other microorganisms. The role of vectors. Control of phytoparasites. Parasitism: invertebrates; adaptations; parasite-host relationship. Effects in nature. Benefcial use for Man. Parasitism: vertebrates/ human and veterinary parasitology. Adaptations to host.

Back

Ornithology (BIO0333)

0. The value of birds.
1. Ancestral forms; the evolution of flight. Flightless forms.
2. Biogeographic issues. Historical and ecological biogeography. Perispecífic systematic (population structure of species); cycles of expansion and shrinkage of glaciers (differentiation, speciation and extinction); history of avifaunas in the Mediterranean Region. Relations between the Palearctic and Afrotropical avifaunas.
3. Physiology, ecology, behavior and adaptive strategies. Physiological aspects. Space use and intra-specific relationships. Reproductive strategies. Breeding seasons. Clutch size and broods.
4. Migration. Migration and selection. Inducing stimuli. Navigation.
5 Populations, bird communities and conservation. Demography. Patterns of communities. Conservation of endangered species. Bird census methods and monitoring programs.

Back

Palynology (BIO0343)

PART I - Biology and Pollen Grain of Ecology
1. Introduction: The Grand pollen;
2. Pollen and fertilization biology;
3. Pollen Morphology;
4. Biochemistry of the pollen grain;
5. pollen Ecology;

PART II - The Application of palynological studies
6. Palynology and Systematics Plant;
7. Melissopalynology and Pollen analysis of honeys;
8. Arqueopalinologia and Paleobotany;
9. Palynology and Medicine;
10. Pollen in Agronomy;
11. Other applications.

Back

Marine Pollution and Conservation (BIO0322)

1. Marine pollution: main chemical, organic and biological disturbances (loads, distribution, biological and ecological impact, prevention and control); physical disturbances. Marine pollution in Portugal. Introduction of exotic species in marine environments.
2. Marine conservation: objectives, strategies and threats. Marine protected areas: selection, designation and management. Marine conservation in Portugal. Restoration of marine ecosystems.
3. Human impact assessment in marine environments. Distinction between natural variability and human disturbances. Differences between human impacts in marine and land environments.

Back

Principles of Environmental Microbiology (BIO0323)

Theoretical:
Microbial diversity and physiological diversity. Biogeochemical cycles and anthropogenic action.
The soil as a matrix for microbial growth. The microbial diversity and interactions in the soil.
Water as a growth medium and vehicle for transport and microbial spread. Treatments of drinking water and waste water.
Aerosolization of biological particles and agents and their dispersion. Sampling methods and equipments for the study of microbes in the air. The microbes and organic pollutants and metals: Bioremediation and key factors involved in the efficiency of microbial removal processes of pollutants.
Presentation of case studies.
Practice:
Practical experiments: Effect of herbicides on soil microbial population. Water analyze before and after discharge of waste water treatment plant. The Winogradsky column. Sampling and assessment of indoor environments.
Review the oral presentation of scientific papers in the area of environmental microbiology.

Back

Ecological Quality and Inland Water Monitoring (BIO0324)

1. Status of superficial water bodies and Water Framework Directive (WFD): superficial water bodies; heavy modified and artificial water bodies. Abiotic typology. Reference conditions. (answer to objectives 2 and 3).
2. Evaluation of ecological status/potential; evaluation of chemical status. Classification of systems based on quality elements (biological elements; physic and chemical elements; hydromorphological elements; chemical elements) (answer to objectives 2 and 3).
3. Degradations causes. Objectives and measures at water bodies scale and at basin scale.
4. Sampling and monitoring programmes: objectives and results (answer to objectives 2 and 3).

Back

Virology (BIO0315)

Theoretical Programme
1. Introduction and functioning of the course
2. General and Molecular Virology
3. Taxonomy and Sistematics
4. Infection and infectious agents
5. Immunology of viral infections
6. Epidemiology of viral diseases
7. Treatment and prevention of viral diseases
8. Diagnostic of viruses
9. Biotechnological applications of virus

Laboratory Programme
1. Theoretical introduction. Biosafety in the laboratory.
2. Experimental study of virus
3. Plant viral Infection (tobacco)
4. Bacterial growth curve
5. Preparation of an elevated titre virus
6. Dosing of virus - Plaque forming assay
7. Dosing of virus - Limiting dilutions
8. Autonomous laboratory work: isolation and characterisation of an wild bacteriophage.

Back

Introduction to Biological Anthropology (BIO0336)

1. Human osteology.
1.1. Bone morphology and identification of anatomical structures of the skeleton.
1.2. Sex diagnosis in adult skeletons.
1.3. Choosing useful parameters to assess age at death estimation.
Criteria for age at death estimation in non-adults skeletons. Dental and skeletal indicators in the process of development, growth and maturation.
2. Paleodemography, age and sexual distributions, life expectancy, mortality and birth rates and population size.
3. Growth: endochondral and intramembranous ossifications. Growth disruption.
4. Paleopathology: assessment of health profiles through bone and tooth injuries. Degenerative diseases, traumatic, infectious, oral, metabolic, congenital and neoplastic. Differential diagnosis. Epidemiology.
5. Muscle skeletal markers and reconstitution of physical activity.