

Biological science is the study of life, from single-celled organisms to complex plants and animals. Biological scientists study living organisms to better understand life processes. They also study the ways organisms interact with their environments. The subject covers various areas such as anatomy, cell biology, genetics, microbiology and physiology.

Level 4 modules are introductory in nature, although prior study of biology/chemistry is required whilst level 5 modules are more advanced and do have specific pre-requisites which are listed in each module descriptor.

Please note that if you wish to take more than one LS* module from the Biological Sciences modules listed below, then it must be from the same level to ensure that there are no timetable clashes.

Updated April 2025/PJW

Entry requirements: GPA of 2.75 or above (out of 4.0) or equivalent.

Pre-requisites:

- **Level 4:** prior study of biology/chemistry is required.
- **Level 5:** these modules (typically equivalent to junior-level in the US system, for instance) build upon level 4 courses and as such require prior evidence of successful completion of biology/chemistry at university level. Any further module-specific pre-requisites are clearly outlined in each module summary below.

Taught at: Penrhyn Road campus

KEY TO MODULE DESCRIPTORS

SUITABILITY OF MODULE FOR STUDENTS VISITING KU ON STUDY OPTION _____

1: Indicates module is suitable for students visiting KU on Study Option 1 (Whole Year)

2: Indicates module is suitable for students visiting KU on Study Option 2 (Autumn)

3: Indicates module is suitable for students visiting KU on Study Option 3 (Spring)

Notes:

1. *All modules are at undergraduate level.*
2. *Students enrolled on Study Option 1 are required to study the entire module.*
3. *whilst the University makes every effort to ensure that this information is correct at the time of updating (April 2025), it cannot accept responsibility for omissions or subsequent changes. Module availability and content may be subject to change, as part of the University's policy of continuous improvement and development.*
4. *Details of assessment for students enrolled on either Study Option 2 or 3 where provided are **indicative only** and may also be subject to change as part of the above policy.*

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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Biological Sciences Modules for Visiting Students 2025/26

MODULE CODE	LEVEL	MODULE TITLE	SUITABILITY KEY
LS4001	4	Genes, Cells and Tissues	1, 2, 3
LS4002	4	The Biochemical Foundations of Life	1, 2, 3
LS4003	4	Scientific and Laboratory Skills	1
LS4004	4	Human Physiology	1, 2, 3
LS5001	5	Molecular Biology of the Cell	1, 2, 3
LS5002	5	Proteins and Metabolism	1, 2, 3
LS5009	5	Pathobiology	1, 2
LS5026	5	Concepts in Evolutionary Biology	1

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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Module Code: LS4001
Module Title: Genes, Cells and Tissues
Credits: <ul style="list-style-type: none"> • Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Level: 4
Prerequisites: study of basic biology
Suitability: <ul style="list-style-type: none"> • Study Abroad/International Exchange students for Study Options 1, 2 and 3 • Not open to Erasmus students, as level 4.
Content: <p>This module introduces students to the biology of cells; molecular, evolutionary and population genetics; biodiversity; tissue types in the human body; and an introduction to bacteria, viruses and other disease-causing pathogens.</p> <p>Laboratory practicals give students the opportunity to learn and demonstrate a selection of current techniques used to study cells, tissues, chromosomes and microbes. LS4001 provides a solid foundation for more advanced that expand knowledge in cell biology, anatomy, physiology, genetics and microbiology.</p> <p>➤ Overall topics:</p> <ul style="list-style-type: none"> • basic preparative techniques for examination of biological specimens by light microscopy and correct use of light microscopes • an introduction to the origins of life, cell structure and function of organelles in prokaryotic and eukaryotic cells • an introduction to genes, genomes and chromosomes • a review of the genetic processes in cells including DNA structure, replication, transcription and translation • an introduction to patterns of inheritance, Mendelian genetics, population and evolutionary genetics, basic calculations in inheritance and population genetics • an introduction to genetic recombination and mapping • an introduction to cytogenetics • an introduction to modern molecular techniques including cloning, recombinant DNA technology and DNA analysis • an introduction to early human development • structural and functional characteristics of epithelium, connective tissues, muscle and nervous tissues and their subtypes • an introduction to viruses, bacteria and microbial eukaryotes of medical importance

Study Option 1 = Whole Year
 Study Option 2 = Autumn
 Study Option 3 = Spring

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- basic microbiological techniques
- **Autumn Semester topics:**
 - Cell Membranes
 - Practical 1 (Microscopy)
 - Cell Organelles
 - Genetics: DNA, Genes & Chromosomes
 - Genetics: DNA Replication
 - Genetics: Transcription & translation
 - Genetics: Mendelian Inheritance
 - Practical 2 (Cytogenetics)
 - Genetics: Recombination & Mapping
 - Genetics: Population Genetics
 - Bacteria
 - Viruses
- **Spring Semester topics:**
 - Practical 3 (Microbiology)
 - Eukaryotes of Medical Importance
 - Biodiversity
 - Introduction to Evolution
 - Histology
 - Practical 4 (Histology)
 - Molecular Techniques in Action

Teaching: lectures, seminars and practical sessions

Assessment:

- **Study Option 1:**
 - Portfolio of online MCQ tests and practical skills observation (30%)
 - Online test – Autumn (30%)
 - End of year exam (40%)
- **Study Option 2:**
 - Online test – Autumn (75%)
 - Practical 1 online quizzes (25%)
- **Study Option 3:**

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

- Online practical quizzes (100%)

Note: methods of assessment and weighting are indicative only

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Module Code: LS4002

Module Title: The Biochemical Foundations of Life

Credits:

- Full Year: 8 (US) 15 (ECTS)
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 4

Prerequisites: study of basic chemistry

Suitability:

- Study Options 1, 2 & 3
- Not open to Erasmus students, as level 4

Content:

The module is intended to introduce basic chemistry from first principles with particular emphasis on application to biology and biochemistry. The module also provides students with an understanding of the structure and function of the major classes of biological molecules.

➤ **Autumn Semester topics:**

- **Atoms and chemical bonding:** structure of the atom, electronegativity, resonance effects, bonding within molecules (covalent) and between molecules (ionic, hydrogen, van der Waals).
- **Moles, concentrations and dilutions:** molecular mass, the concept of the mole, calculating concentrations of solutions and dilutions.
- **Building blocks for biomolecules:** structure of simple molecules, small carbon to large biomolecules, identification and naming of common functional groups.
- **Giving biomolecules shape:** 3D biomolecular shapes and isomerism, configuration and conformations.
- **Reactivity of the carbonyl group**
- **The aqueous environment:** water, acids, bases, pH, pKa and buffers
- **Introduction to Bioanalytical methods:** basic techniques including mass spectroscopy, separation techniques.
- **Laboratory skills:** titrations, qualitative biochemical analysis, reaction rates, use of standard curves in quantitating unknown analytes.

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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➤ **Spring Semester topics:**

- **Introduction to the Biomolecules; Proteins and enzymes:** amino acids, peptides and protein structure and function, enzyme kinetics (K_m , V_{max} , competitive and noncompetitive inhibitors);
- **Introduction to Carbohydrates:** mono-, di- and polysaccharides, structure and functions;
- **Introduction to Lipids:** fatty acids, triacylglycerols, structural lipids
- **Metabolism and energy transformations:** basic biochemical reactions, metabolic pathways and energy transformations
- **Laboratory skills:** titrations, qualitative biochemical analysis, reaction rates, use of standard curves in quantitating unknown analytes.

Teaching: weekly lectures and practical sessions

Assessment:

➤ **Study Option 1:**

- Online MCQ test – Autumn (40%)
- Practical online test (30%)
- Portfolio of six small tests (30%)

➤ **Study Option 2:**

- Online MCQ test
- Two small tests

➤ **Study Option 3:**

- Practical online test
- Small tests

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Module Code: LS4003

Module Title: Scientific and Laboratory Skills

Credits:

- Full Year: 8 (US) 15 (ECTS)

Level: 4

Prerequisites: None

Suitability:

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

- Study Option 1 only
- Not open to Erasmus students, as level 4

Content:

This module provides a firm foundation in general scientific and laboratory skills. Students are introduced to the nature of studying in higher education and the key skills they will need in developing their professional development portfolio in the biosciences. Scientific analytical and lab/practical skills are developed, together with essential mathematics and statistical skills for life scientists. A significant component of the module consists of the development of basic research skills such as practical skills in the laboratory, the principles of experimental design and the statistical analysis of data.

➤ **Generic study skills:**

- Time management and planning – use of university information systems; planning and time management of work; planning revision.
- Independent study – Learning Resource Centre (LRC) resources, research databases, and independent reading. Use of reference sources.
- Teamworking, communication, responding to feedback and reflective skills.
- Awareness of employment opportunities, career information sources and events, and identification of relevant key skills developed during the year.
- Exam preparation, revision and technique.

➤ **Maths, Computing and Data Presentation:**

- Foundation mathematics and information technology for the biosciences; accuracy; standard powers of 10; scientific notation.
- Probability, concentrations and dilutions, rates of reaction
- Mathematical models in the biosciences; exponential growth/decay and transformation of data, including logarithms
- Use of spreadsheets for graph plotting and interpretation, model simulation
- Scientific communication
- Referencing, plagiarism and collusion Identifying appropriate research literature sources, use of information technology and the internet.

➤ **Experimental design, basic statistics and SPSS:**

- Asking questions and developing hypotheses.
- Understand the design of basic experiments (e.g. variation, sampling and the need for replication; randomisation and blocking).
- Introduction to statistical software.
- Statistical tests: types of data and the normal distribution, descriptive statistics, t-tests, correlation.

➤ **Laboratory skills:**

- Introduction to COSHH regulations and good laboratory practice.

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

<ul style="list-style-type: none"> • Molar calculations, dilutions and conversion of units • Precision and accuracy in the laboratory. • Colorimetry – Beer-Lambert’s Law. • Safe handling of microorganisms. • Basic separation techniques. • Enzyme-catalysed reaction rates.
Teaching: lectures, workshops/seminars, tutorials and practicals
Assessment: Study Option 1: <ul style="list-style-type: none"> • End of year laboratory practical exam (50%) • Professional development portfolio (20%) • Portfolio of on-line tests which contains 6 math/statistics test, each contributing 5% (30%)
Note: methods of assessment and weighting are indicative only
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Module Code: LS4004
Module Title: Human Physiology
Credits: <ul style="list-style-type: none"> • Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Level: 4
Prerequisites: basic study of biology
Suitability: <ul style="list-style-type: none"> • Study Options 1, 2, 3
Content: The module introduces students to fundamental physiological concepts which underpin the coordinated functioning of the human body, including homeostasis, cellular communication and movement of molecules through body compartments. The main physiological systems of the body are covered, including cardiovascular,

Study Option 1 = Whole Year
 Study Option 2 = Autumn
 Study Option 3 = Spring

digestive, endocrine, muscle, renal, respiratory, immune and nervous systems.

➤ **Autumn Semester topics:**

- **Basic Concepts in Physiology** - Defining physiology; the concept of homeostasis; movement of molecules and ions through body compartments; cellular communication; signal transduction pathways.
- **Respiratory Physiology** - Organisation of the respiratory system; ventilation, exchange of gases in alveoli and tissues; transport of oxygen and carbon dioxide in blood, control of respiration; hypoxia; selected examples of disorders of the respiratory system.
- **Cardiovascular Physiology:** blood, plasma, blood cells, overall design of cardiovascular system; cardiac action potentials, cardiac ECG, excitation-contraction coupling and the cardiac cycle; cardiac output, control of heart rate and stroke volume; relationship of pressure, flow and resistance; arterial blood pressure and its measurement, control of vessel tone, the function of capillaries, the function of veins; regulation of arterial pressure by control systems; selected examples of pathophysiology.
- **Endocrine Physiology:** hormone structure and synthesis, hormone transport in the blood, hormone metabolism and excretion, mechanisms of hormone action, control of hormone secretion; selected examples of pathophysiology.

➤ **Spring Semester topics:**

- **Renal Physiology** - structure of the kidneys and urinary tracts. Filtration, reabsorption and secretion in the nephron; composition of urine; control of micturition; regulation of fluid and electrolytes; selected examples of pathology of the urinary system.
- **Neurophysiology** - structure and classification of neurons; membrane potentials, the resting potential, graded potentials and action potentials; synapses, excitatory and inhibitory chemical synapses; neurotransmitters and neuromodulators; modification of synaptic transmission; selected examples of neuropathology.
- **Gastrointestinal Physiology** - Digestion and absorption of carbohydrate, protein, fat, vitamins, minerals, and water; regulation of secretion and motility of the gastrointestinal tract; selected examples of pathology of the gastrointestinal system.
- **Muscle Physiology** Skeletal muscle, molecular mechanisms of contraction, the neuromuscular junction, mechanics of single fibre contraction, skeletal muscle energy metabolism, types of skeletal muscle fibres; selected pathologies of skeletal muscle; smooth muscle, excitation-contraction coupling, types of smooth muscle.

Teaching: lectures, workshops/seminars, tutorials and practicals

Assessment:

- Study Option 1:
 - End of year exam (40%)
 - Online practical MCQ test (40%)
 - 2 x coursework assignments (20%)

- Study Option 2:
 - Online practical MCQ test (80%)
 - Written coursework (20%)

- Study Option 3:
 - Exam (33%)
 - Practical MCQ test (33%)
 - Written coursework (33%)

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Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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LEVEL 5 – INTERMEDIATE

Module Code: LS5001
Module Title: Molecular Biology of the Cell
<ul style="list-style-type: none"> • Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Level: 5
Prerequisites: introductory university-level study of cell biology such as LS4001 or similar
Suitability: Study Option 1 only
<p>Content:</p> <p>The module builds on topics covered in LS4001 (Genes, Cells and Tissues) or similar and explores more advanced concepts in cell and molecular biology. The module provides insight into the structure and function of cells, and takes an integrated approach to looking at how cells respond to changes in their environment – from receptor interactions and intracellular signalling pathways through to the regulation of gene expression and changes in cellular processes.</p> <p>➤ Autumn Semester: Cell Biology and Cell Signalling</p> <ul style="list-style-type: none"> • an overview of cellular and molecular processes in the cell • cell structure, adhesion and motility • intracellular trafficking and molecular motors • cell cycle and cell death • an introduction to receptor activation and intracellular signalling pathways • MAPK signalling • PKC and NF-κB signalling • Western blot <p>➤ Spring Semester: Molecular Biology</p> <ul style="list-style-type: none"> • DNA packaging, chromatin modification and epigenetic regulation • DNA packaging, chromatin modification and epigenetic regulation • transcription and post-transcriptional processing • translation and the regulation of gene expression • mutation and the genetic code • practical methods relevant to cell and molecular biology, for example fluorescence microscopy, RT-PCR

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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Teaching: Lectures, tutorials, workshops and practical sessions/demonstrations

Assessment:

➤ Study Option 1:

- Cell biology data analysis MCQ test (30%)
- Gene expression MCQ test (30%)
- End of year exam (40%)

➤ Study Option 2:

- Cell biology data analysis MCQ test (100%)

➤ Study Option 3:

- 1.5-hour online MCQ test - transcriptional regulation and gene expression (50%)
- Online exam - covering translation and genetic code (50%)

Note: methods of assessment and weighting are indicative only

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Module Code: LS5002

Module Title: Proteins and Metabolism

Credits:

- Full Year: 8 (US) 15 (ECTS)
- Single Semester: 4 (US) 7.5 (ECTS)

Level: 5

Prerequisites: study of introductory biomolecules at university level such as [LS4002](#) or similar.

Suitability: Study Options 1, 2 & 3

Content:

The module provides students with knowledge of the structure and methods of analysis of proteins, with particular emphasis on enzymes. This is followed by the study of the major catabolic and anabolic pathways and investigates how organisms obtain and use energy. These processes, and their regulation in health and disease, are considered at the molecular level, which involves many proteins including enzymes.

➤ **Autumn Semester: Protein Structure, Function and Analysis**

Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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- **Amino Acids** - Revision of basic structure and chemical properties. Structure of side chains.
- **Protein Structure** - Structure and properties of the peptide bond, levels of protein structure relating to primary structure and function of proteins. Methods of protein structure determination.
- **Enzymes** - Structural features of enzymes relating to function. Measurement of enzyme activity, including calculation of kinetic parameters and enzyme inhibition.
- **Protein Purification Techniques:** Ultracentrifugation, chromatography, electrophoresis as applied to the purification of proteins.
- **Bioenergetics & Oxidative Phosphorylation:** Free energy changes, reduction potentials, coupled reactions and electron transport. Organisation of the inner mitochondrial membrane and its relationship to the chemiosmotic theory.

➤ **Spring Semester: Metabolism**

- **Carbohydrate Metabolism:** Integration and regulation of glycolysis/ gluconeogenesis, glycogen metabolism, pentose phosphate pathway and the citric acid cycle.
- **Amino Acid Metabolism:** Integration and regulation of amino acid metabolism.
- **Lipid & Cholesterol Metabolism:** Integration and regulation of β -oxidation, ketone body metabolism, fatty acid synthesis, triglyceride metabolism and cholesterol synthesis. Classification and roles of serum lipoproteins.

Teaching: weekly lectures, workshops and practicals

Assessment:

➤ **Study Option 1:**

- Enzymes, Protein Structure and Protein Purification Workbook 1 (30%)
- Metabolism Workbook 2 (40%)
- Practical portfolio (30%)

Study Option 2:

- Practical 1
- Practical 2
- Workbook 1

Study Option 3:

- TBC

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Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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Module Code: LS5009
Module Title: Pathobiology
Credits: <ul style="list-style-type: none"> • Full Year: 8 (US) 15 (ECTS) • Single Semester: 4 (US) 7.5 (ECTS)
Level: 5
Prerequisites: prior university-level study of biological sciences
Suitability: Study Options 1 or 2
Content: <p>The module discusses cellular mechanisms of disease. In addition, it considers the role of cellular pathology in the context of other pathology disciplines such as clinical pathology. Particular emphasis is given to laboratory aspects of cellular injury and their application in routine diagnosis.</p> <p><i>Note that some topics may swap semesters.</i></p> <p>➤ Topics:</p> <ul style="list-style-type: none"> • Pathogenesis of cell injury: Morphological features of cell injury, acute cellular oedema, fatty change, storage diseases, necrosis and apoptosis. Genetic and acquired disease, inflammation, cancer and infertility.. • Neoplasia • Definition of epidemiology, its role in public health, application of basic statistical methods in epidemiology. • Review of histological and cytological methods, including sources and types of specimen, tissue treatments and processing and staining. Applications of microscopes in disease diagnosis (such as light, fluorescence and electron microscopy). • Histochemistry and immunocytochemistry and its use in diagnostic pathology. • Image capture, image processing and image analysis techniques and their use in cellular pathology including quantification and histomorphometry. • Medical genetics-including chromosomal and monogenic disorders, complex diseases, genomic medicine, pharmacogenomics and ethical issues.
Teaching: weekly lectures, tutorials and practicals
Assessment: <p>➤ Study Option 1:</p> <ul style="list-style-type: none"> • End of year exam (50%)

Study Option 1 = Whole Year
 Study Option 2 = Autumn
 Study Option 3 = Spring

- Online practical test – breast cancer (25%)
- Poster presentation (25%)

➤ Study Option 2:

- Online practical test – breast cancer

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Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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Module Code: LS5026
Module Title: Concepts in Evolutionary Biology
Credits: <ul style="list-style-type: none"> • Full Year: 4 (US) 7.5 (ECTS)
Level: 5
Prerequisites: university-level study of biology/biological sciences
Suitability: Study Options 1 or 2
<p>Content:</p> <p>Students are introduced to the biodiversity of organisms and their evolutionary relationships; the fundamental concepts of evolution such as natural selection, adaptation, speciation, and coevolution; evolutionary genomics and genetics; and an introduction to phylogenetics and bioinformatics. These subjects are further examined in terms of the latest knowledge, techniques and research in modern evolutionary theory.</p> <p>The module will introduce the main characteristics of these disorders, current approaches to understanding and the main treatment options. The module will also explore how cognitive functions can be localised within the brain. Cognitive impairments that can arise in some psychological disorders will be examined. Finally, examples of how neurobiological data can help inform an understanding of psychological disorder will be evaluated.</p> <p>➤ Autumn Semester:</p> <ul style="list-style-type: none"> • Concepts in Biodiversity • Diversity of plants • Diversity of invertebrates • Diversity of vertebrates • Genes, genomes & variants • Principles of population genetics • Molecular genetics in evolution <p>➤ Spring Semester:</p> <ul style="list-style-type: none"> • Natural selection and adaptation • Sexual selection • Speciation and extinction • Co-evolution through time • Interactions: cooperation & conflict • Co-evolution: Host-Pathogen • Human evolution

Study Option 1 = Whole Year
 Study Option 2 = Autumn
 Study Option 3 = Spring

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Teaching: weekly lectures and workshops

Assessment

Study Option 1:

- Computer practical 1: population genetics (15%)
- Computer practical 2: natural selection (15%)
- Computer practical 3: Phylogenetics (20%)
- Exam (50%)

Note: methods of assessment are indicative only

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Study Option 1 = Whole Year
Study Option 2 = Autumn
Study Option 3 = Spring

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