



Schola Europaea

Office of the Secretary-General

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## **Biology syllabus 4th and 5th Year (2 periods)**

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**APPROVED BY THE JOINT TEACHING COMMITTEE ON 9, 10 AND 11 FEBRUARY 2011 IN BRUSSELS**

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**Entry into force: 1<sup>st</sup> September 2011 for the Year 4**

**Entry into force: 1<sup>st</sup> September 2012 for the Year 5**

### **1) General introduction:**

The aim of the 4<sup>th</sup> and 5<sup>th</sup> year Biology course is

- a. to promote respect, responsibility, curiosity and understanding of ourselves and the environment.
- b. to appreciate the multidisciplinary nature of Biology showing the connections with other subjects e.g. Physical Sciences, ICT, Mathematics and Geography and to integrate the historical, social, ethical, cultural and technological influences that place biology into its present social context.
- c. to provide an overall understanding of Biology for all students.
- d. to prepare the students for advanced Biology courses.
- e. to appreciate the importance of the scientific process in the study of Biology.

### **2) Knowledge with understanding:**

Train students to be able to demonstrate knowledge and understanding of

- a. scientific phenomena, facts, laws, definitions, concepts and theories.
- b. scientific vocabulary, terminology, conventions (incl. symbols, units).
- c. scientific instruments and apparatus, incl. manipulative skills and aspects of safety.
- d. scientific and technological applications with their individual, social, economic and environmental implications.
- e. the difference between models and reality.

### **3) Methodological aims/ Using information:**

Train students to be able to use oral, written, symbolic, graphical and numerical forms of presentation to

- a. locate, select, organize and present information from a variety of sources (book, video, diagram, picture etc.).
- b. translate information from one form to another.
- c. manipulate numerical and other data.
- d. identify patterns, report trends and draw inferences.
- e. present reasoned explanations of phenomena, patterns and relationships.
- f. make predictions and propose hypotheses, solve problems, including some of a quantitative nature.

in a clear and accurate manner.

### **4) Experimental skills:**

Train students to

- a. work safely in a laboratory situation.

N.B. Teachers must be aware of local safety regulations and teachers and pupils must respect them.

- b. use techniques, apparatus and materials.
- c. follow oral and written instructions.
- d. make and record observations and measurements (e.g. draw simple diagrams of specimens viewed under the microscope, record data from experiments and draw apparatus diagrams).
- e. present results of experiments in different ways (e.g. tables, graphs, text).
- f. interpret and evaluate experimental observations and data (incl. basic understanding of degree of accuracy).
- g. plan and carry out investigations, evaluate methods and suggest possible improvements.
- h. cooperate with others during group activities (e.g. sharing of duties).
- i. organise time (during experiments and group work).

## **5) Assessment**

Time spent on assessment must be geared to the total course time available (2 periods per week).

### **A. Assessment will consist of**

- a. observation of experimental work, and evaluation of its quality.
- b. evaluation of pupils' capacity to understand and summarise a scientific text.
- c. evaluation of experimental reports, written class work and homework.
- d. monitoring of the quality of pupils' oral contributions in class discussion.
- e. a number of formal tests (one or two tests per semester).
- f. a year 5 harmonised exam, in accordance with the general rules of the European Schools and the appropriate decisions of the Board of Governors. This examination is harmonised across all language sections and is set and approved by all the teachers teaching the course in year 5.

### **B. Remarks about the exams**

- a. The written examinations should test basic knowledge and understanding and pupils' ability to apply knowledge to a situation which may be new to them. The accent should be on the application of principles rather than the reproduction of learned processes.
- b. Examinations should be set and marking schemes devised in such a fashion that the pupil of average ability in the subject, who has worked well, can achieve a satisfactory mark.
- c. In setting examinations, in years 4 and 5, it is important to bear in mind that the subject is compulsory. Examinations should ensure that no more than 40% of the question require only rote learning.

Topics [ links to syllabuses of other years]	Suggested number of periods	Core	Limits of the syllabus	Suggested practical activities
<p><b>4.1 Cell biology</b> [7.1]</p> <p>[1.6]</p>	<p>3</p> <p>2</p> <p>1</p>	<ul style="list-style-type: none"> <li>●Appreciation of the cell as the unit of an organism.</li> <li>●Generalised diagrammatic representation and overview of the function of the following structures and organelles: <ul style="list-style-type: none"> <li>-mitochondria</li> <li>-chloroplasts</li> <li>-ribosomes</li> <li>-nucleus</li> <li>-cell membrane</li> <li>-vacuole</li> <li>-cell wall.</li> </ul> </li> <li>●Organic molecules: lipids, proteins, carbohydrates: <ul style="list-style-type: none"> <li>-structure</li> <li>-synthesis of large molecules from basic units</li> <li>-importance within the cell.</li> </ul> </li> <li>●Recognise and classify the levels of organisation (one example from plant and animal kingdom): <ul style="list-style-type: none"> <li>-atom</li> <li>-molecule</li> <li>-cell</li> <li>-tissue</li> <li>-organ</li> <li>-organism.</li> </ul> </li> <li>●Appreciation of the difference between unicellular and multicellular organisms.</li> </ul>	<p>Limit differences between eukaryotes/ prokaryotes to the presence/absence of a nucleus only.</p> <p>No details of:</p> <ul style="list-style-type: none"> <li>-molecular structure of the cell membrane</li> <li>-aerobic respiration and photosynthesis required except overall equations.</li> </ul> <p>Chemical formulae of molecules as in EUROBIO 4/5.</p> <p>Block diagrams of molecular structure only: see EUROBIO 4/5.</p>	<p>Preparation and observation of microscope slides; animal, plant cells and a unicellular micro-organism.</p> <p>Biological drawing of the cells viewed under the microscope.</p> <p>Demonstrate the physical and chemical properties of these substances using food.</p>

<p><b>4.2 Plant structure and physiology</b></p>	<p>4</p>	<ul style="list-style-type: none"> <li>•Revision of the notion of concentration.</li> <li>•Transport across the cell membrane (carbon dioxide, oxygen, ions and water) <ul style="list-style-type: none"> <li>-diffusion</li> <li>-osmosis</li> <li>-active transport.</li> </ul> </li> </ul>	<p>No details concerning the role of specific components of the cell membrane.</p>	<p>Demonstration of Brownian movement.</p> <p>Demonstrating the notion of concentration by tasting.</p> <p>Experiment to show relationship between size, surface area to volume ratio and diffusion.</p> <p>Demonstration or class practical using diffusion and osmosis.</p>
<p>[2.5]</p>	<p>4</p>	<ul style="list-style-type: none"> <li>•Leaf structure and function.</li> </ul>	<p>No details of the cellular mechanisms of photosynthesis.</p> <p>No details of the factors involved in the opening and closing of stomata.</p> <p>Only the basic role of chlorophyll, no other pigments.</p>	<p>Observe prepared slides of the cross-section of a leaf.</p> <p>Experiments to show factors that effect photosynthesis.</p> <p>Determine the distribution of stomata using CoCl<sub>2</sub>-Paper.</p> <p>Preparation and observation of a microscope slide of leaf epidermis to show stomata (e.g. Polypode).</p> <p>Biological drawing of the stomata.</p> <p>Use osmosis to show stomata opening and closing under microscope.</p>
<p>[2.5]</p>	<p>1</p>	<ul style="list-style-type: none"> <li>•Fate of glucose <ul style="list-style-type: none"> <li>-respiration</li> <li>-growth</li> <li>-storage</li> <li>-transport.</li> </ul> </li> </ul>	<p>No biochemical details.</p>	<p>Testing for starch in a leaf.</p> <p>Demonstrate properties of starch as a storage molecule (=&gt; comparison of osmotic effect of starch and glucose).</p>
	<p>3</p>	<ul style="list-style-type: none"> <li>•Root structure and function.</li> <li>•Shoot structure and function.</li> <li>•Transport of water (transpiration, diffusion, root pressure).</li> </ul>	<p>Restrict details to</p> <ul style="list-style-type: none"> <li>-Xylem vessels consist of dead cells</li> <li>-Phloem consists of living cells.</li> </ul>	<p>Observe prepared slides of root and stem cross-sections; biological drawings from observations.</p> <p>Demonstrate the movement of water in plants and selective uptake of substances by roots.</p> <p>Measure the rate of transpiration under different conditions using a potometer.</p> <p>Weighing method to</p>

				show which surface of a leaf transpires more.
<b>4.3 Ecology</b>	1	<ul style="list-style-type: none"> <li>•Understanding of the terminology and levels of organization in ecology with reference to examples: <ul style="list-style-type: none"> <li>-organism</li> <li>-population</li> <li>-community</li> <li>-habitat</li> <li>-ecosystem</li> <li>-biome</li> <li>-biosphere.</li> </ul> </li> </ul>	Ecosystems where light is not the initial energy source not required.	
[3.4, 6.4]	4	<ul style="list-style-type: none"> <li>•main abiotic factors: <ul style="list-style-type: none"> <li>-temperature</li> <li>-characteristics of the soil</li> <li>-water</li> <li>-light.</li> </ul> </li> <li>•main biotic factors: <ul style="list-style-type: none"> <li>-intraspecific: <ul style="list-style-type: none"> <li>competition concerning food and reproduction</li> </ul> </li> <li>-interspecific: <ul style="list-style-type: none"> <li>•predator</li> <li>•prey</li> <li>•symbiosis</li> <li>•competition/ reduction of competition</li> <li>•parasitism</li> <li>•commensalism.</li> </ul> </li> </ul> </li> </ul>		Design and/or carry out an experiment to show the importance of an abiotic factor.
[2.5]	1 2	<ul style="list-style-type: none"> <li>•Ecological niche.</li> <li>•Feeding relationships <ul style="list-style-type: none"> <li>-producer/ consumer/ decomposer</li> <li>-food chain</li> <li>-food web.</li> </ul> </li> </ul>		Experiment using leaf litter to construct food chains, food webs and pyramid of numbers.
[2.5]	2	<ul style="list-style-type: none"> <li>•Pyramids of numbers and biomass.</li> <li>•Flow of energy.</li> </ul>		
[2.5, 1.4]	2	<ul style="list-style-type: none"> <li>•Cycles of matter (C, N).</li> </ul>	Limit to an appreciation of the cycling of Nitrogen (No chemical details of the nitrogen cycle).	
	1	<ul style="list-style-type: none"> <li>•Changes in population: <ul style="list-style-type: none"> <li>-factors affecting growth curves</li> <li>-predator-prey interaction.</li> </ul> </li> <li>•Field trip of at least 2 days to study an ecosystem, applying the aforementioned processes and vocabulary.</li> </ul>		Use of computer simulations to show changes in size of population.
	2	<ul style="list-style-type: none"> <li>•Comparison of the ecosystem studied with another inaccessible ecosystem (e.g.</li> </ul>		Collection, analysis and presentation of data from field work.



		overview of function of a nephron).		kidney.
<b>5.1 Communication within the human body</b> [[2.4: Senses]] [3.3 Substance abuse]	6	<ul style="list-style-type: none"> <li>•Nervous system:             <ul style="list-style-type: none"> <li>-nerve cell, Schwann cell and synapses (anatomy and function, simple)</li> <li>-central and peripheral nervous system (overview)</li> <li>-Stimulus and reaction, reaction time</li> <li>-drugs (general effect and one example).</li> </ul> </li> </ul>	No details of the mechanisms of conduction of a nervous impulse along nerve cells.	Observation of prepared slides of neurons. Measuring reaction time under different conditions. Model for saltatory conduction using dominoes.
	5	<ul style="list-style-type: none"> <li>•Hormones             <ul style="list-style-type: none"> <li>-Position of endocrine glands, hormones produced and a summary of their effects</li> <li>-short comparison with exocrine glands</li> <li>-interaction between nervous system and hormone system (pituitary gland)</li> <li>-one example of feedback control in homeostasis.</li> </ul> </li> </ul>	Limit comparison of different types of glands to EUROBIO 4/5.	
<b>5.2 Reproduction of plants and animals</b>  [1.6]  [1.6]  [1.6]  [1.6]	3	<ul style="list-style-type: none"> <li>•Chromosome structure.</li> <li>•DNA             <ul style="list-style-type: none"> <li>-structure</li> <li>-replication</li> <li>-mutation</li> <li>-DNA as code for proteins (triplet code).</li> </ul> </li> </ul>	Limit details of chromosome, DNA and DNA replication to EUROBIO 4/5. No details of the mechanisms of mutation. No protein synthesis required except that there is a necessity to use sequences of three bases in order to code for 20 different amino acids.	Construct a model of a chromosome. Extract and stain DNA from plant cells. Construct models of DNA.
	4	<ul style="list-style-type: none"> <li>•Mitosis.</li> <li>•Meiosis.</li> <li>•Recognize stages requiring mitosis and meiosis in the life cycle of             <ul style="list-style-type: none"> <li>-flowering plants (including revision of pollination, fertilization, fruit development, germination, growth, flowering)</li> <li>-mammals (fertilization, growth and development, gametogenesis).</li> </ul> </li> </ul>	No crossing over. Life cycle: general overview only.	Microscopic observation and recording of different stages of mitosis and meiosis.
	1	<ul style="list-style-type: none"> <li>•Reproductive organs of humans (revision).</li> </ul>		
	3	<ul style="list-style-type: none"> <li>•Summary of the physical changes at puberty in males and females.</li> <li>•Menstrual cycle and its hormonal control.</li> </ul>	Details of gametogenesis and hormonal control of spermatogenesis are not required.	
	2	<ul style="list-style-type: none"> <li>•Development from fertiliza-</li> </ul>	No details of fertilisation.	Visit to family plan-

