



## Liste de concepts-clés

Extraite du « Guide to the International Biology Olympiad »

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L'usage que vous pouvez faire d'une telle liste en vue de préparer l'épreuve olympique est de la parcourir et de vous demander à chaque ligne ce que cela vous évoque, quel lien vous établissez avec d'autres termes de la liste etc.

Il ne s'agit pas de **savoir**, par exemple, les formules des sucres, mais bien de se rappeler que le lactose est un sucre du lait et que la lactase est l'enzyme (autre nom : bêta galactosidase) permettant sa dégradation. Il y a évidemment des sujets que vous n'avez pas encore rencontrés, c'est normal : ceci est la liste des sujets de l'Olympiade internationale.

Pas de panique, donc, mais de la curiosité !

Les concepts contenus dans la liste ne doit pas être « bloqués » : elle est faite **pour vous remuer les méninges** et vous inciter à consulter, chaque fois que vous avez un problème, un bouquin (ex. Campbell, Raven) ou Internet (Wikipedia...) ou votre professeur !

N.B. La partie « Biosystematics » est à considérer de loin...

**A GUIDE TO THE  
INTERNATIONAL BIOLOGY OLYMPIAD**

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## A Guide to the International Biology Olympiad

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# APPENDIX I

## Content Theoretical part of the IBO

The IBO theoretical examination should concentrate on biological concepts applied to the majority of organisms of the same group. It should not contain specific facts, exceptions or knowledge about local organisms that require special or local experiences.

The majority of questions should test students' understanding, science process skills and application of their biological knowledge. The host country should definitely make every effort to deliver theoretical tasks requiring sound biological understanding, rather than being based upon high-end / cutting-edge knowledge. Questions testing only knowledge should be expelled.

The maximum obtainable points for correct answers of each particular question have to be stated in the examination papers.

Questions concerning Principles of Scientific Reasoning and Principles of Biological Methods should be included in the Theoretical test, which should cover the following 7 topics in the indicated proportions.

In the IBO tasks the names of organisms will be the national names (no description) together with the scientific names (Latin) in brackets. Any description instead of name is prohibited. The organizers should construct the questions so that the name of the organism is not a key element for answering; otherwise they should use very well known organisms (general representatives of a group) mentioned in the list for biosystematics.

### I **Cell biology :** **(20 %)**<sup>4</sup>

#### **Structure and function of cells**

- Chemical components
  - Monosaccharides; disaccharides; polysaccharides
  - Lipids
  - Proteins: amino acids, three letter symbol; structure of proteins;
    - . chemical classification of proteins:  
simple proteins and conjugated proteins
    - . functional classification of proteins:  
structural proteins and enzymes
  - Enzymes
    - . Chemical structure: apoenzyme and coenzyme
    - . Model for enzyme action: enzyme binds with substrate
    - . Denaturation

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<sup>4</sup> Percentage representing points in the test

- . Nomenclature
- Nucleic Acids : DNA, RNA
- Other important compounds
  - . ADP and ATP
  - .  $\text{NAD}^+$  and NADH
  - .  $\text{NADP}^+$  and NADPH
- Organelles
  - nucleus
    - nuclear envelope
    - (nucleohyaloplasm)
    - chromosomes
    - nucleoli
  - cytoplasm
    - cell membrane
    - hyaloplasm
    - mitochondria
    - endoplasmatic reticulum
    - ribosomes
    - Golgi apparatus
    - lysosomes
    - vacuole membrane
    - proplastides
    - plastides
      - . chloroplasts
      - . chromoplasts
      - . leucoplasts (e.g. amyloplasts)

Plant cells are surrounded with a cell wall

- Cell metabolism
  - Breakdown of carbohydrates
    - . Anaerobic break down (anaerobic respiration) of glucose: glycolysis
    - . Aerobic break down (aerobic respiration) of glucose: glycolysis  
citric acid cycle  
oxidative phosphorylation
  - Dissimilation of fats and proteins
  - Assimilation
    - . Photosynthesis
    - . Light reaction
    - . Dark reaction (Calvin cycle)
- Protein synthesis
  - Transcription
  - Translation
  - Genetic code

- Transport through membranes
  - Diffusion
  - Osmosis, plasmolysis
  - Active transport
- Mitosis and meiosis
  - Cell cycle: interphase (replication) and mitosis (prophase - metaphase - anaphase - telophase)
  - Chromatids, equatorial plate, haploid and diploid, genome, somatic and generative cells, gamete, crossing over
  - Meiosis I and meiosis II.

### **Microbiology**

- Prokaryotic cell organization
- Morphology
- Phototrophy and chemotrophy

### **Biotechnology**

- Fermentation
- Genetic manipulation of organisms

## **II Plant anatomy and physiology**

**(15 %)**

(with emphasis on seed plants)

Structure and function of tissues and organs involved in:

- Photosynthesis, transpiration and gas exchange
  - Leaf : structure; function stomata
- Transport of water, minerals and assimilates
  - Root : structure (endodermis)
  - Stem : structure (vascular bundles)
- Growth and development
  - Apical meristem and cambium
  - Germination
- Reproduction (ferns and mosses included)
  - Asexual reproduction (clone forming)
  - Sexual reproduction
    - . Structure of flowers
    - . Pollination
    - . Double fertilization
  - Alternation of generation in seed plants, ferns and mosses

## **III Animal anatomy and physiology**

**(25 %)**

(with emphasis on vertebrates and especially man)

Structure and function of organs and tissues involved in

- Digestion and nutrition
  - Digestive tract (including liver, gall bladder and pancreas)
  - Mechanical and chemical breakdown of food
  - Absorption
  - Food components (water, minerals, vitamins, proteins, carbohydrates and fats)
- Respiration
  - Breathing mechanism
  - Gas exchange
  - Respiratory organs
- Circulation
  - Blood : blood plasma, red blood cells, white blood cells, blood platelets
  - Blood circulation : arteries, capillaries, veins, heart
  - Lymphatic system : tissue fluid, lymph
- Excretion
  - Structure of the renal system
  - Urine production
- Regulation (neural and hormonal)
  - Nervous system : peripheral nervous system, central nervous system (spinal cord and brain), autonomic nervous system (sympathetic and parasympathetic), reflexes, sense organs (eyes and ears)
  - Endocrine system : pituitary gland, thyroid gland, islets of Langerhans, adrenal medulla, adrenal cortex, ovaries and testes
- Reproduction and development
  - Structure and function of male and female reproductive systems
  - Ovulation and menstrual cycle
  - Fertilization
  - Formation of ectoderm, mesoderm, endoderm
  - Embryonic membranes
- Immunity
  - Antigens, antibodies

#### **IV Ethology**

**(5 %)**

- Methodology of Ethology
- Innate and Learned Behavior
- Communication and Social Organization
- Foraging Behavior
- Defensive Behavior
- Mating systems and Parental care
- Biorhythms

**V Genetics and Evolution (20 %)**

- Variation : mutation and modification
- Mendelian inheritance
  - Monohybrid cross
  - Dihybrid cross
  - Polyhybrid cross
- Multiple allelism, recombination, sex linkage
- Hardy-Weinberg principle
- Mechanism of evolution
  - Mutation
  - Natural selection
  - Reproductive isolation
  - Adaptation
  - Fitness

**VI Ecology (10 %)**

- Individual Organisms
  - Unitary and modular organisms
- Population
  - Population structure
    - . dispersion, age, size and sex structure
  - Population dynamics
    - . birth rate, death rate
    - . exponential and logistic growth, carrying capacity
  - Population regulation
    - . metapopulation dynamics
- Biotic Communities
  - Species richness and diversity
  - Niche, competition exclusion principle
  - Interspecific Interactions
    - . competition, predation, symbiosis
  - Community dynamics
    - . succession
  - Terrestrial biomes
  - Aquatic biomes
- Ecosystems
  - Trophic structure
    - . food webs
  - Trophic levels
    - . producers, consumers, decomposers
  - Energy flow
  - Productivity
    - . gross and net primary productivity
    - . energy transfer efficiencies

- Matter flux through ecosystems
- Global biogeochemical cycles
- Biosphere and man
  - Human population growth
  - Pollution
    - . threats of biodiversity
    - . in situ conservation
    - . ex situ conservation

## VII BIOSYSTEMATICS

(5 %)

Structure and function, evolutionary and ecological relationships among typical organisms in the following groups. Knowledge of scientific terms will not be required for successful solution of the tasks. However, competitors should know what the named representatives of genera mentioned below look like.

Domain Archaea	<i>Methanobacterium, Halobacterium, Thermoplasma, Sulfolobus</i>
Domain Bacteria	<i>Agrobacterium, Anabaena, Bacillus, Escherichia, Rhizobium, Salmonella, Streptomyces</i>
Domain Eukarya	
Kingdom Protista	
D. Rhodophyta	<i>Chondrus</i>
D. Phaeophyta	<i>Sargassum</i>
D. Bacillariophyta	<i>Navicula</i>
D. Euglenophyta	<i>Euglena</i>
D. Chlorophyta	<i>Chlamydomonas, Spirogyra, Chlorella, Ulothrix</i>
P. Rhizopoda	<i>Amoeba</i>
P. Zoomastigophora	<i>Trypanosoma</i>
P. Apicomplexa	<i>Plasmodium</i>
P. Ciliophora	<i>Paramecium</i>
Kingdom Fungi	
D. Zygomycota	<i>Mucor</i>
D. Ascomycota	<i>Claviceps, Penicillium, Saccharomyces</i>
D. Basidiomycota	<i>Agaricus</i>
Kingdom Plantae	
D. Bryophyta	<i>Polytrichum, Sphagnum</i>
D. Hepatophyta	<i>Marchantia</i>
D. Rhynophyta	<i>Rhynia</i>

D. Lycopodiophyta	<i>Lycopodium</i>
D. Equisetophyta	<i>Equisetum</i>
D. Polypodiophyta	<i>Pteridium</i>
D. Ginkgoophyta	<i>Ginkgo</i>
D. Pinophyta	<i>Pinus</i>
D. Cycadophyta	<i>Cycas</i>
D. Magnoliophyta	
C. Magnoliopsida	
F. Magnoliaceae	<i>Magnolia</i>
F. Ranunculaceae	<i>Ranunculus, Pulsatilla</i>
F. Rosaceae	<i>Rosa, Malus, Prunus</i>
F. Fabaceae	<i>Pisum</i>
F. Oleaceae	<i>Syringa</i>
F. Fagaceae	<i>Quercus</i>
F. Cactaceae	<i>Opuntia</i>
F. Brassicaceae	<i>Brassica</i>
F. Lamiaceae	<i>Lamium</i>
F. Solanaceae	<i>Solanum</i>
F. Asteraceae	<i>Helianthus</i>
C. Liliopsida	
F. Liliaceae	<i>Lilium, Allium</i>
F. Orchidaceae	<i>Orchis</i>
F. Poaceae	<i>Zea, Triticum, Bambusa</i>
F. Arecaceae	<i>Cocos</i>
F. Araceae	<i>Monstera</i>
Kingdom Animalia	
P. Porifera	<i>Euspongia</i>
P. Cnidaria	
C. Hydrozoa	<i>Hydra</i>
C. Scyphozoa	<i>Aurelia</i>
C. Anthozoa	<i>Corallium</i>
P. Platyhelminthes	
C. Turbellaria	<i>Polycellis</i>
C. Trematoda	<i>Fasciola</i>
C. Cestoda	<i>Taenia</i>
P. Nematoda	<i>Ascaris, Trichinella</i>
P. Mollusca	
C. Gastropoda	<i>Helix, Arion</i>
C. Bivalvia	<i>Ostrea, Mytilus</i>
C. Cephalopoda	<i>Sepia, Octopus</i>
P. Annelida	
C. Polychaeta	<i>Nereis</i>
C. Oligochaeta	<i>Lumbricus</i>
C. Hirudinea	<i>Hirudo</i>
P. Arthropoda	
sP. Crustacea	<i>Astacus, Daphnia, Cyclops</i>

<sub>s</sub> P. Chelicerata	
C. Arachnida	<i>Euscorpius, Araneus, Ixodes</i>
<sub>s</sub> P. Myriapoda	
C. Chilopoda	<i>Scolopendra</i>
C. Diplopoda	<i>Julus</i>
<sub>s</sub> P. Hexapoda	
C. Insecta	
O. Thysanura	<i>Lepisma</i>
O. Odonata	<i>Libellula</i>
O. Blattodea	<i>Blatta</i>
O. Phasmatodea	<i>Carausius</i>
O. Isoptera	<i>Kalothermes</i>
O. Orthoptera	<i>Gryllus, Locusta</i>
O. Phthiraptera	<i>Pediculus</i>
O. Hemiptera	
<sub>s</sub> O. Homoptera	<i>Aphis, Cicada</i>
<sub>s</sub> O. Heteroptera	<i>Gerris, Nepa, Cimex</i>
O. Coleoptera	<i>Calosoma, Leptinotarsa,</i> <i>Ips, Tenebrio, Dytiscus</i>
O. Diptera	<i>Anopheles, Drosophila, Musca</i>
O. Lepidoptera	<i>Papilio, Bombyx</i>
O. Hymenoptera	<i>Ichneumon, Apis, Formica</i>
O. Siphonaptera	<i>Pulex</i>
P. Echinodermata	
C. Asteriodia	<i>Asterias</i>
C. Echinoidea	<i>Echinus</i>
C. Holothuroidea	<i>Holothuria</i>
P. Chordata	
<sub>s</sub> P. Urochordata	<i>Ascidia</i>
<sub>s</sub> P. Cephalochordata	<i>Branchiostoma</i>
<sub>s</sub> P. Vertebrata	
<sup>s</sup> C. Agantha	<i>Petromyzon</i>
<sup>s</sup> C. Gnathostomata	
C. Chondrichthyes	<i>Scylliorhinus, Carcharodon</i>
C. Osteichthyes	
<sub>s</sub> C. Actinopterygii	<i>Acipenser, Clupea, Salmo,</i> <i>Carassius, Muraena</i>
<sub>s</sub> C. Sarcopterygii	<i>Lepidosiren, Latimeria</i>
C. Amphibia	
O. Caudata	<i>Salamandra</i>
O. Anura	<i>Rana, Bufo</i>
C. Reptilia	
O. Testudinata	<i>Testudo</i>
O. Crocodylia	<i>Crocodylus</i>
O. Squamata	<i>Lacerta, Vipera</i>
C. Aves	
O. Struthioniformes	<i>Struthio</i>

O. Sphenisciformes	<i>Spheniscus</i>
O. Ciconiiformes	<i>Ciconia</i>
O. Anseriformes	<i>Anser</i>
O. Falconiformes	<i>Falco</i>
O. Galliformes	<i>Gallus</i>
O. Columbiformes	<i>Columba</i>
O. Strigiformes	<i>Strix</i>
O. Piciformes	<i>Dryocopus</i>
O. Passeriformes	<i>Parus, Passer</i>
C. Mammalia	
O. Monotremata	<i>Ornithorhynchus</i>
O. Marsupialia	<i>Macropus</i>
O. Insectivora	<i>Erinaceus, Talpa</i>
O. Chiroptera	<i>Myotis</i>
O. Rodentia	<i>Mus, Rattus</i>
O. Carnivora	<i>Ursus, Canis, Felis</i>
O. Proboscidea	<i>Elephas</i>
O. Perissodactyla	<i>Equus</i>
O. Artiodactyla	<i>Sus, Bos</i>
O. Cetacea	<i>Delphinus</i>
O. Primates	<i>Cebus, Macaca, Hylobates, Pan, Gorilla, Pongo, Homo</i>
“Virales”	Bacteriophage
“Lichenes”	<i>Parmelia, Cladonia</i>