DEPARTMENT OF BIOLOGY

PROGRAMME OF STUDIES AND COURSE DESCRIPTIONS OF STUDY-UNITS OFFERED FOR ACADEMIC YEAR 2007 2008

B.Sc. (Hons) and Other Courses

Version: 26 Sep 07

Introductory Note

This is a catalogue of all study-units in Biology offered by the Department of Biology for various courses including: B.Sc. (Hons); Foundation Course in Biology; B.Ed. (Hons); courses at the Institute of Health Care and others.

Programme of Studies in Biology (B.Sc. Hons)

Students following the Programme of Studies in Biology (B.Sc. Hons) are required to take a number of study-units other than in biology. Such study-units are designed to provide additional skills and knowledge required within the training of a general biologist.

Furthermore, most study-units in Biology take the form of a number of lectures (sometimes supplemented by seminars) as well as practical laboratory or field work. The practical work component is considered as essential for the whole degree course and as such is compulsory and non-compensatable for the respective study-unit. This means that no grade will be awarded for the respective study-unit unless the average mark for practical reports related to that study-unit is a minimum of 45%.

Students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular, and all other course requirements as indicated below, have been satisfied.

In their final year Biology students will be required to follow one of two "tracks" to be made available. One track will be focused on environmental biology, while the other will deal with industrial biology (including biotechnology). Each track will have a value of 8 credits.

Study-Units Offered For Academic Year 2006/2007

YEAR 1 (B.Sc. Hons.) and Other Courses

Type of Unit	Code	Unit Title	Credit Value	Semester	Lecturer
Compulsory for BSc Biol Chem Year 1 + B.Ed Students Year 1. Assessment for Practical component is non-compensatable	**BIO1010**	Cellular and Biochemical Basis of Life	5	1	J Buhagiar
	BIO1020	Diversity of Life: Animals	5	1	P J Schembri
	BIO1030	Diversity of Life: Non-animals	5	2	E Lanfranco

	BIO1040	Basic Life Functions	5	2	D Dandria
Compulsory for BSc Biol Chem Year 1	**CIS 1003**	Programming for Scientists	2	1	C Meli and J Galea
	SCI1200	Science of the Earth	4	1,2	P Galea and J M Bonnici

YEAR 2 (B.Sc. Hons.) and Other Courses

Type of Unit	Code	Unit Title	Credit Value	Semester	Lecturer
Compulsory for BSc Biol Chem Year 2 + B.Ed. Students Year 2. Assessment for practical component is non-compensatable	**BIO2070**	Biochemical Strategies of Life	5	1	A Vella
	BIO2020	Plant Biology	7	2	E Lanfranco and J. Buhagiar
	BIO2030	Animal Form and Function I	6	2	V Axiak
Compulsory for BSc Biol Chem Year 2. Assessment for practical component is non-compensatable	**BIO2040**	Ecology and Ethology	8	1	P J Schembri and A. Vella
	BIO2050	Science, Society and Ethics	2	2	To be identified
	PHY1020 or PHY1030	Basic Concepts in Physics I or II	2	1, 2	M.Borg

YEAR 3 (B.Sc. Hons.) and Other Courses

Type of Unit	Code	Unit Title	Credit Value	Semester	Lecturer
Compulsory for BSc Biol Chem Year 3. Assessment for practical component is non-compensatable	**BIO3130**	Genetics and Developmental Biology	6	1	A Vella
	BIO3020	Microbiology and Parasitology	5	1	C Agius
Compulsory for BSc Biol Chem Year 3 + B.Ed. Students Year 3. Assessment for practical component is non-compensatable	**BIO3030**	Evolution, Phylogeny and Adaptation	4	1	E Lanfranco
Compulsory for BSc Biol Chem Year 3. Assessment for practical component is non-compensatable	**BIO3050**	Animal Form and Function II	5	2	V Axiak
	BIO3040	Biotechnology 1	6	2	C Agius
	BIO3060	Field Biology	4	(1, Sep)	J A Borg, P J Schembri and others

YEAR 4 (B.Sc. Hons.) and Other Courses

Type of Unit	Code	Unit Title	Credit Value	Semester	Lecturer
Compulsory for BSc Biol Chem Year 4. Assessment for practical component is non-compensatable	**BIO3070**	Studies in Conservation Biology	4	1,2	Adriana Vella
	BIO3080	Agriculture, fisheries and the management of biological resources	4	1	C Agius and D Dandria

	BIO3090	Environmental Applications and Management (and Informatics	4	1	V Axiak and others
Elective Environmental Biology Track for BSc Biol Chem Year 4. Assessment for practical component is non-compensatable	**BIO3100**	Marine Biology	4	2	P J Schembri and J A Borg
	BIO3300	Biotechnology 2	6	1	C Agius and others
Elective Industrial Biology Track for BSc Biol Chem Year 4. Assessment for practical component is non-compensatable	**CPH2500**	Introduction to Pharmacology	2	2	J Mifsud
Elective for BSc Biol Chem Year 4. Non-compensatable.	**BIO3110**	Project in Biology	18	1,2	various
BSc Biol Chem Year 4	**SCI3508**	Professional Skills for Scientists	10	1,2	Various (J Buhagiar coordinator)

Study-Units Offered for Other Courses and Not Available for B.Sc.Biology Students

Type of Unit	Code	Unit Title	Credit Value	Semester	Lecturer	Remarks
Optional	**BIO0070**	Cell Biology	4	2	Occasional Lecturer	Diploma Dental Technology Course
Optional	**BIO0080**	Introductory Biochemistry	4	2	Occasional Lecturer	Diploma Dental Technology Course
Optional	**BIO1050**	Molecules and Life	2	1	D Dandria	Available to various courses
Optional	**BIO1060**	Introductory Environmental Science	2	2	P J Schembri, S Lanfranco	Available to various course including Tourism Studies
Optional	**BIO1061**	An introduction to the Natural Environment of Malta and the Mediterranean	2	2	P J Schembri, S Lanfranco	Available to various course including Tourism Studies
Optional	**BIO2041**	Ecology	4	1	P J Schembri	BEd Year 2 + Year 3 (part of BIO2040)
Optional	**BIO3132**	Studies in Genetics	4	2	A.Vella	Special Unit for BEd Year 4 students

Code:	**BIO0070**
Title:	**Cell Biology**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**IHC Diploma courses and others**
When Offered:	**Semester 2**
Method of Teaching:	**28 hours of lectures**
Method of Assessment:	**15% by course work and 85% by examination**
Pre-requisite:	**O-level Biology or equivalent**
Lecturer:	**Mr. Alan Deidun**

This unit introduces the basic concepts underlying the biology of prokaryotic and animal cells; the main tools used to study cell biology, the structure and function of the various organelles and structures found inside the cell, communication between cells and the rest of the body, and cell division. Although the topics covered pertain overall to animal biology, there is major reference to human biology.

Aspects of microscopy:	Light microscope Transmission electron Microscope Scanning electron Microscope Preparation of material for microscopy
Cell theory; classification of cells:	Prokaryotes: structure & forms, characteristic features Viruses: structure, life cycle & classification Eukaryotes: origins, endosymbiotic theory Cellular organisation Cell membrane Cytoplasm Eukaryotic organelles Endomembrane system Cilia & Flagella Cell walls & cytoskeleton
Cell processes:	Diffusion, osmosis & facilitated diffusion Active transport Bulk transport
Cell Division:	Chromosomes Cell cycle Mitosis & meiosis Organisation of cells into tissues and organs: Epithelial tissue Connective tissue Muscular tissue Nervous tissue

Course texts

Biological Science by Green, Stout & Taylor
Life - The Science of Biology by Purves, Orians & Heller
Cell Biology by Scheeler & Bianchi
Basic Histology by Janqueira, Carneiro & Long
Molecular Biology of the Cell by Alberts *et al.*
Molecular Cell Biology by Avers
Molecular Cell Biology by Darnell *et al.*

Students are to note that they will be allowed to sit for the respective study-unit examination and will be awarded a grade only if they have regularly attended lectures; if they have submitted any assignments and if they satisfy all other study-unit requirements.

Code:	**BIO0080**
Title:	**Introductory Biochemistry**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**IHC Diploma courses and others**
When Offered:	**Semester 2**
Method of Teaching:	**28 hours of lectures**
Method of Assessment:	**15% by course work and 85% by examination**
Pre-requisite:	**O-level Biology or equivalent**
Lecturer:	**Mr. Alan Deidun**

This unit introduces the basic concepts underlying the structure and function of the main biochemical groups found in animals, and the processes underlying the major biochemical pathways of respiration. Although the topics covered pertain overall to animal biology, there is major reference to human biology.

Main reactions involving biochemicals.

Carbohydrates, lipids, proteins and nucleic acids.

Enzymes:

Properties, use and importance;
Factors affecting enzyme activity;
Hypotheses of enzyme-substrate reactions;
Enzyme co-factors;
Enzyme inhibition

Vitamins, minerals and coenzyme.

Respiration:

Definition of autotrophic and heterotrophic nutrition;
Definition of anabolism & catabolism;
Cell respiration.

Basic Biochemical Pathways:

Glycolysis and the pentose phosphate pathway;
Citric acid cycle;
Oxidative phosphorylation;
Glycogen metabolism and gluconeogenesis;
Fatty acid metabolism;
Amino acid degradation and the urea cycle;
Integration of different metabolic pathways;
Regulation.

Course texts

Biological Science by Green *et al*
Biochemistry by Matthews & van Holde
Biochemistry by Stryer L.

Students are to note that they will be allowed to sit for the respective study-unit examination and will be awarded a grade only if they have regularly attended lectures; if they have submitted any assignments and if they satisfy all other study-unit requirements.

Code:	**BIO1010**
Title:	**Cellular and Biochemical Basis of Life**
Credit Value	**5 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 1**
Method of Teaching:	**28 hours of lectures; 5 practical sessions of 3 hours each**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test.** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**A-level Biology or equivalent**
Lecturer:	**Dr. Joseph Buhagiar**

1. **Microscopy and other experimental methods in cell biology**: including light and electron and other forms of microscopy, use of isotopes as tracers, centrifugation and cell fractionation, X-ray diffraction and other methods in investigating macromolecular structures, introduction to cell culture techniques.
2. **Basic biochemicals**: including the unique properties of water and carbon compounds relevant to life processes; structure and biological role of carbohydrates, lipids, proteins and nucleic acids.
3. **The cellular basis of life**: classical cell theory, viruses, the prokaryotic and the eukaryotic cell. Cell-division and cell-cycle.
4. **Biological membranes**: models, biogenesis, their role in controlling transport across the cell, interaction with hormones and other chemical or physical factors, membrane proteins associated with ATP production in mitochondria and chloroplasts, cell to cell communication.
5. **The nucleus**: major components as seen under the EM, chromosomal structure, DNA replication, transcription and translation, the cell cycle.
6. **Other cell organelles**: structure and function.
7. Cell contraction and motility.
8. Cell senescence, cell death including apoptosis and necrosis and cell malignancy.
9. A **programme of practical work** (approximately 15 hours) covering the theoretical topics discussed above. The aim is to give the students experience in the relevant experimental techniques in cell biology with particular reference to microscopy and histological techniques as well as to help them acquire the necessary skills including: observational skills, the planning and performing of experiments, the use of statistical techniques for collecting, evaluating and presenting biological data, the interpretation of such data, and reporting skills. Students will be required to write regular practical reports.

READING LIST

Bruce ALBERTS, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter.2002. *Molecular biology of the cell*. 4th Edition. Garland Science Publishing, Inc. New York and London.
Geoffrey M. COOPER and Robert E. Hausman. 2002. *The Cell: A Molecular Approach*, Third Edition
Jeremy M. Berg; John L. Tymoczko; Lubert STRYER. Biochemistry. 5th Edition.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO1020**
Title:	**Diversity of Life: Animals**
Credit Value	**5 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 1**
Method of Teaching:	**21 hours of lectures; 6 practical sessions of 3 hours each**
Method of Assessment:	**10% course work, which may include various forms of written assignments and/or interviews;** **75% by test.** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**A-level Biology or equivalent**
Lecturer:	**Professor PJ Schembri**

A survey of the main types of animal life on Earth stressing evolutionary relationships, functional design, and adaptations to the environment. Emphasis will be made on those groups represented in the Maltese Islands. The course consists of two parts: Part 1 introduces evolutionary concepts and the principles underlying modern zoological classification; Part 2 surveys the diversity of animal organisms (kingdom: Animalia).

Part 1: Introduction to the diversity of life

* The numbers of organisms
* Evolution as the driving force behind diversity
* The concept of species
* Modern zoological classification

Part 2: The diversity of animal organisms

* **Zoological diversity**:	general principles; major divisions of the kingdom *ANIMALIA*
* **Parazoa** ***phylum PORIFERA***:	characteristics
* **Radiata** ***phylum CNIDARIA***:	characteristics; mode of life
* **Bilateria Acoelomata** ***phylum PLATYHELMINTHES***:	characteristics of the free-living flatworms (Turbellaria) and parasitic flatworms (Trematoda and Cestoda)
* **Bilateria Pseudocoelomata**: ***phylum NEMATODA***: ***phylum ROTIFERA***:	introduction to the pseudocoelomate phyla characteristics characteristics
* **Bilateria Coelomata Prostomia** ***phylum ANNELIDA***:	characteristics; mode of life of polychaetes, oligochaetes and hirudinians
phylum MOLLUSCA:	characteristics; modifications of the basic molluscan structure in Polyplacophora, Gastropoda, Bivalvia, and Cephalopoda
superphylum ARTHROPODA:	the arthropod grade of organization; the main arthropod groups; arthropod phylogeny; general characteristics of arthropods

phylum BRYOZOA:	introduction to the lophophorate phyla and characteristics of the Bryozoa
* **Bilateria Coelomata, Deuterostomia**:	introduction to the deuterostome phyla
phylum ECHINODERMATA:	characteristics; mode of life of crinoids, asteroids, ophiuroids, echinoids and holothurians
phylum HEMICHORDATA:	characteristics
phylum CHORDATA:	characteristics; the main chordate groups

READING LIST

Basic Course Texts

HICKMAN, CP; ROBERTS, LS & LARSON, A (2003) *Animal diversity*. [3rd ed.] McGraw Hill [A new edition HICKMAN, CP; ROBERTS, LS; KEEN, SL; LARSON, A & EISENHOUR, DJ (2007) *Animal diversity*. [4th ed.] McGraw Hill is planned for 2007]

BARNES, RSK; CALOW, P; OLIVE, PJW; GOLDING, DW & SPICER, J. (2001) *The invertebrates: a new synthesis*. [3rd ed.] Blackwell Scientific Publ [An excellent synthetic treatment of the invertebrates, however, if you use this book you will need an additional source to cover the vertebrates]

Supplementary Reading

BUCHSBAUM, R; BUCHSBAUM, M; PEARSE J & PEARSE, P (1987) *Animals without backbones*. [3rd ed] University of Chicago Press [A rather basic introduction but useful if your pre-university course was not strong on invertebrate systematics]

CROWSON, RA (1970) *Classification and biology*. Heinemann Educational

HICKMAN, CP; ROBERTS, LS & LARSON, A (2006) *Integrated principles of zoology*. [13th ed] McGraw Hill

MARGULIS, L; SCHWARTZ, KV & DOLAN, M (1999) *Diversity of life: the illustrated guide to the five kingdoms*. [3rd ed] Freeman

ROSE, MR & MUELLER, LD (2006) *Evolution and ecology of the organism.* Pearson Prentice Hall. [This text integrates evolution with ecology and is a very useful text for Part 1 of the present study unit as well as for other units in the course on ecology and evolution]

For Practicals

Wallace, R. & Taylor, W (2002) *Invertebrate zoology lab manual*. [6th ed] Pearson Educational

Important note:

The study-unit includes ***an integrated programme of practical work*** *(approximately 18 hours) covering the topics discussed in lectures. The aim is to provide students with an opportunity to become familiar with a range of different animal life forms as well as to help them acquire the necessary observational and reporting skills. Students will be required to write regular practical reports, which will be graded.*

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore, students are informed that regular attendance for lectures is obligatory. A grade may be awarded to a particular study-unit only if a student's attendance for lectures and practical sessions has been regular.

Code:	**BIO1030**
Title:	**Diversity of Life : Non-Animals**
Credit Value	**5 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**21 hours of lectures; 6 practical sessions of 3 hours each**
Method of Assessment:	**10% course work, which may include various forms of written assignments and/or interview;** **15% by practical reports (Compulsory and non-compensatable)** **75% by test.**
Pre-requisite:	**A-level Biology or equivalent**
Lecturer:	**Mr. Edwin Lanfranco**

This study-unit is meant to give students an idea of the diversity of non-animal biota highlighting the criteria used for determining taxonomic groupings. It will cover systematics in relation to non-animal organisms as well as nomenclature conventions.

This study-unit is meant to give students an idea of the diversity of non-animal biota highlighting the criteria used for determining taxonomic groupings. It will cover systematics in relation to non-animal organisms as well as nomenclature conventions.

* **Principles of nomenclature and classification**.

* **Prokaryotes:**
Brief survey of the main prokaryote groups: Archaea and Eubacteria (including Cyanobacteria)

* **Eukaryotes:**
Evolution of the eukaryote cell including primary and secondary endosymbiosis. Types of flagella, mitochondrial cristae and chloroplasts. Plant life cycles, a general review.

* **Traditional groupings:**
Algae, fungi, lichens, bryophytes, pteridophytes, spermatophytes; their significance.

* **'Animal' protoctists:** A review of the main protozoan groups: Basal flagellate groups including excavates, discicristates, amoeboid groups, slime moulds, choanozoans.

* **Chromoalveolata**:

Alveolatea,
Heterokontophyta
- Chrysophyceae;
- Tribophyceae;
- Oömycetes;
- Bacillariophyceae;
- Fucophyceae;

Haptophyta
Cryptophyta
brief reference to other groups of chromist microalgae

* **True Fungi:** Chytridiomycota;
Zygomycota;
Ascomycota (including lichens);
Basidiomycota

* **Rhodophyta:** including also brief treatment of Glaucocystophyta.

* **Green Plants:**
Chlorophyta: characteristics and classification of the green algae.

Charophyta: in particular their role as embryophyte ancestors.
Bryophytes: adaptations to life on land; Bryophyta; Marchantiophyta; Anthocerotophyta.
Vascular Plants: review of pteridophyte groups (including reference to fossil record).
Seed plants: The seed and the basic life cycle.
Review of Gymnosperm groups including reference to fossil record.
Angiosperms: evolution of flower and enclosed ovules from gymnospermous structures; dicots and monocots.

READING LIST

Basic Course Texts

BARNES, R.S.K. (1998) – *The Diversity of Living Organisms*. Blackwell Science
SCAGEL RF; BANDON, RJ; MAZE, JR; ROUSE, GE; SCHOFIELD, WB & STEIN, JR (1989) - *Plants - An evolutionary survey*. Wadsworth

Supplementary Reading

BAKER, A *Parasitic Protozoa*. Hutchinson
CHAPMAN, VJ *The Algae*. Macmillan
GRELL, KG *Protozoology*. Springer
INGOLD, CT *The Biology of Fungi*. Ingold
JAHN, TL & JAHN, FF *How to Know the Protozoa*. WC Brown
SPORNE, KR *The Morphology of Pteridophytes*. Hutchinson
SPORNE, KR *The Morphology of Gymnosperms*. Hutchinson
SPORNE, KR *The Morphology of Angiosperms*. Hutchinson
SZE, P *A Biology of the Algae* [2nd ed] WC Brown
WATSON, EV *The Structure and Life of Bryophytes*. Hutchinson

Latest editions of standard textbooks such as LAWSON's *Botany*; STRASBURGER's *Textbook of Botany* and WEIER, TE; STOCKING, CR; BARBOUR, MG and ROST, TL's *Botany* are also useful.

Reference

PARKER, SP [ed] (1982) *Synopsis and classification of living organisms*. [2 vols] McGraw-Hill Book Co.

It should be borne in mind that systems of plant and animal systematics are by no means fixed and the system followed in the lectures need not follow any of those in the suggested texts.

Important note:

The study-unit includes ***an integrated programme of practical work*** *(approximately 18 hours) covering the topics discussed in lectures. The aim is to provide students with an opportunity to become familiar with a range of different animal life forms as well as to help them acquire the necessary observational and reporting skills. Students will be required to write regular practical reports, which will be graded*

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore ,students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO1040**
Title:	**Basic Life Functions**
Credit Value	**5 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**28 hours of lectures; 6 practical sessions of 3 hours each**
Method of Assessment:	**10% course work, which may include various forms of written assignments and/or interview;** **75% by test.** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**A-level Biology or equivalent**
Lecturer:	**Mr. David Dandria**

The objective of this study unit is to help students acquire a sound information on various aspects of comparative physiology. In dealing with such a broad subject, students will also be trained to co-ordinate knowledge relevant to the different physiological topics *vis-a-vis* particular species.

1.0 **Plant Physiology**: Plant functions are illustrated by reference to the basic needs of water and nutrient uptake

1.1 **Water relations**:
- Cells and water
- Water uptake and transport
- Stomatal action
- Adaptations of plants to different water regimes

1.2 **Ion uptake**:
- Passive and active

2.0 **Environmental relationships of animals**

2.1 **Basic relationships with the environment**:
- tolerance and resistance
- acclimation and acclimatization
- conformity and regulation

2.2 **Temperature relationships**:
- temperature and rate of biological activities
- temperature classification of animals
- poikilotherms and homeotherms
- ectotherms, endotherms and heterotherms
- temperature compensation in 'poikilotherms'
- temperature compensation in 'homeotherms'
- extreme temperature regimes

2.3 **Ionic and osmotic balance**:
- environmental considerations: needs and problems in maintaining water and electrolyte balance
- osmotic classification of animals
- regulation in hypoosmotic aquatic environments
- regulation in hyperosmotic aquatic environments
- regulation in terrestrial environments: adaptations for maintaining water and electrolyte balance on land

3.0 **Excretion of nitrogenous wastes**

3.1 Endproducts of nitrogenous metabolism

3.2 Organs of osmoregulation and excretion:
- cell membranes and contractile vacuoles;
- excretory tubules; nephridia; malpighian tubules;
- the vertebrate nephron

4.0 **Respiratory gaseous exchange**

4.1 A review of gas transfer systems in invertebrates and vertebrates
4.2 Regulation of gas transfer and ventilatory movements
4.3 Respiratory pigments, and transport of CO_2 and O_2 by the blood

5.0 **Feeding, digestion and assimilation**
5.1 Ingestion strategies in animals
5.2 Nutritional requirements
5.3 Gastrointestinal secretions and their control
5.4 Assimilation and absorption efficiencies
5.5 Bioenergetics and feeding

6. The study-unit includes a **programme of practical work** (approximately 18 hours) covering the theoretical topics discussed above. The aim is to give the students experience in a wide variety of experimental techniques in physiology as well as to help them acquire the necessary skills including: observational skills, the planning and performing of experiments, the use of statistical techniques for collecting, evaluating and presenting biological data, the interpretation of such data, and reporting skills. Students will be required to write regular practical reports.

READING LIST

Course Texts

Randall D.,Burgren W. & French K. (2001) *Eckert Animal Physiology*. W.H. Freeman.
SALISBURY, F.B. & ROSS, C.W. (1991) *Plant physiology*. Wadsworth

Supplementary Reading

HOAR, WS (1983) *General and comparative physiology*. Prentice-Hall
SCMIDT-NIELSEN, K (1997) *Animal physiology: adaptation and environment*. Cambridge University Press
Willmer. (2000) *Environmental Physiology of Animals* Blackwell Science (UK).

Reference

BLIGH, J; CLOUDSLEY-THOMPSON, JL & MACDONALD, AG (1976) *Environmental physiology of animals*. Blackwell Scientific
LITTLE, C (1983) *The colonisation of land: origins and adaptations of terrestrial animals*. Cambridge University Press
SUTCLIFFE, J *Plants and water*. Arnold

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore ,students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO1050**
Title:	**Molecules and Life**
Credit Value	**2 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**Various**
When Offered:	**Semester 1**
Method of Teaching:	**14 hours of lectures**
Method of Assessment:	**15% by course work; 85% by test**
Pre-requisite:	**none**
General Restrictions:	**Not for Biology Students following the B.Sc (Hons) or the B.Ed. (Hons.) degree courses or students following the B. Pharm course.**
Lecturer:	**Mr. David Dandria**

1. **Introduction**: The nature and characteristics of life. The role and importance of water. The unique role and properties of carbon.

2. **Basic Biomolecules**: proteins, carbohydrates, lipids, nucleic acids: molecular structure related to biological function.

3. **Genetic Material**: nature and prerequisites of the genetic code; DNA replication; control of protein synthesis.

4. **Bioenergetics**: nature and flow of energy through living systems, chemical reactions and energetics, role of enzymes, energy rich compounds, ATP formation, photosynthesis and respiration.

5. **Cell organisation**: The use of microscopes. Structure of cell organelles as related to function.

Students are to note that no grade may be awarded for this study-unit, unless they fulfill all course work requirements.

READING LIST

PURVES *W.K.*(2001) *Life - The science of biology*. Sinauer & Freeman.

Important note:

Students are to note that they will be allowed to sit for the respective study-unit examination and be awarded a grade only if they have regularly attended lectures, have submitted all assignments and have satisfied all study-unit requirements.

Code:	**BIO1060**
Title:	**Introductory Environmental Science**
Credit Value	**2 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**Various, except B.Sc. (Hons.) biology students and B.Ed (Hons.) students taking biology as a main or subsidiary subject**
When Offered:	**Semester 2**
Method of Teaching:	**14 hours of lectures and three hours of practicals/fieldwork**
Assessment:	**15% by course work (which may include a site-visit report); 85% by test**
General Restrictions:	**Not for students taking Biology as a main subject area as part of the B.Sc (Hons) or of the B.Ed. (Hons) degree courses.**
Lecturers:	**Prof. P J Schembri and Mr S Lanfranco (Department of Environmental Science, Junior College)**

This unit introduces environmental science and is aimed especially at non-scientists although it will also be of interest to science students who are not taking chemistry and biology as their principal subject areas. It provides an overview of the biosphere and its components, outlines the ecological principles necessary for an understanding of populations and biotic communities, and discusses the impact of human society on natural ecosystems and resources. This unit is designed for non-biology students and as such assumes little knowledge of biology.

Students are to note that no grade will be awarded for this study-unit, unless they fulfil all course work requirements

1. **What is the 'environment'?**
   Concepts basic to a study of the environment

2. **The Earth**
   a) Age of the Earth
   b) Structure and composition
   c) Crustal structure and dynamics

3. **Life support systems of the planet**
   a) The atmosphere
   b) The hydrosphere
   c) Soil (pedosphere)
   d) The biosphere

4. **Populations, communities and ecosystems**
   a) Biodiversity
   b) Populations: growth and regulation
   c) Communities: community composition; ecological niches; ecological succession
   d) Ecosystems

5. **Water**
   a) States of water
   b) The water cycle
   c) Aquatic systems; marine, freshwater, groundwater
   d) Pollution of aquatic systems

6. **The atmosphere and climate change**
   a) Composition and maintenance of the atmosphere
   b) Atmospheric circulation and climate
   c) Principal pollutants and their sources
   d) Acid precipitation
   e) Greenhouse effect
   f) Depletion of the ozone shield

7. **Resources and their conservation**
   a) Conservation biology
   b) Case studies

COURSE TEXTS

Any one of a number of textbooks on environmental science, of which the ones below are recommended. The text by McKinney and Schoch is especially useful for those who have access to the Internet since it offers a great deal of supplementary material via a specially developed environmental science web site.

CUNNINGHAM, W.P.; CUNNINGHAM, M.A. & SAIGO, B.W. (2005). *Environmental Science: A Global Concern.* (9th ed.). McGraw Hill. [with online learning centre web site]

McKINNEY, ML & SCHOCH, RM (2003) *Environmental science: systems and solutions*. [Web enhanced edition] (3rd ed.) Jones + Bartlett.

MILLER, GT (2005) *Living in the environment: principles, connections and solutions*. [15th ed] Thomson Brooks/Cole [with 4-month subscription to Thomson Learning's 'Infotrac' online library]

SUPPLEMENTARY TEXTS

COTGREAVE, P. & FORSETH, I (2002) *Introductory ecology*. Blackwell Science. [Excellent introductory text that touches on all aspects of ecology]

Recommended readings

A list of readings on specific topics will be given during the course.

Important Note:
This study-unit is partly based on on-site experience. Therefore, site-visits, which may be part of the course, are considered as essential for the understanding of the basic principles discussed during the formal lectures. Students will be required to prepare reports after each site-visit. As such, attendance to these site-visits, as well as satisfactory site-visit reports are considered as obligatory. A grade will be issued for this study-unit only if these conditions are satisfied.

Furthermore, students are to note that they will be allowed to sit for the respective study-unit examination and be awarded a grade only if they have regularly attended lectures, have submitted all assignments and have satisfied all study-unit requirements.

Code:	**BIO1061**
Title:	**An Introduction to the Natural Environment of Malta and the Mediterranean**
Credit Value	**2 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**Various, except B.Sc. (Hons.) biology students and B.Ed (Hons.) students taking biology as a main or subsidiary subject**
When Offered:	**Semester 2**
Method of Teaching:	**14 hours of lectures; field visits and/or laboratory sessions**
Assessment:	**15% by course work (including site-visit report); 85% by test**
Pre-requisite:	**BIO1060 is strongly recommended**
General Restrictions:	**Not for students taking Biology and Chemistry as part of the B.Sc (Hons) or the B.Ed. (Hons) degree courses.**
Lecturers:	**Prof. P J Schembri and Mr S Lanfranco (Department of Environmental Science, Junior College)**

This study-unit, which has been primarily designed for non-biology students, applies the basic concepts reviewed in BIO 1060 (Introductory Environmental Science) to the Mediterranean in general and to the Maltese Islands in particular; it surveys the distinctive characteristics of the Mediterranean basin and identifies the main features which make this a unique region. Topics discussed include:

- Geological features and evolution of the Mediterranean and of the Maltese Islands
- The Mediterranean Climate
- Earth surface processes including: land degradation, mass movements, processes on hillslopes and coastlines
- Mediterranean freshwater resources
- Mediterranean soils and vegetation
- Habitats and biodiversity, with special reference to habitats of special interest to Malta
- The Mediterranean marine environment

READING LIST

There is no set text but a list of readings will be given during the course. The following provide a useful background:

ALLEN, HD (2001) *Mediterranean ecogeography*. Prentice Hall.

BLONDEL, J & ARONSON, J (1999) *Biology and wildlife of the Mediterranean region*. Oxford University Press.

LANFRANCO, E & LANFRANCO, G (2003) *Il-Flora Maltija*. [Kullana Kulturali] PIN, Malta.

LANFRANCO, S (2002): *L-ambjent naturali tal-Gżejjer Maltin*. [Kullana Kulturali] PIN, Malta.

MOJETTA, A (1996) *Mediterranean Sea: guide to the underwater life*. Swan Hill Press.

PEDLEY, M; HUGHES CLARKE, M & GALEA, P (2002) *Limestone isles in a crystal sea. The geology of the Maltese Islands*. PEG, Malta.

SCHEMBRI, PJ (1994) Natural heritage. In: Frendo, H. & Friggieri, O. [eds] *Malta culture and identity*. pp. 105-124; Valletta, Malta: Ministry of Youth and the Arts.

SCHEMBRI, PJ & BALDACCHINO, AE (1998) *Ilma, blat u ħajja: is-sisien ta' l-ambjent naturali Malti*. [It- tieni edizioni riveduta]. Malta University Publishers Ltd, Malta.

The ‘State of the Environment’ reports for Malta will also provide much useful information; three have been published so far: 1998, 2002 and 2005, all of which are available from the Malta Environment and Planning Authority (MEPA website at http://www.mepa.org.mt/

Important Note:
This study-unit is partly based on on-site experience. Therefore, site-visits, which may be part of the course, are considered as essential for the understanding of the basic principles discussed during the formal lectures. Students will be required to prepare reports after each site-visit. As such, attendance to these site-visits, as well as satisfactory site-visit reports are considered as obligatory. A grade will be issued for this study-unit only if these conditions are satisfied.

Furthermore, students are to note that they will be allowed to sit for the respective study-unit examination and be awarded a grade only if they have regularly attended lectures, have submitted all assignments and have satisfied all study-unit requirements.
.

Code:	**BIO2020**
Title:	**Plant Biology**
Credit Value	**7 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**28 hours of lectures; 8 practical sessions of 6 hours each.**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test;** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year Study-Units or equivalent**
Lecturer:	**Mr. Edwin Lanfranco and Dr Joe A Buhagiar**

Aspects of plant physiology, adaptation and function will be illustrated by reference to the translocation of photosynthates, and nutritional interrelationships involving autotrophs. A treatment of structural and functional plant anatomy based on both histology and gross morphology. Development and reproduction in angiosperms. Adaptations to water availability. Brief treatment of Mediterranean plant communities.

Translocation of photosynthates:

* The phloem. Models of phloem structure in relation to function. Nature of photosynthates. Theories of translocation mechanisms and their evaluation.

Aspects of the chemical ecology of plants

- Utilization of secondary metabolites by plants to control their environment, potential competitors, browsers, and pathogens.

Nutritional interrelationships involving autotrophs:

* Mutualism: Mycorrhizal associations; Nitrogen fixation symbiosis; Lichen associations and animal/autotroph associations.
* Parasitic plants (excluding fungi) with special reference to parasitic tracheophytes.
* Commensalism: autotrophic epiphytes and epizoonts.

The Cell Wall: Composition and adaptations

Plant Anatomy: General structure of a tracheophyte. Histology to include treatment of the various plant tissue types with special emphasis on the functional aspect.

Development and Reproduction: An account of micro- and megaspore formation in Angiosperms including reference to Gymnosperms. Development of male and female gametophytes. The role of phytohormones in development and reproduction. Meristems.

Adaptation to different water availability regimes:

- xerophytes
- halophytes
- hydrophytes
- helophytes

Floral structure: The structure of the flower as exemplified by some important plant families: e.g. Brassicaceae, Fabaceae, Asteraceae, Liliaceae (s.l.), Poaceae.

Mediterranean plant communities:

* Mediterranan climate
- Sclerophyll vegetation

- Rupestral, wetland and coastal habitats.

The study-unit includes **an integrated programme of practical work** (approximately 48 hours) covering the topics discussed in lectures. Students will be required to write regular practical reports.

READING LIST

MOORE, R; CLARK, WD & VODOPICH, DS (1998) Botany [2nd ed] WCB, McGraw-Hill.
RAVEN, PM; EVERT, RF & CURTIS, H *Biology of plants*. Worth
SALISBURY, FB & ROSS, CW *Plant physiology*. Wadsworth
ESAU, K (1977) *Anatomy of Seed Plants*. Wiley
MAUSETH, JD (1988) *Plant Anatomy*. Benjamin/Cummings.
RAVEN, PM; EVERT, RF & CURTIS, H *Biology of Plants*. Worth.
SALISBURY, FB & ROSS, CW *Plant Physiology*. Woodsworth.

Supplementary reading

BLONDEL & ARONSON, J.C. (1999) *Biology and Wildlife of the Mediterranean Region.* Oxford University Press.
FOSKET, D (1994) *Plant Growth and Development: a molecular approach.* Academic Press, New York.
LANFRANCO, S. (2002) – l-ambjent naturali tal-Gzejjer Maltin. PIN.
LYNDON, R. F (1990) *Plant Development: the cellular basis*. Unwin Hyman, London.
POLUNIN, O 7 WALTERS, M (1985) – *A guide to the vegetation of Britain and Europe.* Oxford University Press.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%. Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO2030**
Title:	**Animal Form and Function I**
Credit Value	**6 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**28 hours of lectures; 6 practical sessions of 6 hours each.**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test;** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year Study-Units or equivalent**
Lecturer:	**Professor V Axiak**

This course reviews how adaptations in animal morphology and physiology have been adopted and evolved by invertebrates and vertebrates in their interactions with their environment. The aim is to identify the basic and comparative aspects of such morphological and functional strategies from a mechanistic approach. The evolutionary significance of the relationship between the form and function of animals and the environment will be emphasized throughout the course.

The course is divided into two study-units: BIO2030 and BIO3050.

Unit BIO2030 will cover the following specific topics:

1 **Animal size** and **general body plans** in relation to different modes of life. The constraints imposed by scaling in relation to the morphology and physiology of animals.

2 **Biomechanics**: physical basis for understanding life designs.

3 **Neurophysiology:** membrane excitation: ionic basis; propagation of excitation phenomena; variety of excitable cells. Properties of glial cells.

4 A **comparative review of nervous systems and nervous integration** in invertebrates and vertebrates**:** including sensory filter networks; neuromotor networks; neural organisation of vertebrate brains. The role of glial cells in nervous integration.

5 **Receptor physiology**: general characteristics; chemoreception, mechanoreception, thermoreception, photoreception, electroreception in a variety of animals; special adaptations.

6 **Chemical coordination:** glands abd secretions. Endocrine systems

7 **Motility at the cellular level**: contractile systems in muscle cells; amoeboid, ciliary and flagellal movement.

8 **Muscles and locomotion**: mechanical and electrical properties of muscles; aquatic, terrestrial and aerial locomotion.

9 **Swimming**: adaptations of form and functions.

10 **Flight**: adaptations

11 **Other effector organs:** Electrical Discharge, Bioluminescence and Colour Changes.

The course includes an integrated programme of practical work covering topics discussed during the study-unit and other relevant topics.

READING LIST

KARDONG, K. V. (2001). Vertebrates: Comparative Anatomy, Function, Evolution.
RANDALL,D. BURGGREN, W., FRENCH, K. Eckert Animal Physiology: Mechanisms and Adaptations, Fifth Edition. Freeman. New York.
SCHMIDT-NIELSEN, K (1997) *Animal physiology. Adaptation and environment.* [5th ed] Cambridge University Press.
HILL,R.W., WYSE, G. (1997) Animal Physiology. 2nd Edition. Harper Collins. Publishers.
WILLMER, P., STONE, G. JOHNSTON, I. (2000) Environmental Physiology of Animals (1st Edition). Blackwell Science.

VOGEL, S. (2003). Comparative Biomechanics: Life's Physical World

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%. Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO2040**
Title:	**Ecology and Ethology**
Credit Value	**8 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) students and others**
When Offered:	**Semester 1**
Method of Teaching:	**38 hours of lectures; 3 practical sessions of 6 hours each and 1 day fieldwork for Parts 1 and 2** **4 hours of lectures for Part 3**
Assessment:	**10% course work, which may include various types of written assignments and/or interviews;** **15% by practical reports (Compulsory and non-compensatable)** **75% by test.**
Pre-requisites:	**B.Sc. (Hons.) 1st Year Study-Units or equivalent**
Lecturers:	**PROF. P.J. SCHEMBRI (Parts 1 and 2)** **DR A. VELLA (Part 3)**

Part 1. Ecology (PROF. P.J. SCHEMBRI)

An introduction to the principles, concepts and controversies involved in the study of plant and animal populations and their interactions with the biotic and abiotic environments. Special reference will be made to the ecology of the Mediterranean area and that of the Maltese Islands.

1. **Introduction**
- The nature of ecology
- Ecology as the driving force behind evolution by natural selection

2. **Environmental factors**
- Limiting factors, limits of tolerance, ecological valency and ecotypes
- Introduction to the niche concept

3. **Population ecology**
- Populations and population attributes:
  dispersion patterns; population density and its estimation;
  natality and mortality; survivorship curves;
  age distribution; sex ratio;
  rate of natural increase: exponential and logistic growth; the logistic hypothesis and other population models;
- Population fluctuations and regulation of population size:
  density-dependent and density-independent factors;
  May's model
- Population cycles: extrinsic and intrinsic control
- Life-history strategies: opportunist and equilibrium species;
- Intraspecific interactions and their population consequences:
  group effects, overcrowding effects, intraspecific competition

4. **Interspecific interactions**
- Types of interspecific interactions and their effect on population size
- Competition: competitive exclusion; ecological isolating mechanisms and niche separation; guilds; niche theory and competition as niche overlap
- Predation: types and characteristics of predators; predator-prey interactions; predator responses to prey; prey defence against predators
- Parasitism: types and characteristics of parasites; parasite-host interactions
- Amensalism and allelopathy
- Commensalism, protocooperation and mutualism
- Co-evolution

5. **Biotic communities**
- Development of the community concept in ecology

- Classification of communities; biomes
- Species richness and relative abundance: diversity and its measurement; the different kinds of diversity; causes and patterns of diversity and theories accounting for them
- Ecological dominance; community structure; periodicity
- The nature of communities
- Community change:
  cyclic change
  successional change: characteristics and mechanisms of succession, examples of ecological successions

6. **Ecosystems ecology**
- Concept of ecosystem
- Solar radiation as the driving force of ecosystems; ecosystems not based on solar radiation
- Production and productivity:
  primary production in the biosphere;
  secondary production; energy budgets
- Food chains, food webs, and trophic structure
- Energy flow in ecosystems and efficiency of energy transfer
- Ecological pyramids
- Biogeochemical cycles:

READING LIST FOR PART 1 (ECOLOGY)

Basic Course Texts
(any one of the following)

BREWER, R (1994) *The science of ecology* [2nd ed] Saunders.

RICKLEFS, RE (2001) *The economy of nature*. [5th ed] W.H. Freeman.

Additional Texts and Supplementary Reading

BEGON, M, TOWNSEND, CR & HARPER, JL (2005) *Ecology: from individuals to ecosystems*. [4th ed] Blackwell. [There is a CD-ROM to accompany this text] This is an advanced text that will be useful to those who intend to continue their studies in ecology. Other students may find the following simplified version more accessible TOWNSEND, CR, BEGON, M & HARPER, JL (2002) *Essentials of ecology*. [2nd ed] Blackwell Science.

COLINVAUX, P (1993) Ecology 2. [2nd ed] J. Wiley [Very good text but unfortunately out of print]

COTGREAVE, P. & FORSETH, I (2002) *Introductory ecology*. Blackwell Science. [Excellent introductory text that touches on all aspects of ecology]

KREBS, CJ (2001) *Ecology: the experimental analysis of distribution and abundance*. [5th ed] Harper Benjamin Cummings [Essential reference; somewhat mathematical; there is a CD-ROM to accompany this text]

PIANKA, ER (1999) *Evolutionary ecology*. [6th ed] Benjamin-Cummings [An excellent text, useful also for units in animal behaviour and evolutionary biology]

SCHEMBRI, PJ & BALDACCHINO, AE (1998) *Ilma, blat u hajja: is-sisien ta' l-ambjent naturali Malti*. [It-tieni edizzjoni riveduta] Malta University Services Limited. [In Maltese: provides the local dimension].

Field and Laboratory methods

Recommended text:

BROWER, J; ZAR, J & VON ENDE, C (1998) *Field and laboratory methods for general ecology*. [4th ed] Wm C Brown.

Additional texts:

WAITE, S. (2000) *Statistical ecology in practice*. Prentice Hall [recommended for those intending to do an ecology-based research project]

ROSE, MR & MUELLER, LD (2006) *Evolution and ecology of the organism.* Pearson Prentice Hall. [This text integrates evolution with ecology and is a very useful background text not only for the 'ecology' component of this unit, but also for 'animal behaviour' component as well as for the unit on 'evolution']

Part 2. Ethology (PROF. P.J. SCHEMBRI)
A study of the biology of animal behaviour in an evolutionary context. Behavioural adaptations are discussed with particular reference to their ecological significance.

1. **Introduction**
- What is behaviour?
- Historical outline of the study of animal behaviour
- Ethology

2. **Behavioural ecology: the animal in the abiotic environment**

2.1 Orientation:
- Kineses and taxes
- Navigation: piloting, orienting, goal-directed orientation; mechanisms

2.2 Behaviour in changing environments:
- Characteristics
- Circadian rhythms
- Lunar and tidal rhythms
- Annual rhythms and seasonal timing
- Biological clocks: temperature compensation, entrainment, exogenous and endogenous control
- Nature of the pacemaker

3. **Behavioural ecology: the animal in the biotic environment**

3.1 Evolutionary aspects: evolutionary stable strategies

3.2 Territorial behaviour, agonistic behaviour and mating strategies:
- Function and characteristics of territorial behaviour
- Satellite males, sneaky mating and other mating strategies
- Function and characteristics of agonistic behaviour
- Evolutionary aspects of aggressive behaviour and application of games theory to agonistic behaviour

4. **Social behaviour**
- Aggregations and societies: consequences of group life
- Social interactions
- Evolutionary aspects of social behaviour:
  Altruism and kin selection
  Types of altruistic behaviour: defence against predators, cooperative breeding, food sharing
  Kin recognition
  Reciprocal altruism

READING LIST FOR PART 2 (ETHOLOGY)

Basic Course Texts
(any one of the following)

McFARLAND D (1999) *Animal behaviour: psychobiology, ethology and evolution* [3rd ed] Longman.

DRICKAMER LC, VESSEY SH & JAKOB EM (2002) *Animal behaviour: mechanisms, ecology, evolution* [5th ed] McGraw Hill.

BARNARD C (2004) *Animal behaviour: mechanism, development, function, evolution*. Prentice Hall.

Supplementary Reading

SHERMAN, PW & ALCOCK, J (2001) *Exploring animal behaviour.* [Readings from *Scientific American*] [3nd ed] W.H. Freeman.

MANNING, A & DAWKINS, MS (1998) *An introduction to animal behaviour*. [5th ed] Cambridge University Press.

Reference

McFARLAND, D [ed] (1987) *The Oxford companion to animal behaviour*. Oxford University Press.

Part 3. Applied ecology and ethology – an Introduction to Conservation Biology (Dr A. Vella)

This part of the course will introduce students to the various areas constituting this fast developing scientific field. Tools that are required in conservation risk assessments and management will be briefly reviewed and will include methods in ecology, genetics, mathematical modeling and monitoring techniques.

READING TEXT FOR PART 2 (Conservation biology)

PRIMACK, RB. (2002) ***Essentials of Conservation Biology*** (3rd Edition), Sinauer Ass.

Important Note:
This study-unit is partly based on on-site experience. Therefore, site-visits, which may be part of the course, are considered as essential for the understanding of the basic principles discussed during the formal lectures. Students will be required to prepare reports after each site-visit. As such, attendance to these site-visits, as well as satisfactory performance in the site-visit reports are considered as obligatory. A grade will be issued for this study-unit only if these conditions are satisfied.

Furthermore, students are to note that they will be allowed to sit for the respective study-unit examination and be awarded a grade only if they have regularly attended lectures, have submitted all assignments and have satisfied all study-unit requirements.

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%. Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO2041**
Title:	**Ecology**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Ed. (Hons.) students and others**
When Offered:	**Semester 1**
Method of Teaching:	**28 hours of lectures; 1 practical session of 6 hours each; 1 day fieldwork**
Assessment:	**10% course work, which may include various types of written assignments and/or interviews;** **15% by practical reports (Compulsory and non-compensatable);** **75% by test**
Pre-requisites:	**B.Sc. (Hons.) 1st Year Study-Units or equivalent**
Lecturers:	**Professor PJ Schembri**

This study-unit will be concurrently held with the first part of BIO2040.

An introduction to the principles, concepts and controversies involved in the study of plant and animal populations and their interactions with the biotic and abiotic environments. Special reference will be made to the ecology of the Mediterranean area and that of the Maltese Islands.

1. **Introduction**
- The nature of ecology
- Ecology as the driving force behind evolution by natural selection

2. **Environmental factors**
- Limiting factors, limits of tolerance, ecological valency and ecotypes
- Introduction to the niche concept

3. **Population ecology**
- Populations and population attributes:
  dispersion patterns; population density and its estimation;
  natality and mortality; survivorship curves;
  age distribution; sex ratio;
  rate of natural increase: exponential and logistic growth; the logistic hypothesis and other population models;
- Population fluctuations and regulation of population size:
  density-dependent and density-independent factors;
  May's model
- Population cycles: extrinsic and intrinsic control
- Life-history strategies: opportunist and equilibrium species;
- Intraspecific interactions and their population consequences:
  group effects, overcrowding effects, intraspecific competition

4. **Interspecific interactions**
- Types of interspecific interactions and their effect on population size
- Competition: competitive exclusion; ecological isolating mechanisms and niche separation; guilds; niche theory and competition as niche overlap
- Predation: types and characteristics of predators; predator-prey interactions; predator responses to prey; prey defence against predators
- Parasitism: types and characteristics of parasites; parasite-host interactions
- Amensalism and allelopathy
- Commensalism, protocooperation and mutualism
- Co-evolution

5. **Biotic communities**
- Development of the community concept in ecology
- Classification of communities; biomes

- Species richness and relative abundance: diversity and its measurement; the different kinds of diversity; causes and patterns of diversity and theories accounting for them
- Ecological dominance; community structure; periodicity
- The nature of communities
- Community change:
  cyclic change
  successional change: characteristics and mechanisms of succession, examples of ecological successions

6. **Ecosystems ecology**
- Concept of ecosystem
- Solar radiation as the driving force of ecosystems; ecosystems not based on solar radiation
- Production and productivity:
  primary production in the biosphere;
  secondary production; energy budgets
- Food chains, food webs, and trophic structure
- Energy flow in ecosystems and efficiency of energy transfer
- Ecological pyramids
- Biogeochemical cycles:

READING LIST FOR PART 1 (ECOLOGY)

Basic Course Texts
(any one of the following)

BREWER, R (1994) *The science of ecology* [2nd ed] Saunders.

RICKLEFS, RE (2001) *The economy of nature*. [5th ed] W.H. Freeman.

Additional Texts and Supplementary Reading

BEGON, M, TOWNSEND, CR & HARPER, JL (2005) *Ecology: from individuals to ecosystems*. [4th ed] Blackwell. [There is a CD-ROM to accompany this text] This is an advanced text that will be useful to those who intend to continue their studies in ecology. Other students may find the following simplified version more accessible TOWNSEND, CR, BEGON, M & HARPER, JL (2002) *Essentials of ecology*. [2nd ed] Blackwell Science.

COLINVAUX, P (1993) Ecology 2. [2nd ed] J. Wiley [Very good text but unfortunately out of print]

COTGREAVE, P. & FORSETH, I (2002) *Introductory ecology*. Blackwell Science. [Excellent introductory text that touches on all aspects of ecology]

KREBS, CJ (2001) *Ecology: the experimental analysis of distribution and abundance*. [5th ed] Harper Benjamin Cummings [Essential reference; somewhat mathematical; there is a CD-ROM to accompany this text]

PIANKA, ER (1999) *Evolutionary ecology*. [6th ed] Benjamin-Cummings [An excellent text, useful also for units in animal behaviour and evolutionary biology]

SCHEMBRI, PJ & BALDACCHINO, AE (1998) *Ilma, blat u hajja: is-sisien ta' l-ambjent naturali Malti*. [It-tieni edizzjoni riveduta] Malta University Services Limited. [In Maltese: provides the local dimension].

Field and Laboratory methods

Recommended text:

BROWER, J; ZAR, J & VON ENDE, C (1998) *Field and laboratory methods for general ecology*. [4th ed] Wm C Brown.

Additional texts:

WAITE, S. (2000) *Statistical ecology in practice*. Prentice Hall [recommended for those intending to do an ecology-based research project]

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular

Code:	**BIO2050**
Title:	**Science, Society and Ethics**
Credit Value	**2 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc (Hons.) students and others**
When Offered:	**Semester 2**
Method of Teaching:	**14 hours of lectures and a number of tutorials**
Method of Assessment:	**100% by course work and assignments which may include seminars**
Lecturer	**Dr. Pierre Mallia**

Although this course is addressed especially to biology undergraduates, it may also be followed by other students with a sufficient biological background. It will be subdivided into three major areas as follows:

1. **Ethics**: moral issues arising out of advances in scientific knowledge and technology, e.g. models of moral reasoning, limits of biological reductionism, reproductive technologies, moral problems concerning behaviour modification, genetic engineering, cloning, etc…

2. **Ethical scientific research** - Respect of fundamental principles, such as, human life, human dignity, and integrity of the person; democracy, the rule of law, prohibition of inhuman or degrading treatment; freedom of expression and of information; intellectual property rights; privacy and data protection; environmental protection; informed consent, confidentiality, minimal risk.

3. **Ethical codes, legislation and conventions**: codes of ethics, European Union Directives, and conventions of the Council of Europe, Helsinki Declaration.

Course Structure:

- Ethics, Life Sciences and Belief in Progress
- Progress and the Image of Man: Reductionism vs Human Dignity
- Models of Moral Reasoning: Consequentialism vs Deontology
- Concept of Life and Reproductive Technologies
- Research Ethics
- Life Sciences, Democracy and Ethics
- Genetics and behaviour
- Science Fiction as a Cultural Phenomenon: Ethical Implications

READING LIST

A list of readings on specific topics will be given during the course.

European Union, *Modern Biology and Visions of Humanity*, European Communities, 2004
Chadwick R. (ed), *The Concise Encyclopedia of life. Ethics of New Technologies*, Academic Press, London, 2001.
Chadwick R. (ed), *Ethics in Science and Technology Rutledge*
Cauchi M.N. (Ed). Bioethical Issues at the Beginning and End of Life. The Bioethics Consultative Committee. Malta 2002.
Mallia P. The Beginning and End of Life. Moral Dilemmas. PEG Publishers. 2002.

Note: Students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO2070**
Title:	**Biochemical Strategies of Life**
Credit Value	**5 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 1**
Method of Teaching:	**21 hours of lectures; 3 practical sessions of 6 hours each.**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test;** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year Study-Units or equivalent**
Lecturer:	**Dr. Adriana Vella**

Biochemistry is the study of the molecular basis of life. This study unit introduces students to the underlying biochemical principles of life within and outside the human living body as well as of a range of other species including plants. The topics to be covered include:

Basic concepts and design of metabolism;
Protein, DNA and carbohydrates structure and function;
Glycolysis;
Citric Acid Cycles;
Oxidative phosphorylation;
Pentose phosphate pathway;
Gluconeogenesis;
Glycogen and Fatty Acid Metabolism;
Amino Acid Degradation and Urea Cycle;
Antibody structure – function; its role in survival
Photosynthesis; Nitrogen Fixation.

As far as it is feasible, the above topics will be treated from a comparative perspective, i.e. how different organisms adopt different or similar biochemical strategies to adapt to different environments and modes of life. Furthermore, a range of applied topics of biochemistry in our every day life, will be discussed, including:

Photoreceptors;	Cholesterol	Dopamine;
Chemotherapy;	Insulin and diabetics;	Biochemistry of cancer;
Aging;	Bioelectronic Computers;	Effects of alcohol abuse.

The study-unit includes **an integrated programme of practical work** (3 sessions of 6 hours each) covering the topics discussed in lectures. The aim is to provide students with an opportunity to become familiar with a range of standard laboratory techniques. Experiments will include: identification of amino acids; size exclusion chromatography of chloroplasts; and determination of vitamin contents in foodstuffs. Students will be required to write regular practical reports.

READING LIST

STRYER, L (2002) 5th Ed. ***Biochemistry***. W.H. Freeman and Co.
PRATT, C.W. and CORNELY, K.(2004) ***Essential Biochemistry*** J.Wiley & Sons, Inc.
DOW, J; LINDSAY, G & MORRISON, J (1995) ***Biochemistry.*** Addison-Wesley
MATHEWS, VAN HOLDE, AHERN (2000) 3rd Ed. ***Biochemistry*** Addison-Wesley/Longman

Important note: *Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%. Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.*

Code:	**BIO3020**
Title:	**Microbiology and Parasitology**
Credit Value	**5 credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 1**
Method of Teaching:	**21 hours of lectures; 4 practical sessions of 6 hours each**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year and 2nd Year Study-Units or equivalent**
Lecturer:	**Professor Carmelo Agius and others**

1. The nature of microbes.
2. The relationship between structure and mode of life of bacteria.
3. The role of the bacterial cell membrane in disease pathogenesis.
4. Bacterial physiology nutrition, growth and division.
5. Extrachromosomal factors; their nature and functions in imparting properties such as bacterial drug resistance.
6. The relationship between structure and mode of life of viruses.
7. Virus replication and cytopathic effects *in vitro*
8. Symptomatology and pathology of selected examples of viral infections *in vivo*.
9. The structure and mode of life of the bacteriophages.
10. Basic mycology: structure and mode of life of fungi.
11. Fungi as disease agents.
12. Fungi of beneficial economic importance.
13. Mycoplasmas and Rickettsiae.
14. The culture of microbes *in vitro*.
15. Principles of Immunology.
16. Specific and non-specific immune mechanisms.
17. Humoral and cell-mediated immune responses.
18. Factors affecting the immune responses.
19. Parasitism in the context of the different types of relationships amongst living organisms.
20. Host-parasite relationship with particular emphasis on the adaptations that secure successful co-existence of the host and the parasite.
21. Main types of plant and animal parasites.
22. Biology of parasitic species with special reference to the Protozoa, Helminthes, Nemtoda, Acanthocephalan and Arthropoda.
23. Transmission of parasites
24. Diseases and pathology caused by parasites.
25. Brief overview of prevention and treatment strategies adopted in order to control parasitic infections.

READING LIST

TORTORA GERARD, J: FUNKE BENDELL, R & CASE CHRISTINE, L. *Microbiology: An Introduction*. 7th edition; 2001. ISBN: 080537597 (X).
TIMBURY & WHITE *Essentials of microbiology and immunology*.
DAVIS; DULBECCO; EISEN & GRINSBERG *Microbiology*. Harper International Edition
Wesley A. Volk. (1992) *Basic microbiology* (7th Ed.), Harper Collins Publisher
CHANDLER, C & READ, C *Introduction to Parasitology*. J. Wiley & Sons. pp. 822.
CHENG *The biology of animal parasites.* W.B. Saunders Co.
SALMIDT, GD & ROBERTS, LS *Foundations of parasitology*.
TRAGER, W *Living together - the biology of animal parasitism.* Plenum Press. pp. 467.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable.. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3030**
Title:	**Evolution, Phylogeny and Adaptation**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 1**
Method of Teaching:	**28 hours of lectures/seminars and site visits**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test** **15% by site-visit reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year and 2nd Year Study-Units or equivalent**
Lecturer:	**Mr. Edwin Lanfranco**

This unit is designed to give a general overview of the processes of evolution and of phylogenetic systematics. Topics to be discussed include:

1. The concept of evolution and the development of evolutionary thought.
2. Evolutionary dynamics to include discussion of principal hypotheses proposed to explain evolutionary processes.
3. Methodology in research on evolution.
4. Concepts of systematics
5. Cladistic versus phenetic classification systems
6. Methododolgy of systematics
7. Evolution & systematics in some of the principal taxonomic groups.

The study-unit includes **an integrated programme of site visits** covering the topics relevant to those discussed in lectures. . Students will be required to write site visit reports.

READING LIST

FUTUJMA, D (1986) *Evolutionary Biology*. [2nd ed] Sinaur
STRICKBERGER, MW (1990) *Evolution* Jones & Bartlett

Supplementary reading
At this level one is expected to read widely but the following may be taken as a guidance
BRIGGS, D & WALTERS, SM *Plant Variation and Evolution*. Weidenfield & Nicholson
JUDD, W.S, CAMPBELL, C.S., KELLOGG, E.A. & P.F. STEVENS (1999). Plant Systematics: A Phylogenetic Approach. Sinauer Associates Inc.
MINELLI, A (1993) *Biological systematics - the state of the art*. Chapman & Hall.
MOORE-LANDECKER, E (1996) *Fundamentals of the fungi*. [4th ed] Prentice Hall.
SCHOPF, JW (Ed) *Major Events in the History of Life*. Jones & Bartlett
VAN DEN HOEK, C; MANN, DG & JANHS, HM (1995) *Algae - an introduction to phycology*. Cambridge University Press.

Important note:

Students are to note that for assessment purpose, the practical (site-visit) component of this study-unit is compulsory and non-compensatable.. This means that no grade will be awarded for this study-unit, unless they attend all site-visit sessions and unless their average mark for the site-visit reports is a minimum of 45%.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3040**
Title:	**Biotechnology 1**
Credit Value	**6 credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**28 hours of lectures, 4 practical sessions of 6 hours each and site visits**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test;** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year and 2nd Year Study-Units or equivalent**
Lecturer:	**Professor Carmelo Agius and others**

1. General introduction of biotechnology, types and ethics of biotechnology
2. Review of genes and genomes
3. Recombinant DNA technology
4. Introducing RNA and proteins into cells; reporter genes
5. Enabling technologies of Biotechnology: immunology basic principles and technologies
6. Enabling technologies of Biotechnology: electrophoresis, molecular markers, PCR, genome mapping and DNA sequencing
7. Enabling technologies of Biotechnology: cell and tissue culture
8. Animal biotechnology: animal models, clones, transgenic animals
9. Animal biotechnology: producing human antibodies in animals
10. Bioremediation
11. Regulating the use of biotechnology
12. Ethics and biotechnology

READING LIST

GLICK, B.R. and PASTERNAK, J.J. (1998) *Molecular Biotechnology*. ASM Press 2nd edition.
ACQUAAH, G. *Understanding Biotechnology. An integrated and cyber-based approach.*(2004) Pearson Prentice Hall
THIEMAN, W.J. and PALLADINO, M.A. *Introduction to Biotechnology.* (2004) Pearson Benjamin Cummings
BAINS, W. *Biotechnology from A to Z.* (1998) Oxford University Press

Other suggestions for reference literature will be given by the various lecturers during the course.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%. Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3050**
Title:	**Animal Form and Function II**
Credit Value	**5 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**21 hours of lectures; 4 practical sessions of 6 hours each or a practical mini-project..**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test;** **15% by practical reports/practical mini-project report. (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year and 2nd Year Study-Units or equivalent and in particular BIO2030.**
Lecturer:	**Professor V Axiak**

This course, which is a continuation of BIO2030 , reviews how adaptations in animal morphology and physiology have been adopted and evolved by invertebrates and vertebrates in their interactions with their environment. The aim is to identify the basic and comparative aspects of such morphological and functional strategies from a mechanistic approach. The evolutionary significance of the relationship between the form and function of animals and the environment will be emphasized throughout the course.

In addition to any themes which may have been incompletely covered in BIO2030 and which would therefore need to be concluded here, the following topics will be covered:

1. **Nutrition and digestion**: comparative review of different life forms.
2. **Gaseous exchange and respiratory surfaces**.
3. **Circulation**: the biomechanics of circulatory systems. Diversity of designs
4. **Support:** material properties; hydrostatic support, designs for mechanical support, a comparative account of vertebrate skeletons.
5. **Osmo-ionic regulation and excretion**
6. **Reproductive strategies**
7. **Metabolism and energy relations:** Energetics, temperature relations, energetics of reproduction, ectothermy and endothermy
8. **Vertebrate designs:** a brief review of the vertebrate body plans, body designs and adaptations in amphibians, synapsids and sauropsids, avian and mammalian specializations.

The course includes a**n integrated programme of practical work** covering topics discussed during the study-unit and other relevant topics. Alternatively the practical component for this unit will take the form of a group mini-project assigned to different groups of students following the study-unit. This MAY replace the scheduled practical classes for this unit.

Each group will be given a specific investigation which they will need to complete within a specified period of time. They will be required to make a literature review of the theme to be investigated. On the basis of this review and in view of the facilities which may be available, design the experimental approach to be adopted as well as the manner in which they will undertake the investigation, with minimal supervision. At the end, they will be required to present their results and conclusions during a class seminar. Assessment of the practical mini-project will be carried out as follows:

20%	Level of initiative and commitment shown by each member of the group.
40%	Written report (one common mark for the group).
40%	Performance during seminar presentation by each member of the group.

READING LIST

KARDONG, K. V. (2001). Vertebrates: Comparative Anatomy, Function, Evolution.
RANDALL,D. BURGGREN, W., FRENCH, K. Eckert Animal Physiology: Mechanisms and Adaptations, Fifth Edition. Freeman. New York.
SCHMIDT-NIELSEN, K (1997) *Animal physiology. Adaptation and environment.* [5th ed] Cambridge University Press.
HILL,R.W., WYSE, G. (1997) Animal Physiology. 2nd Edition. Harper Collins. Publishers.
WILLMER, P., STONE, G. JOHNSTON, I. (2000) Environmental Physiology of Animals (1st Edition). Blackwell Science.
VOGEL, S. (2003). Comparative Biomechanics: Life's Physical World

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports (or report for practical mini-project) is a minimum of 45%. Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3060**
Title:	**Field Biology**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**September before Semester 1 of Year 3 of BSc (Hons) course**
Method of Teaching:	**12 hours of lectures; 5 fieldwork sessions of 3 hours each; 5 laboratory sessions of 3 hours each**
Assessment:	**100% by practical reports**
Pre-requisite:	**BIO1020, 1030, 2040; SOR1211, 1221 or equivalent units; pre-requisites may be waived with prior permission**
Tutors:	**Dr. J.A.Borg (Course Coordinator), P.J.Schembri, and others**

Introduction

With a coastline of some 190km and a submerged area within the 100m-depth contour of ca. 1,940km^2, the Maltese Islands present practically all the different adlittoral, littoral and shallow sublittoral habitats characteristic of the central Mediterranean. Additionally, the islands' environment, history, culture and economy are intimately connected with the sea. It is therefore appropriate that the coastal and marine environments of the Maltese Islands should be studied as important components of the islands' ecosystem, while they are ideal natural laboratories for field biology in general.

This short, intensive course in practical field biology as applied to coastal and marine systems is designed to familiarise students with the methodologies used in the study of these environments and the practical application of these techniques, as well as the organisms and habitats of the Maltese coastal zone and seabed and waters off it. This course is primarily aimed at undergraduate biology students, but may also be followed with benefit by others. Because the course is intensive and heavily fieldwork-based, it cannot be offered when the university is in session as it would interfere with other academic activities, and it is therefore offered during the summer recess, also because summertime is ideal for fieldwork due of weather considerations.

Objectives

1. To give students the opportunity to supplement the theoretical component of their biology course with practical work using a variety of standard fieldwork techniques and equipment used to study, sample and monitor coastal and marine habitats and their biota.
2. To acquaint biology students with the range of habitats constituting the coastal and marine environment of the Maltese Islands, including the terrestrial maritime fringe, sandy beaches, rocky shores, sublittoral hard substrata, sedimentary bottoms and seagrass meadows, shallow costal water, and with the biota they support.
3. To instruct students in the use of such equipment as quadrats, corers, grabs, dredges, water samplers, plankton nets and underwater TV, and to give students hands-on experience using such equipment in the field.
4. To familiarise students with the taxonomic identification of various groups of coastal; and marine plants and animals, including terrestrial coastal plants and animals, benthos, nekton and plankton.

Programme

The course will run for a period of 6 days. The first day will consist of a briefing on the whole course and introductory lectures. Following that, each day will start with a short briefing on the practical session of the day followed by fieldwork and subsequent laboratory processing. Each day will end with a short discussion session to review and integrate the day's academic work, followed by an introductory lecture to set the next day's practical sessions in context, Fieldwork will mainly focus on exposing students to different coastal and marine habitats and the techniques used to study and sample them. Laboratory work will concern processing of samples, analysis of environmental samples, and species identification.

A detailed course programme and instructions will be provided to students immediately before the commencement of the study-unit.

Code:	**BIO3070**
Title:	**Studies in Conservation Biology**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons) and others**
When Offered:	**Semester 1**
Method of Teaching:	**20 hours of lectures; 1 fieldwork session/visit.**
Method of Assessment:	**15% by course work including seminars and 85% by examination**
Pre-requisite:	**B.Sc. (Hons.) 1st Year, 2nd Year and 3rd Year Study-Units or equivalent**
Lecturer:	**Dr. A. Vella**

Conservation biology is the applied science of maintaining the earth's biological diversity. It is a cross-disciplinary subject reaching far beyond biology into subjects of philosophy, economics and sociology as well as into subjects such as law and education. On the other hand there are many biological aspects of conservation such as biological research, and in this respect, a detailed overview of appropriate research methods for conservation assessment, monitoring and management are the focus of this study unit.

"Thirty years ago maintaining biological diversity meant saving endangered species from extinction and was considered a small component of conservation, completely overshadowed by forestry, soil and water conservation, fish and game management and related disciplines. Now, with so many species at risk and the idea of biological diversity extending to genes, ecosystems and other biological entities, conservation biology has moved into the spotlight as the crisis discipline focused upon saving life on earth, perhaps the major issue of our time." Hunter (1996) in *Fundamentals of Conservation Biology.*

In this fast advancing and demanding field of studies, students will be required to consider both the theoretical background while considering Global, European and Maltese practical scenarios. Topics to be focused on, through case studies, include:

- Advanced technologies applied to Conservation biology research and monitoring for conservation management and sustainable exploitation of natural resources;
- Biodiversity Conservation and Climate Change;
- Ex-situ and in-situ conservation assessment and management;
- Conservation Areas: their role in biodiversity/species/habitat protection, research and education for conservation;
- Socio-Economic factors in relation to biological conservation issues: managing species and habitats within a human socio-economic framework;
- Habitat degradation and Restoration.

READING LIST

CAUGHLEY, G & GUNN, A (1996) ***Conservation Biology: Theory and practice.*** Blackwell Science Inc.

HUNTER, ML (2002) ***Fundamentals of Conservation Biology***. Blackwell Science.

SUTHERLAND, WJ Ed. (1998 & 2002 reprint) ***Conservation Science and Action,*** Blackwell Science.

SUTHERLAND, WJ & HILL, DA (Ed) (1995) ***Managing habitats for conservation***. Cambridge.

Several other texts will be suggested during the course.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions/visits

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3080**
Title:	**Agriculture, fisheries and the Management of Biological Resources.**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons) and others**
When Offered:	**Semester 1**
Method of Teaching:	**20 hours of lectures; 3 fieldwork session/visit.**
Method of Assessment:	**15% by course work including seminars and 85% by examination**
Pre-requisite:	**B.Sc. (Hons.) 1st Year, 2nd Year and 3rd Year Study-Units or equivalent**
Lecturer:	**Prof. C.Agius and Mr. D. Dandria**

Agriculture (Mr. David Dandria 5 hours of lectures)

1. Overview of agricultural and horticultural practices with special reference to the situation in Malta (particular emphasis will be placed on underlying biological aspects).
2. Crop husbandry.
   - 2.1 Soils and Fertility
   - 2.2 Crop pests.
   - 2.3 Crop diseases.
   - 2.5 Pest and disease control.
3. Animal husbandry.
   - 3.1 Nutritional aspects.
   - 3.2 Livestock diseases and their control.
4. GMOs in agriculture
5. Organic agriculture

Aquaculture (Prof. Carmelo Agius: 10 hours of lectures)

5. Principles of aquaculture
6. Benefits and potential problems of aquaculture
7. Local, regional (Mediterranean) and global status of aquaculture
8. Criteria for species and site selection in aquaculture
9. Culture technologies
10. Application of reproductive biology in aquaculture: hatchery technology
11. Nutrition of farmed aquatic species
12. Pathology of farmed aquatic species including prevention and treatment
13. United Nations Code of conduct for responsible aquaculture
14. New trends (technologies/species) in aquaculture
15. Organic aquaculture

Fisheries Management (Prof. Carmelo Agius: 5 hours of lectures)

1. Local, regional (Mediterranean) and global status of the fisheries industry
2. Species biology and environmental aspects relevant to fisheries
3. Fisheries management strategies
4. The fisheries industry in Malta; capture methods, conservation measures, catch statistics, etc
5. United Nations Code of conduct for responsible fishing
6. EU Fisheries policy

READING LIST

STICKNEY, R.R. (2005) *Aquaculture:An Introductory Text.* CABI Publishing
BARNABE, G. [Ed] (1990) *Aquaculture*. (Volumes I & II). Argent.
LUCAS, J.S. and P.C. Southgate (Ed) (2003) *Aquaculture: Farming aquatic animals and plants.* Fishing News Books
MEADE, J.W. (1989) *Aquaculture Management*. VanNost. Reinhold.

MEVEY, J. [Ed] (1991) *Handbook of Mariculture - Volume II Finfish Aquaculture*. Argent.

Additional Reading

IKENOUE, H. and KAFUKU, T. editors (1992) *Modern methods of aquaculture in Japan. Elsevier ISBN-0-444-98665-0 (Vol 24)*
BEVERIDGE, M. (1996) *Cage Aquaculture*. Fishing News Books, 2nd edition.
PILLAY, T.V.R. (1990) *Aquaculture: Principles and Practices*. . Fishing News Books.

In view of the diverse aspects of agriculture, reading material will be suggested by the lecturers. For adequate coverage, extensive references to sources other than standard textbooks may be required. Copies of articles etc., will be provided by lecturers if they are not available in the library

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions/ visits.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3090**
Title:	**Environmental Applications, Informatics and Management**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons) Environmental Biology Track**
When Offered:	**Semester 1**
Method of Teaching:	**20 hours of lectures and 3 laboratory sessions**
Method of Assessment:	**15% by course work and 85% by examination**
Pre-requisite:	**B.Sc. (Hons.) 1st Year, 2nd Year and 3rd Year Study-Units or equivalent**
Lecturer:	**Prof. V Axiak, Dr Maria Attard, Ms Ruth Guillaunier, Dr. Elaine Tabone Adami)**

This unit aims at presenting a range of techniques which are employed in environmental biology and management.

1. **Remote Sensing and the Environment** (Dr. Elaine Tabone Adami: 6 hours)
   A brief review of basic concepts in remote sensing including sensors, thermal IR, microwave, radiowave. Visible and near IR remote sensing. Data analysis and processing. Application to remote sensing.
   Application of remote sensing in environmental management

2. **Marine Ecotoxicology** (Prof. V.Axiak and Ms Ruth Guillaumier: 6 hours)
   Themes to be discussed include: interaction between biota and marine pollutants; acute toxicity tests; sublethal toxicity tests; fate of contaminants in the marine environment: marine pollution in the Mediterranean; application of ecotoxicological data in environmental risk management.

3. **Environmental Informatics** (Dr Maria Attard: 8 hours)
   The use and applications of informatics to the study and management of environmental resources. An introduction to geographical information systems and their applications to land-use classification, agriculture, hydrology, geology and others. All lectures are normally held in the GIS Laboratory.

READING LIST
A list of texts will be provided during the course. Some examples are given below:

CLARK, R. (2001, 5th Ed.). Marine Pollution. Oxford University Press.
LILLESAND, T.M., and KIEFER, R.W. (1994). Remote Sensing and Image Interpretation. John Wiley.
JENSEN, J.R. (2000, 2nd Edition). Remote Sensing of the Environment.. U.S. Imports and PHIPEs

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions/ visits.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3100**
Title:	**Marine Biology**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons) Environmental Biology Track**
When Offered:	**Semester 2**
Method of Teaching:	**20 hours of lectures and 2 laboratory sessions/visits**
Method of Assessment:	**15% by course work and 85% by examination**
Pre-requisite:	**BIO1020, BIO1030, BIO2040 and BIO3030**
Lecturers:	**Dr J A Borg and Professor PJ Schembri**

Marine biology comprises the study of organisms that live in oceans and their fringing terrestrial areas, and of how these organisms interact with their environment. The first part of this study unit will deal with basic aspects of marine biology, including physical and chemical oceanography, major divisions of the marine environment, productivity, and functional adaptations of marine organisms. The second part of the course will focus on the Mediterranean Sea and will discuss aspects of Mediterranean marine ecology and biogeography highlighting how geological, physical and biological factors have interacted to give the observed patterns. The Mediterranean Sea is a complex environment, in some aspects functioning as a miniature ocean, while in others presenting rather unique features. In particular, the ecology of the sea is profoundly influenced by the climate and by interactions with the surrounding land-masses. The biogeography of the Mediterranean has been shaped by the geological and climatic history of the sea, and more recently, by human intervention.

Topics discussed during this unit include:

Part 1 General marine biology (Dr Joseph A. Borg)

- Basic physical and chemical oceanography: temperature and salinity, vertical stratification, water masses, oceanic circulation, tides, currents and waves;
- Basic biological oceanography: major divisions of the marine environment;
    - Pelagic ecosystems: plankton, primary and secondary productivity;
    - Nekton: functional adaptations, secondary productivity and importance to fisheries;
    - Benthic ecosystems: phytobenthos and zoobenthos, primary and secondary productivity, benthic habitats, functional adaptations to life on the seabed;

Part 2 Aspects of Mediterranean marine biology (Prof. Patrick J. Schembri)

- Physical geography of the Mediterranean Sea, including climate;
- Oceanography of the Mediterranean: salt and water balance, water types, circulation;
- Production in the Mediterranean: primary production, secondary production, the Mediterranean plankton;
- Geological evolution and palaeoecology of the Mediterranean with special reference to the central Mediterranean area;
- Marine biogeography of the Mediterranean: patterns of distribution, the Mediterranean endemics, immigrant and alien species.

READING LIST

CASTRO, P. & HUBER, M. E. (2005) *Marine biology*. [5th ed] McGraw-Hill.

GINSBURG, N; HOLT, S & MURDOCH, W [Eds] (1974) *The Mediterranean marine environment and development of the region*. International Ocean Institute.

GRANT GROSS, M. (1996) *Oceanography: a view of the earth*. [7th ed] New Jersey: Prentice Hall.

KETCHAUM, BH [Ed] (1983) *Estuaries and enclosed seas*. Elsevier.

LEVINTON, J. (2001) *Marine Biology: function, biodiversity, ecology*. [2nd ed] Oxford University Press.

MARGALEF, R [Ed] (1985) *Western Mediterranean*. Pergamon Press.

MOJETTA, A (1996) *Mediterranean Sea: guide to the underwater life.* Swan Hill Press.

NYBAKKEN, JW & BERTNESS, MD (2004) *Marine biology; An ecological approach*. [6th ed] Benjamin Cummings.

RODRÍGUEZ PRIETO, C. & PARDINI, G. [Eds] (2004) *The Mediterranean Sea. An overview of its present state and plans for future protection*. [Lectures from the 4th International Summer School on the Environment, 2004] Institut de Medi Ambient. Universitat de Girona, Spain.

STANLEY, DJ [Ed] (1972) *The Mediterranean Sea: a natural sedimentation laboratory.* Dowden, Hutchinson & Ross.

TAIT, R.V. & DIPPER, F. A. (2003) *Elements of marine ecology*. [4th ed] Butterworth Heinemann.

BARNES R. S. K. & HUGHES R. N. (1999) *An introduction to marine ecology*. [3rd ed] Blackwell Science.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions/ visits.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade will be awarded to a particular study-unit only if attendance for lectures and practical sessions has been regular.

Code:	**BIO3110**
Title:	**PROJECT WORK IN BIOLOGY**
Credit Value	**18 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons)**
When Offered:	**Semesters 1 and 2**
Method of Teaching:	**see below**
Method of Assessment:	**see below (non-compensatable)**
Lecturers:	**Various, as indicated below**

During their final year, students following the B.Sc. degree course are required to choose a Project within one subject area. More details are available in a **STUDENTS MANUAL** entitled**: BIO3110: PROJECT WORK IN BIOLOGY** , (downloaded from the departmental website).

The general objectives of this Project Work Programme are:

- to provide the student with in-depth knowledge of some topic of his/her choice
- to give the student experience in planning and performing of scientific research and in critically evaluating the current literature on the particular topic.

B.Sc. (Hons.) students are to note that this study-unit is non-compensatable.

Method of assessment: The Project Work Programme carries 18 credits. It consists of two components:

Seminars: An advanced theoretical treatment of a specific topic through a number of lectures and /or student-led seminars. This component will carry 10% of the final assessment mark.

Project Work: A student project involving research work. This component will carry 90% of the final assessment mark. This project work will be assessed on the basis of a written dissertation and on performance during an interview.

The assessment criteria include: level and depth of knowledge attained in coursework/seminars: originality and quality of dissertation; initiative shown by the student in the undertaking of his/her studies; quality of first draft of dissertation; as well as performance during the interviews.

The percentage total mark will be awarded as follows:

10%	seminars
10%	initiative shown during project work
15%	performance during interview
50%	originality – background, methodology, results/data analyses; discussion/summary/references.
15%	final presentation of project (dissertation)

The coursework/seminars programme must include a minimum of 8 seminars with each student giving at least 2 seminars. In the case where a single student is following a Project Work Programme, then the programme of seminars must include a minimum of 5 seminars.

Each student will be required to prepare a written assignment for each seminar. These should be between 6 and 9 pages long excluding figures, tables and references.

A complete list of titles of seminars will be prepared by the respective tutor and forwarded to the departmental office as soon as possible and prior to the start of the seminars (i.e. normally by the second week of October).

The titles of seminars must reflect the whole range of subjects on the general project work theme, rather than focus on the work project of the respective students. The student should make available to all participants copies of the seminar presentation. The delivery of the seminar should include an appropriate introduction and then proceed to the main presentation. The delivery should largely be based on overhead transparencies; students are discouraged from reading directly from their original script.

The students are reminded that the level of seminars and assignments are to be of the appropriate standard. Students are expected to spend approximately 8 hours a week on their project work during their final year.

The tutor will submit copies of the written seminar assignments to the departmental office normally by the second week in April. Such copies will then be made available to all examiners.

The interviews to assess the student project will be held as usual immediately after the final examinations.

The topics available for the various Project Work Programmes in Biology may vary from year to year. Detailed descriptions, specific objectives and content of such programmes in Biology, follow.

Other topics my be offered for projects in Biology for Academic Year 2007/2008, depending on availability of tutors/supervisors.

I. Fisheries and Aquaculture

Tutor/Supervisor: Professor C Agius

Introduction:

The rational exploitation of living aquatic resources has led to the development of successful fishing industries the world over. By contrast, although aquaculture which implies the farming of aquatic organisms under controlled conditions has had a long history in some parts of the world such as South-east Asia, it is only in the last twenty years or so that major advances have been achieved in Western Europe. Major breakthroughs have been achieved in key aspects such as breeding techniques, feed formulations and disease control and this has guaranteed the economic viability of such ventures. There is still, however, a need for considerable research on new species.

Objectives:

1. To explain the basic concepts underlying the management of wild fisheries with special emphasis on the biological aspects affecting such an activity.
2. To introduce the discipline of aquaculture both with respect to the underlying biological parameters and in commercial terms. Particular emphasis will be placed on reproductive biology, fish nutrition and disease problems.

Contents:

1. Physical, chemical and biological factors that affect aquatic productivity.
2. Fish stock assessment and fisheries management.
3. Fish farming practices worldwide with special reference to the Mediterranean situation.
4. Fish nutrition.
5. Reproductive biology of fish with particular reference to commercial exploitation. eg. production of all-male fish.
6. Water quality parameters in fish farming.
7. Stress factors in aquaculture.
8. Diseases of fish viz;
   Parasitology

Bacteriology
Mycology
Virology

9. Disinfection, chemotherapy and vaccines in aquaculture.
10. Other aspects of aquaculture. eg. social parameters, financing, insurance etc.

All students will be expected to carry out a long-term practical project on a selected topic within this general theme. The project is likely to involve considerable fieldwork and candidates must therefore be prepared to commute accordingly.

II Marine Ecotoxicology and Environmental Management

Tutor/Supervisor: Professor V Axiak

Introduction:

Marine ecotoxicology deals with the distribution of toxicants in the marine environment, their movement in the environment, their changing chemistry during these processes and their effects on the marine fauna and flora. It provides the data and information required in order to be able to assess environmental risks and hazards on exposure to contaminants and to protect the marine environment in general.

Objectives:

1. To introduce the student to the basic concepts and approaches of toxicology with respect to the marine environment
2. To enable the student to critically assess the applicability of toxicological data to the real problems of the Mediterranean marine environment
3. To provide the student with first-hand experience in basic toxicological and analytical techniques, and in the analysis and interpretation of data
4. To introduce students to basic principles/methods in environmental management (including waste management; environmental auditing and environmental impact assessment)

Contents:

The following general themes will be discussed through a number of lectures, seminars, workshops and discussion:

Acute toxicity tests: theory and applications
Sublethal toxicity tests: theory and applications
Fate of contaminants in the marine environment: biogeochemical cycles
Analytical chemistry and toxicological investigations
Genotoxicity
Data analysis and biostatistics for ecotoxicology
Marine pollution in the Mediterranean
Waste management in small-island states
Environmental management: auditing, environment management systems
Environmental impact assessments: methodologies; limitations

Each student will also be required to undertake a long-term practical project under the supervision of the above tutor on aspects of marine ecotoxicology and environmental management. In most cases such projects will be undertaken within the framework of the present research activities undertaken within the Faculty of Science.

III Applied Plant Biology: Bioactivity of plant extracts.

Tutor/Supervisor: Dr. Joseph Buhagiar

Plants adapted to a Mediterranean-type climate have developed a rich repertoire of phytochemicals that the plants use for a range of ecological and biological functions such as antifeedants, antimicrobial agents and as germination inhibitors to mention just a few. A good number of them are aromatic plants that have found use in traditional medicine, or as food preservatives and flavour compounds. These phytochemicals remain the subject of intensive studies into their biological and ecological functions as well as their activity at the cellular level. The scope for further and deeper investigations remain as does the potential to use findings for biotechnological applications.

Objectives:

1. Introduction to the techniques used in phytochemical extraction and analysis.
2. Familiarisation with in vitro techniques for investigation of bioactivity. This involves learning and mastering cell culture techniques.
3. Recognition of the potential for future applications in biotechnology, food industry, bioremediation and ecological restoration.

Contents:

Topics to be considered include:

- Seasonal variations in phytochemical production by indigenous plants.
- Applications to chemosystematics and chemical ecology.
- In vitro investigations into the induction of cell death by apoptosis in malignant cells by terpenoid extracts.
- Biotransformation of phytochemicals and biotechnology applications.
- In vitro and in vivo investigations into the bioactivity of extracts on soil microbes and soil dwelling organisms.
- Role of phytochemicals to encourage natural composting and recycling of nutrients.

Students are required to undertake a long-term project based on original work connected with aspects the above mentioned research areas.

IV Marine/Terrestrial vegetation and floristics

Tutor/Supervisor: Mr E Lanfranco

Introduction:

The Mediterranean area is characterised by a great diversity of both terrestrial and marine vegetation communities. The most characteristic terrestrial communities are the various stages of the scerophyll series together with others such as saline marshes freshwater wetlands and dunes. Marine communities include various bioconstructions based on coralline algae as well as algal forests and seagrass meadows. Although we have much information on the general structure and ecology of such communities, there are still many deficiencies in our knowledge of specific aspects.

Objectives:

1. Familiarization with the diversity of vegetational communities.
2. Interpretation of the information provided by plant/community distribution.
3. Introduction to the techniques employed in evaluating vegetation.

4. Recognition of the potential for future research.
5. Awareness of the use, actual and potential, of plants.

Contents:

The Project Work Programme will include lectures, discussions, seminars, practical and field sessions. Topics to be considered include:

- vegetational communities
- floristcs
- biogeography
- economic uses
- conservation

Students are required to undertake a long-term project based on original work connected with aspects of terrestrial (including freshwater) vegetation.

V Coastal Ecology

Tutors/Supervisors: Professor PJ Schembri and Dr. JA Borg

Introduction:

Ecologically, the coastal (or littoral) zone is defined as that region of the marine environment from the upper limit of seawater inundation down to a depth of some 40m. The upper parts of this zone are essentially terrestrial, while its lower regions are marine; in between, one environment grades into the other. However, the upper coast still experiences some marine influence (e.g. wetting by sea splash and spray) while reciprocally, shallow coastal water is affected by the adjacent land (e.g. by runoff). This Project Work Programme is designed to introduce students who have already followed a course in basic ecology to the special features of the coastal environment. It seeks to analyse those factors and processes that interact to shape and influence the coastal ecosystem, particularly its productivity, dynamics and structure. In addition to general principles, the special features of the Mediterranean coastal environment will be discussed with particular reference to the Maltese Islands.

Objectives:

1. To discover which are the main physical, chemical and biological components of the coastal environment and how they interact within the coastal ecosystem, and to analyse the types, distribution and temporal changes of coastal biotic communities;
2. To understand why the coastal zone is one of the most diverse and productive of all ecosystems but also one of the most susceptible to human impact, and to analyse human use and management of coastal biological resources;
3. To provide practical experience in ecological field and laboratory techniques as applied to the study of the coastal environment, as well as in the analysis and interpretation of biological data.

Contents:

The course consists of a seminar series but may also include lectures, demonstrations and practical work (both fieldwork and laboratory sessions). Themes that will be discussed include:

- Nature of the coastal environment: physical and biological characteristics, nutrient cycles and energy flow, zonation;
- Shore ecology: rocky and sandy shores, other shore types, saltmarshes;
- Shallow water benthos: structure and dynamics of benthic communities; Mediterranean benthic biocoenoses;
- Human exploitation of coastal resources: types, impacts and coastal zone management.

Additionally, students will be required to undertake a long-term project on some aspect of local coastal ecology during which they will be encouraged to make original observations.

COURSE TEXT

LEVINTON, JS (2001) Marine *biology: function, biodiversity, ecology*. [2nd ed] Oxford University Press.

(**Or**)

NYBAKKEN, JW & BERTNESS, MD (2004) *Marine biology; An ecological approach*. [6th ed] Benjamin Cummings.

READING LIST

BARNES, RSK & HUGHES, RN (1999) *An introduction to marine ecology*. [3rd ed.] Blackwell Science.
CARTER, RWG (Ed) (1990) *Coastal environments*. Academic Press.
DOBSON, M & FRID, C (1998) *Ecology of aquatic systems*. Longman.
LITTLE, C & KITCHING, JA (1996) *The biology of rocky shores*. Oxford University Press.
VALIELA, I (1995) *Marine ecological processes.* [2nd ed] Springer.

For coastal zone management:

CLARK, JR (1998) *Coastal seas: the conservation challenge*. Blackwell Science.

Other selected readings will be given during the course.

The following text is highly recommended for the Project Work Programme project:

WAITE, S. (2000) *Statistical ecology in practice*. Prentice Hall

Code:	**BIO3130**
Title:	**Genetics and Developmental biology**
Credit Value	**6 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons.) and others**
When Offered:	**Semester 1**
Method of Teaching:	**28 hours of lectures; 4 practical sessions of 6 hours each**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test** **15% by practical reports (Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year and 2nd Year Study-Units or equivalent**
Lecturer:	**Dr. Adriana Vella**

The general aim of this study-unit is to cover the main basic concepts of Genetics and Developmental biology. While the former part of the course will allow the students to cover theory and practice in aspects of Mendelian, Molecular and Population genetics, it will also pave the way to genetic processes responsible in developmental biology of organisms. The latter part of the course will then focus on the main stages of embryonic development in various organisms so as to compare and contrast the developmental processes.

Genetics

This study unit covers the fundamental principles and contemporary concepts in genetics, while over-viewing the diversity of approaches with which this subject has investigated heredity, genes, genomes, molecular technology and population genetics.

Classical Mendelian genetics, its extensions and exceptions, and human Mendelian genetics investigated through pedigree analyses paves the way to the more innovative areas of molecular genetics through recombinant DNA technology, genome organization and gene mapping, (genomics), cloning and a basic overview of the applications of these techniques in today's world. The role of genetic variation, its measurement and relationship to environmental variation, its maintenance by selection and its use in taxonomy, and genetic diversity assessments within and between populations will be considered side by side to the applications of these analyses. Thus, population genetics and evolutionary genetics will be considered hand in hand with the molecular aspects of genetics to produce a more detailed understanding of what makes human and species diversity possible. The importance of genetic diversity for survival of species in a changing environment and the ethical issues related to genetics and its developing technology will be discussed.

The main topics to cover will include:

- Mendelian Genetics and its extensions and exceptions
  - Mendel's experiments, results and postulates/laws of heredity;
  - Extensions of Mendelian Genetics;
  - Human Pedigree analyses;
  - Nature-Nurture / Genetics-Environment studies.

- Molecular Genetics, its latest advances and applications;
  - Chromosome Structure and DNA Sequence organization;
  - Gene expression;
  - Gene mutation, DNA repair and transposable elements;
  - Extranuclear Inheritance;
  - Genetic analyses of Bacteria and Bacteriophages;
  - Regulation of gene expression in prokaryotes;
  - DNA Biotechnology and Genomics;
  - Applications and Ethics of Genetic technology.

- Quantitative and Population Genetics:
    - Principles of population genetics, including the Hardy-Weinberg Law;
    - Extensions of the Hardy Weinberg law;
    - Calculating heterozygote frequency
    - Changes to gene frequencies caused by: Natural selection, mutation, genetic drift, nonrandom mating;
    - Methods of investigating genetic structure and differences within and between populations across space and time;
    - Conservation Genetics and its applications.

Developmental Biology

The objective of this course is to introduce students to the process of embryological development and pattern morphogenesis in animals. The treatment of the subject from the chemical, physiological and morphological aspects is envisaged to help grasp the concept of the developmental processes in embryonic forms in view of the sequence of subtle, well-timed, gene controlled changes which form the basis of embryogenesis. This topic will be considered in a comparative manner where various organisms' embryology will be dealt with, including Echinoderms, Insects, Fish, Amphibians, Reptiles, Birds and Mammals. Amongst the areas there will be an overview of the following stages in various organisms:

- Comparative Animal Gametogenesis:
    - How structure and function of gametes fit their role and natural environments toward successful fertilization.
- Comparative Fertilization
    - The reaction of the egg; The essence of activation; The spermatozoon in the egg interior; the changes caused by fertilization, such as, the organization of the egg cytoplasm; Avoidance of polyspermy; Compare and contrast this developmental stage in various animals from echinoderms to mammals.
- Comparative Cleavage
    - Chemical changes during cleavage; Patterns of cleavage and role of the yolk size and position; Morula and Blastula formation; the nuclei of cleavage cells; Distribution of cytoplasmic substances in the egg during cleavage; Compare and contrast this developmental stage in various animals from echinoderms to mammals.
- Comparative Gastrulation
    - Cell movements and Fate maps; formation of rudimentary tissue layers: mesoderm, ectoderm and endoderm; Compare and contrast this developmental stage in various animals from echinoderms to mammals.
- Pattern morphogenesis and organogenesis.
    - Tissue specialization and organ formation in various organisms.

READING LIST

For Genetics:

KLUG, WS & CUMMING, MR (2003) 7th Ed. ***Concepts of genetics.*** Prentice Hall. (**OR**)
KLUG, WS & CUMMING, MR (2002 or any later edition) ***Essentials of genetics***. Prentice Hall.

For Developmental Biology:

GILBERT, SF (2006) 8th Ed. ***Developmental Biology***. In Sinauer Assoc.
Gilbert, S.F. and Raunio, A.M., Eds. (1997). ***Embryology: Constructing the Organism***. Sunderland, MA: Sinauer Associates.

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit,

unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore, students are informed that regular lecture attendance is obligatory. A grade may be awarded to a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3132**
Title:	**Studies in Genetics**
Credit Value	**4 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Ed. (Hons.) and others**
When Offered:	**Semester 2**
Method of Teaching:	**20 hours of lectures; 3 practical sessions of 6 hours each**
Method of Assessment:	**10% by course work, which may include various forms of written assignments and/or interviews;** **75% by test** **15% by practical reports(Compulsory and non-compensatable)**
Pre-requisite:	**B.Sc. (Hons.) 1st Year and 2nd Year Study-Units or equivalent**
Lecturer:	**Dr. Adriana Vella and/or occasional lecturer**

This study unit covers the fundamental principles and contemporary concepts in genetics, while over-viewing the diversity of approaches with which this subject has investigated heredity, genes, genomes, molecular technology and population genetics.

Classical Mendelian genetics, its extensions and exceptions, and human Mendelian genetics investigated through pedigree analyses paves the way to the more innovative areas of molecular genetics through recombinant DNA technology, genome organization and gene mapping, (genomics), cloning and a basic overview of the applications of these techniques in today's world. The role of genetic variation, its measurement and relationship to environmental variation, its maintenance by selection and its use in taxonomy, and genetic diversity assessments within and between populations will be considered side by side to the applications of these analyses. Thus, population genetics and evolutionary genetics will be considered hand in hand with the molecular aspects of genetics to produce a more detailed understanding of what makes human and species diversity possible. The importance of genetic diversity for survival of species in a changing environment and the ethical issues related to genetics and its developing technology will be discussed.

The main topics to cover will include:

- Mendelian Genetics and its extensions and exceptions
    - Mendel's experiments, results and postulates/laws of heredity;
    - Extensions of Mendelian Genetics;
    - Human Pedigree analyses;
    - Nature-Nurture / Genetics-Environment studies.

- Molecular Genetics, its latest advances and applications;
    - Chromosome Structure and DNA Sequence organization;
    - Gene expression;
    - Gene mutation, DNA repair and transposable elements;
    - Extranuclear Inheritance;
    - Genetic analyses of Bacteria and Bacteriophages;
    - Regulation of gene expression in prokaryotes;
    - DNA Biotechonology and Genomics;
    - Applications and Ethics of Genetic technology.

- Quantitative and Population Genetics:
    - Principles of population genetics, including the Hardy-Weinberg Law;
    - Extensions of the Hardy Weinberg law;
    - Calculating heterozygote frequency
    - Changes to gene frequencies caused by: Natural selection, mutation, genetic drift, nonrandom mating;

- Methods of investigating genetic structure and differences within and between populations across space and time;
- Conservation Genetics and its applications.

- Conservation Genetics
  This part of the course will include a review of the following basic concepts in conservation genetics:
  - The role of genetics studies in conserving biodiversity.
  - Assessing genetic variation and divergence among species and populations for conservation and sustainable use of biodiversity
  - Inbreeding depression
  - Demography and extinction
  - Metapopulation and fragmentation
  - Phylogeny reconstruction, systematics and taxonomy using molecular genetics
  - Forensic and management applications of genetic identification

Important note:

Students are to note that for assessment purpose, the practical component of this study-unit is compulsory and non-compensatable. This means that no grade will be awarded for this study-unit, unless they attend all practical sessions and unless their average mark for the practical reports is a minimum of 45%.

Furthermore, students are informed that regular lecture attendance is obligatory. A student will be allowed to sit for the examination in a particular study-unit only if the student's attendance to lectures and practical sessions has been regular.

Code:	**BIO3300**
Title:	**Biotechnology 2**
Credit Value	**6 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons) Industrial Biology Track**
When Offered:	**Semester 1**
Method of Teaching:	**24 hours of lectures and 4 laboratory sessions/visits**
Method of Assessment:	**15% by course work and 85% by examination**
Pre-requisite:	**B.Sc. (Hons.) 1st Year, 2nd Year and 3rd Year Study-Units or equivalent , and in particular BIO3040**
Lecturers:	**Prof. C Agius and others**

This study-unit provides a general overview of the more important biotechnological applications including detailed coverage of a selected number of applications as follows:

1. Medical applications
2. Plant biotechnology
3. Microbial biotechnology with special reference to:
   i. vaccines
   ii. microbial diagnostics
4. Aquatic biotechnology with special reference to:
   i. molecular genetics of aquatic organisms
   ii. medical applications of aquatic biotechnology
   iii. environmental applications of aquatic biotechnology
5. Food biotechnology

READING LIST

GLICK, B.R. and PASTERNAK, J.J. (1998) *Molecular Biotechnology*. ASM Press 2nd edition.
ACQUAAH, G. *Understanding Biotechnology. An integrated and cyber-based approach.*(2004) Pearson Prentice Hall
THIEMAN, W.J. and PALLADINO, M.A .*Introduction to Biotechnology.* (2004) Pearson Benjamin Cummings
BAINS, W. *Biotechnology from A to Z.* (1998) Oxford University Press

Other suggestions for reference literature will be given by the various lecturers during the course.

Code:	**CPH 2500**
Title:	**Introduction to Pharmacology**
Credit Value	**2 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons) Industrial Biology Track**
When Offered:	**Semester 2**
Method of Teaching:	**14 hours of lectures a**
Method of Assessment:	**15% by course work and 85% by examination**
Pre-requisite:	**B.Sc. (Hons.) 1st Year, 2nd Year and 3rd Year Study-Units or equivalent ,**
Lecturers:	**Dr. J. Mifsud**

Code:	**SCI 3508**
Title:	**Professional skills for scientists**
Credit Value	**10 Credits**
Department:	**Biology**
Faculty:	**Science**
Course:	**B.Sc. (Hons)**
When Offered:	**Semesters 1 and 2**
Method of Teaching:	**lectures/seminars**
Method of Assessment:	**50% by course work** **50% by final project presentation**
Pre-requisite:	**B.Sc. (Hons.) 1st Year, 2nd Year and 3rd Year Study-Units or equivalent , and in particular BIO3040**
General Restrictions:	**Only for Biology and Chemistry Students following the B.Sc (Hons)**
Lecturers:	**Dr. Joe Buhagiar and Dr Joseph Grima (Coordinators) and others.**

This study unit will involve lectures, seminars and other forms of course work.

(a) Statistical techniques

Part of the coursework in this study unit involves the taking of a 2-credit class in statistics involving use of SPSS (SOR 0230). This component contributes 20% to the overall mark of the study unit.

(b) Entrepreneurial skills

In this part of the study unit, students will be provided with an opportunity to acquire a set of skills that should better prepare them for a future professional career; students will be introduced to ideas and techniques that could assist them in running a business enterprise.

The course of lectures will include consideration of the following skills:

Ability to define and solve problems creatively.
Positive thinking, motivation and commitment
Team work
Ability to communicate ideas convincingly and coherently both orally and in writing (including business plans)
Negotiation skills
Business skills: evaluating business concepts for potential value; business market research, feasibility studies.
Management of personnel

Presentations will be given by a group of experts and professionals from academia and the business community. However it is planned that the study-unit will follow a curriculum which is learner-oriented and flexible enough to allow contributions from local industrialists, businessmen as well as agencies and institutions.

Students will be required to undertake business-oriented minor projects (mainly related to the application of concepts/ideas from the physical and biological sciences) which would allow them to work in groups and foster in them such entrepreneurial skills.

Students will be continuously assessed throughout the course through various means, as follows:

20% as course work in statistics
30% as course work related to other professional skills
50% minor project