International Biology Olympiad (IBO) Fout! Bladwijzer niet gedefinieerd.

[1,3]Jan Stoklasa and [2,3]Tomáš Soukup
with the collaboration of [4]Hans Morélis

[1]Department of Didactics, Methodology and History of Natural Sciences, Faculty of Natural Sciences, Charles University, Prague, [2]Czechoslovak Academy of Sciences, Institute of Physiology, Prague, and [3]Institute of Children and Youth, The Coordinating Centre of the IBO, Prague, Czechoslovakia, [4]Institute for Curriculum Development, Enschede, the Netherlands

Content

1. THE CZECHOSLOVAK BIOLOGY OLYMPIAD

The Biology Olympiad (BO) is the oldest and most popular biology competition in Czechoslovakia, since it originated in the mid-sixties. The aim of BO is to attract students to study biological problems and develop their ability to apply biological knowledge to other subjects, e.g. to chemistry, geography or mathematics. It should also help students to select their future profession and to help in seeking out talented students and direct their scientific interests. In the course of time, BO has been divided into categories reflecting the age of students, the level of their thinking and basic knowledge. At present, BO is divided into four categories - D and C for pupils of the 5^{th} - 6^{th} and 7^{th} - 8^{th} grades of primary school and B and A for students of the 1^{st} - 2^{nd} and 3^{rd} - 4^{th} grades of secondary schools.

As has already been emphasized, BO has a longlasting tradition in Czechoslovakia. The number of competitors in all the 4 categories in the first school run has increased from 26.000 in the 1981/82 to 50.000 in the 1988/89 school year. The best students from school rounds continue to compete in district or regional rounds and, for the winners in category A, a national competition is organized.

As regards the categories C, B and A, all participants have to prepare in advance (usually during summer time) a short treatise limited to 15 written pages. The subject of this work is based on one of the selected themes and is related to task orientation for that year and category. It's aim is to teach students a systematic and methodological approach to biological problems and to work with literature. They should acquire the ability to explain shortly the logical reasoning of their contribution and to defend their results. It thus prepares students for the next competition.

The competition itself, has a theoretical part, which usually evaluates the student's knowledge in test form and a practical part which can take place in a laboratory or the terrain, or both. In this practical part, the ability of the student is tested together with his/her theoretical knowledge and their skill in independent formulation of the conclusions based on their own practical results.

2. HISTORY OF THE ORGANIZATION OF THE FIRST INTERNATIONAL BIOLOGY OLYMPIAD (IBO)

Our goal is to improve the skills and talent of students, their independence and initiative, creativity and self-realization in spheres of their interests and future professional specialization at the international level. Because competitions similar to the Czechoslovak BO have taken part also in other European countries, the deputies from responsible ministries and representatives of organizers of BO from Bulgaria, Czechoslovakia, the German Democratic Republic, Poland and the Soviet Union met in Prague in June 1988. They informed each other about the forms and organization of teaching of biology at the primary and secondary school levels and about the organization and scientific content of biological competitions in their countries. All participants supported the idea of international student contacts, their expediency and importance and they agreed that there are favourable conditions for organizing an International Biological Olympiad (IBO). They agreed that the scientific content of the competition should be related to general biological disciplines. The examinations should preferably be in the form of written tests (theoretical part) and practical part in the terrain and/or in the laboratory.

At the seminar, the Organization Rules of IBO were presented and accepted after discussion. Due to the long tradition and extensive experience with the organization of BO, it was decided that the first IBO will be held in Czechoslovakia in July, 1990. It was also accepted that the model of Czechoslovak BO comprising a theoretical test part and a practical part in the laboratory and terrain will be used. At this meeting, Belgium was accepted as a regular participant of the First IBO. The establishment of the coordinating centre (Secretariat) of IBO in Prague was also approved. It was also recommended to nominate coordinators, i.e. representatives from all countries to the preparatory committee of IBO. The second meeting of the preparatory committee was held in May 1989, when the coordinators met during the final round of the 23rd Czechoslovak BO. They approved the current version of the Organization Rules of IBO and selected the preparatory competition tasks of the first IBO.

3. PREPARATORY TEXT FOR THE FIRST IBO

I. The wording of the tasks of the 1st IBO is based on the general aims of the 1st IBO, approved at the second meeting of coordinators of the IBO (1989), and respects Resolution No. 4 of the first meeting of coordinators of the IBO (1988), which reads:

> "The thematic tasks of the IBO should be based in general, on the teaching material of the last two years of secondary school level as regards general biology. Suitable themes are molecular biology, cytology, physiology, anatomy and morphology, genetics, phylogenesis, ecology, etc. The tasks should be prepared in such a way as to be a broad as possible so that the competitors may demonstrate not only actual knowledge and skills, but also their standard of "biological thinking".

II. **Tasks of the Theoretical Part**

will presume more extensive biological knowledge of the competitors and questions may be formulated in several ways:

1) Questions where the competitor selects one correct answer out of the four possible answers offered.
   Example:
   You will find radial vascular bundles:
   A) in the stalk of monocotyledonous plants
   B) in the leaves of conifers
   C) in the roots of dicotyledonous plants
   D) in the stems of some families of dicotyledonous plants, i.e. the marrow family (Cucurbitaceae)

2) Questions where the competitor allocates a certain characteristic or phenomenon, for example, to the name of an object (and vice versa).
   Example:
   Classify the given animals according to their type of breathing:
   A) through the body surface: .....
   B) by means of gills : .....
   C) through tracheae : .....
   D) through the lungs : .....
   Animals: 1 - Diver (Colymbus) 2 - Hydra (Hydra)
   3 - Ant (Formica) 4 - Earthworm (Lumbricus)
   5 - Leaf-nosed bat (Rhinolophus) 6 - Diving beetle (Dytiscus)
   7 - crayfish (Astacus) 8 - Shellfish (Anodonta)

3) The competitor fills in the missing words in a given text or explains in his own words a described phenomenon (presented by means of video technology).
   Example:
   Every day the sun supplies 1 m2 of the ocean with 12.500 kJ. On this same area silicious algae use up 37.5 kJ of energy from the given quantity for

photosynthesis. The increase in the biomass of plankton (zooplankton) feeding on these algae corresponds to E = 1.5 kJ. Finally it can be stated that the increase in the biomass of fish feeding on the plankton equals 0.02 kJ.

a) Sketch the food network of the above organisms and state their nutritional (trophic) level.
b) Draw the food pyramid on graph paper ....

4) Indicated structures (parts of an organism, graphic depiction of a phenomenon), presented by means of video technology, are to be named by the competitor or he/she should explain the connections.
Or vice versa: the competitor fills in the missing names in an incomplete diagram, etc.
Example:
Fill in the names of organisms in the plan of the food chain of a fishpond (Fig. 1 - simplified):
A - Bacteria
B - Algae
C - Infusoria
D - Plankton crustaceans
E - Annelida
F - Non-predatory fish
G - Pike (Esox)
H - Man

5) Other types of questions and tasks will also be used, based on possible combinations of the above types of task.

III. Tasks of the Practical Part

concern certain methods of ecological study of biological objects and will presume the following biological knowledge and especially skills and working techniques from the competitors:

1) Observation through a magnifying glass : on the one hand an ordinary one (magnifying 1.5x and 10x) and on the other hand a stereoscopic magnifying glass (Cytoplast type: see Fig. 2)

2) Observation through a microscope (binocular microscopes of Czechoslovak manufacture will be available with a cross stage and interior lighting)

3) The preparation of thin slices from living or fixed plant material with a razor blade and of a native microscopical preparation, including sample staining with a safranin solution.

4) Sketch of the observed microscopical preparation and description of the structures seen.

5) Knowledge of the common plants of mesophyte deciduous forests and slightly damp or drying meadow plants and a similar knowledge of types of insects living there. Knowledge of the national names of plants and animals is sufficient, although knowledge of the international (Latin) designations would be well appreciated.

6) Knowledge of the classification of known kinds (genera) into higher taxotomic units (families, orders).

7) Dissection of a flower and determination of the flower pattern.

8) Knowledge of the main parts of the skeleton of common field or meadow mammals, birds (songbirds) and the frog.

9) Knowledge of the anatomy of insects.

10) Ability to compare the structure of objects living under differing conditions and characterization of the differences observed.

11) The making of precise records of the observed phenomena in a logbook.

IV. Notes of Examination Procedure

A) The theoretical part will take place in a classroom with the use of video technology, part of the observations of the practical part will be realized by the competitors on an experimental plot, the greater part in a classroom or laboratory.

B) With the use of their knowledge and the above mentioned skills and techniques the competitors will suggest the connections of the biological problems and formulate partial conclusions on the basis of precise observation. We do not presume any particular specialization in this area of biology.

In some tasks the competitors will be able to select their own procedures which they consider to be optimum for solving their problem, or they may request more detailed instructions from the organizers.

In some tasks the guideline for the work will be an illustration (e.g. a plan of procedure, documentary photographs or even a video recording).

C) A non-competitive part of the programme will be a visit to some cultural event (e.g. an organ concert), as well as an excursion to places of natural science and historical interest in the environments of Olomouc (special clothing suitable for an outing in the terrain).

V. Example of Text of a Similar Set of Tasks

As an example of a set of tasks similar to the test to be presented to competitors at the 1st IBO there follow excerpts from the tasks set in the final (national) round of the Czechoslovak Biology Olympiad for this age group in 1982 dealing with organisms living in and around water.

i) Comparison of the structure of the water-lily (Nymphea sp.) and the Iris (Iris sp.)

All work with biological material should begin with the consideration of what is known about the problem and the formulation of a working hypothesis (i.e. what we expect the result of the work will be). On the basis of this hypothesis we then determine the methods and actual working procedure.In conclusion we compare the results we have

achieved ourselves with the hypothesis.

Material for realization of the task:

Leaf of water-lily with leaf stalk and iris (underground part with growing leaves and part of stalk).

Partial tasks:

A) Formulate briefly the hypothesis of the whole task
B) Formulate the procedure you select to test the hypothesis: break it up into partial tasks
C) Elaborate the partial tasks you have proposed
D) Express partial conclusions

Example:

A) Due to the fact that the water-lily leaf floats, I presume that the pores will be on the upper surface of the leaf. In the case of the iris .....
B) Proposed procedure:
   a) removal of skin of the upper surface of a water-lily leaf, preparing of microscopical preparation, drawing of detail.
   b) ditto with lower side of water-lily leaf
   c),d) ditto with both surfaces of iris leaf etc.

ii) **Body structure of a typical representative of fishpond plankton**

Procedure:

With the aid of a pipette, transfer one of the animals from the dish in front of you onto a cavity glass slide (with a hollow). You have available there various types of plankton organisms, but you must select that animal whose basic outline is in the attached picture (Fig. 4). Do not use a cover slip. Use a magnification of around 10x and be careful that the water on the glass slide do not dry up during observation.

Partial tasks:

A) Write down the name of the animal and classify it in the zoological system.
B) On the attached basic outline draw in and name the eye, both pairs of feelers and the heart. Give a precise description of an important characteristic: the rear end in detail.
C) Observe the heart. Determine the rate of the heart-beat per minute at room temperature.
D) Similarly count the rate of the heart-beat a temperature of 0 - 5 °C, etc.

iii) **Rough quantitative assessment of the number of representatives of individual groups of organisms in the fish pond plankton**

At your workplace you have a sample of plankton. How to take such a sample will be demonstrated to you during the terrain excursion.

Partial tasks:

A) Determine the numbers of individuals of different types (groups) in a 100 ml sample.
Procedure for quantitative assessment: .....

B) According to the attached key diagram determine the most numerous type in the sample:
Method of determination:

iv) **Some organisms in and around water**

Partial tasks:

A) We will show you the main part of a well known short film for schools. In the opening sequence there is a diagram of the structure of the cell of a well known water organism. Also shown are common representatives of a single system.

Procedure:

a) Write down the names of the individual parts of the cell as demonstrated in diagramatic form in the film;
b) Name the type of reproduction you see in the film;
c) Write down progressively the familynames of the organisms of this system;
d) Give the name of an organism which cannot be found in the fishpond plankton.

B) Now you will be shown some further organisms living in and around water. Enter in the table their name (or at least the family) and the system in which they are included.
etc.

v) **Partial conclusions**

A) According to the attached photographs describe the parts of the flower of some water plants. Remember also some of the plants demonstrated in Task 4 and try to give examples of several plants on which you could demonstrate (compare) the original or more derived structure of the flower or other characteristics of the plant.

Example: .....

B) On the basis of the results of the tasks from preceding rounds of the BO and the results of the partial tasks of this round, try to formulate a few partial observations on the relation of the structure of some organ of the plant to the function of this organ, using as examples plants growing around the fishpond.

C) Try to describe (to give reasons for) possible seasonal changes in the relative representation of organisms in the plankton of fishponds.

This text was sent to all participating countries in March, 1990.

4. A BRIEF SURVEY OF THE PREPARATIONS, CONTENT AND RESULTS OF THE FIRST INTERNATIONAL BIOLOGICAL OLYMPIAD (IBO) 1990

I. Basic Information about the Preparation and Results of IBO:

An International seminar, initiated by Czechoslovak organizers, took place in Prague, devoted to biological competitions. A second meeting of coordinators took place at Brno in 1989. This led to the conclusion that an International Biological Olympiad (IBO) should be proposed. Besides confirming the Organization Rules of IBO, it was decided to organize a Coordinating Centre of IBO in Prague and the following general directions of the 1st IBO were approved.

i) The theoretical part of IBO will include "classical" questions. Besides this, the contributions should be covered by individual diagrams, slides and video. The questions should pertain to the general field of biology (especially the last two years of Secondary School level covering general biological interests). The main interests should concern molecular biology, cytology, anatomy, morphology and the physiology of plants and animals, genetics, phylogenetics and ecology. All coordinators promised to send a set of questions by October 31st, 1989, which should make it possible to establish the examination papers of the first IBO. In the practical part, the competitors were expected to deal with the ecological methods of studying biological objects. The main authors of the competition, Dr.Stoklasa, characterized in detail the aims of each task in an experimental garden (ecological observations) and in the laboratory (plant anatomy, insect morphology, analysis of the disgorged pellets of an owl).

ii) In order to improve the preparation of the participants from different competing countries a Preparatory Text was sent out in March 1990. This included a detailed characterization of the requirements in biology, skill and technical ability in dealing with biological material for the tasks given in IBO (Preparatory Text for the first Olympiad).

iii) The first IBO took place at the Faculty of Science, Palacký University in Olomouc, the theoretical part July 3 and the practical part July 5, 1990. Four students represented each country, except two pupils from the Flemish part of Belgium. Each competing delegation had two accompanying persons, members of the international jury. To facilitate the evaluation for members of the jury, translation of the texts were available (with the exception of Flemish). The translation (excepting Bulgarian) were up to standard, although their checking by the jury was relatively time consuming. It was not possible to find accommodation for members of the jury outside Olomouc, so that it was difficult to discuss the examination texts a day before. This causes an one day's delay in the competitions schedule.

Observers of IBO, who participated in the 3rd meeting of coordinators, were from Australia, Germany, Canada, The Netherlands, Sweden, Thailand, Zambia and representatives from UNESCO.

iv) The most difficult problem was, of course, the preparation of the competition itself and of all biological and technical materials. The actual preparations for this competition already started in January 1989 and lasted till June 1990. The main author (Science Faculty, Charles University in Prague) consulted all problems with a team of collaborators in Olomouc and Prague (Prof. Bi_ík, Doc. Nová_ek, Doc. Bedná_, Dr. Kincl, Dr. Trávní_ek, Dr. Starý, Doc. Opatrný, Dr. Šigutová, Dr. Jur_ák and Dr. Plesník).

The question in the theoretical part were aimed to represent all the proposed biological disciplines and to utilize various forms of formulating the questions.

In the practical part, certain unifying aspects were adhered to with respect to the individual tasks.

The whole complex of questions was equalized from the point of view of the requirements on

a) biological knowledge attained by the competitors, what they had remembered and their capability of reproducing them;

b) the ability of the competitors to make logical deductions from actual observations during the solution of individual tasks;

c) acquired skills resulting from biological thinking and dealing with biological objects.

The competition also included tasks when there was option for individual solutions, which were preferentially evaluated. It was also possible to require more detailed explanation for the solution.

It was the aim of the authors to prepare a balanced competition between theory and the practical part of IBO. Hence, both parts were awarded approximately the same number of points.

II. Theoretical tasks

The theoretical part consisted of three sections (T1, T2 and T3):

T1 This comprised 100 questions in which each competitor was required to encircle the correct answer out of four possibilities. Each correct answer was ascribed one point. The proportion of answers requiring concrete knowledge founded on memory to those exhibiting more profound biological thinking was about 60:40.

Proposals for questions were sent from Czechoslovakia (_SFR), Poland, German Democratic Republic (GDR), Bulgaria and Belgium. Some questions from previous competitions between Czechoslovak and Polish students from 1985 and 1986 and by authors from the Olomouc team were also used.

Competitors from Poland answered correctly to 79 questions on the average, those from _SFR to 74, GDR to 62, USSR to 61, Bulgaria to 54 and Belgium to 51 questions.

Out of the 100 questions, 9 were answered correctly almost by all students, 36 questions by 16-20 competitors, 38 by 10-15 and 7 questions by 6 or less competitors. As far as the different fields of biology are concerned, it is not possible to state which field was underestimated, or preferred. The selection of questions apparently covered all aspects homogeneously.

T2 Thirty-five schematic figures were selected from various text-books used in the participating countries. The competitors were required to indicate (in colour) the basic terms, location of organ systems, etc. Each correctly indicated question, one point was allotted, with a maximum of 185 points. The aim of this was again to test the biological thinking of the competitor. Separate parts of the figures were closely related and could be logically deduced.

The answers of competitors from Poland (mean of 154 points) and _SFR (mean of 134 points) were more or less balanced. Significant differences between individual competitors were marked in representatives from GDR (mean of 120 points), USSR (116 points) and Bulgaria (104 points on the average).

T3 The last section of theoretical part combined knowledge of nature and deduction of the correct answer. The competitors were presented with 17 slides and 6 videorecordings and were expected to make correct conclusions in the second part of the question.

It was finally decided by the jury (in view of the time lag due to translations of sections T1 and T2) not to classify this section.

If it were included in the general evaluation, the second place would have belonged to a competitor from GDR and the third place to a competitor from Poland.

III. Tasks of the practical part

When preparing the practical part, the organizers took these aspects into account together with previous experience from past national olympiads.

a) Each competitor had to realize that every task was part of a certain field of problems (e.g. nutrition of owls) and all these subgroups of problems were interconnected, forming a certain representative sample. It was estimated, on the basis of past experience, that each problem required about 60-90 min.

b) The maximum number of competitors who can solve the same tasks at the same time appears to be irrelevant. However, under our conditions, the limiting factor was the area of experimental field conditions for botanical observations - the faculty garden could contain 12 pairs of these plots. Therefore one half of the competitors began with ecological observations of these plots, while the other half solved the entomological part.

c) The organizers originally hesitated whether the areas of interest should include two or four fields. The decision to select the latter was motivated by the fact that ecology is so complex. We realized that 5 hours for the practical task would

also be a complicating factor in the exact organization of the competition and that it also means the uppermost limit of difficulty.

d) In connection with the selection of individual questions, serious thought was given to their evaluation. The anwers to each partial question could be awarded a maximum of two points for an undoubtedly correct answer, one point for an incomplete answer and zero points for a basic error or no solution at all. This helped to minimalize the subjective factor in classifying each competitor. This classification scale was not respected in those tasks, where the competitors could exhibit exceptional creative abilities in their solution. These were alloted double the number of points, i.e. 4-2-0.

At the same time, the jury considered the balance between knowledge (memory), intelligence (deductive ability) and manual skills. According to this point system, competitors could attain the following maximum number of points in these three categories 121 : 113 : 97 points).

The practical section consisted of four categories (P1, P2, P3 and P4) of individual tasks characterized as follows:

P1 ecological observation of the effect of light on the growth of ten species of plants.

Task one: The competitors were asked to classify 10 species, of genera of plants (Leontodon hispidus, Colymbada scabiosa, Festuca rupicola, Plantago media, Sedum sexangulare, Hepatica nobilis, Geranium robertianum, Galium odoratum, Pulmonaria obscura, Stellaria holostea), and classify them into families. Good knowledge concerned only the genera Plantago, Geranium, Sedum and Galium, although this task was in agreement with the Preparatory Text of the first IBO. The majority of competitors only gave the national names of the plants and families.

Task two: The competitors gave the names required in the examination paper for the ecological characteristics. They were expected to consider the relation of plants towards light, temperature, humidity, etc. This task was succesfully solved by 15 competitors, all from _SFR, Poland and GDR.
The best results were obtained if the students were acquainted with the plants (see task 1).

Task three: When comparing the appearance of plants from shaded and fully lighted fields, the students were required to decide the relation of the amount of light necessary for the growth and development of individual plants. Observations should have been concentrated on the general habitat, branching of the stems, the length of the internodia, shape of leaf, number of trichomas, formation of reproductive organs, etc. Both fields differing in the lighting regimen were close to each other, so a comparison was not difficult and could be exactly described in the protocol. In spite of this, only 8 competitors attained more than 50 % of points (three from Bulgaria, two from Poland, one from Belgium and Czechoslovakia).

Task four: Competitors had the option of selecting some plants for laboratory observation. For example, dissection of blossoms (flower) of Geranium and Leontodon were chosen by 17 and 5 competitors respectively.

P2 The effect of light on structural differences between plants.

Task five: Preparation and observation of individual parts of plants, the schematic drawing in a protocol, is a current "school" task. Skill, the schema and correctness were evaluated. The most successful competitors came from GDR (three attained 5 to 6 points, two from Bulgaria and one from _SFR and USSR).

Task six: The density of vents (stomata) per unit area of leaves was to be performed according to exact working instructions given to each competitor. Even such a task, including drawing of vents, is part of the basic school education. The number of tracheae of lighted plants was double that of those in the dark, so that this task posed no problems for the competitors. The general standard of microscopical skill and drawings of the stomata including their description, was not satisfactory, with the exception of the GDR competitors.

Task seven: None of the competitors took advantage of the offer to acquire more detailed instruction when solving the inner structure of plant stems from a dark and lighted environment - all worked independently. Each competitor composed their native preparation with marked microphotographs for identification of the internal structure in cross sections of plant stems. In view of the complexity of this task (it was necessary to make really a thin section), the jury tolerated even incomplete answers as correct.

P3 Representation of insects in the studied biotopes.

Task eight: This task was similar to the botanical problem in the terraine. Each competitor received an entomological box with preparations of 17 insect species. Firstly, those species should have been eliminated, which did not ecologically belong to the demonstrated biotope using a videorecord (aquaeous and synantropic species). Others were asked to name by genus and classify into order or family (Panorpa, Melolontha, Araschnia, Episyrphus, Athalia, Apis, Vespula, Cercopis, Forficula, Chrisopa, Carabus, Graphosoma). Only six competitors attained a more than 50 % of correct answers, although they had been informed about this biotop in the Preparatory Text. In most cases, the correct answers concerned 6 genera (Melolontha, Apis, Vespula, Forficula, Carabus, Araschnia) and classification into orders was analogous.

Task nine: The competitors also received five species out of a group of insect contained in a vessel with ethylalcohol. Using a stereomicroscope, they were expected to observe the adaptation of insects to their mode of life - special wing structure and its modifications and oral

organs. The characteristics of the wings were described relatively well similarly as the identification of the type of the oral organ from the presented diagram.

Task ten: There was free choice for the preparation of the oral organ of any of the species from task 9. Nine competitors chose the cockroach, most of the others preferred the bee. The skill with which those were performed and the description were good. The accessory requirement was to name the individual types and parts of insect oral organ on the basis of schematic figures where each component of different types of the oral organ were depicted in the same colour. Despite the fact that attention of the competitors was drawn, in the Preparatory Text, to insect anatomy, only six of them obtained more than 85 % of points.

Task eleven: The last entomological problem concerned the question of the relationship between larvae and imagos of insects presented in task 8. The competitors were asked to supplement these data into the figure. A completely correct answer was given by only one competitor (from Poland).

P4 Analysis of owl (Strix aluco) disgorged pellets and its nutrition

Task twelve: In case that the competitors had not used the detailed instructions for analysis of a model pellet, they could obtain a two fold number of points (the instructions were required by only four competitors). The task was very satisfactorily solved, with the exception of the identification of skeletal remnants of mice and voles.

Task thirteen: This was followed by the calculation of the absolute and relative representation and mass of animal food of the owl. This required an exact solution by each competitor - however, those from Poland and Bulgaria encountered certain difficulties. The last two sections contained questions pertaining to the nutrition of the Tawny owl; practically all competitors indicated it in the form of the nutritional network. This section did not, actually, present any undue difficulties including the implications for man.

It can be concluded from the review of the points attained that there were differences in the level of answers to individual examination sections (P1 to P4) as well as between various competitors and even among competitors from one team.

Most of the partial tasks corresponded more or less to the teaching curriculum of biology in the competing countries (observation, morphology, sketches from microscopic preparations, dissection of native preparations, anatomy of blossoms, of flower patterns etc.). However, pupils from secondary schools are usually not accustomed to consider problems in a complex manner, to take into account further factors closely related to the various aspects of a given task. Most competitors deal successfully with the basic part of the correct solution, but not completely and precisely.

IV. Global evaluation of the 1st IBO

Compiled on behalf of the Coordination Centre in Prague on the basis of the minutes of negotiations and discussions in Olomouc, July 1-6, 1990.

1) It was concluded that IBO can be organized at an equally high level as that of other International Olympiads in Natural Sciences and can provide all competitors with equal conditions.

2) Evaluation of the practical part.

   Quality of the preparation of the practical part was highly appraised. The following recommendations were accepted:

   i) the bulk of the tasks should, in the future, be reduced by approximately one third;
   ii) according to the students' opinion, however, they were fairly satisfied with the selection of topics and the results. They even wished to spend more time on the practical part as they would have liked to put more effort into some details of their investigations;
   iii) to reduce the number of tasks based on the knowledge of systematic botany and zoology and especially to eliminate the possibility that some species may not be typical for some of the participating countries.

3) Evaluation of the theoretical part.

   The written tests partially selected from the contributions of individual countries were criticized due to the predominance of the classical type of questions (memorizing type of knowledge).
   The part utilizing biological thinking was anulled by the jury due to the lack of time necessary for a complete explanation.

4) Evaluation of the activity of the jury.

   The working schedule of the jury was negatively influenced by the necessity of translating the assignments into Flemish and problems involved with the translation into Bulgarian. This rendered the work of the jury highly time absorbing and psychologically and professionally demanding. Not only specialization in biology but also mastering of one or two official language (at present English or Russian) proved essential for the jury members.

5) Statement of the chief author and organizers.

   i) It was agreed at the preceding meetings of IBO coordinators that in the theoretical part of IBO, the questions would cover all fields of biology. The coordinators promised to send in sample question topics by Oct.31, 1989 (fulfilled by Poland, GDR and later by Bulgaria). Yet, many questions could not be used for the tests (unsuitable for the test form), and this was why they were not included in the tests. Similarly, the topics received from Belgium could only be used partially, as they reached the organizers too late, namely on May 30, 1990.

The drawings for the competition came from textbooks part of the participating countries. Unfortunately, the part requiring "biological thinkings" on the basis of slide and video observation was not presented to the competitors within the competition framework.

ii) Biological thinking and skills required for work with biological material always depend on the knowledge of individual biological objects. This was why the 1st IBO Preparatory Text containing precise characteristics of the technique and knowledge necessary for successful passing of the 1st IBO was sent out in time. Evidently, some countries failed to make use of the possibility of acquainting their competitors with the aims of the competition.

The organizers of the 1st IBO assume that an essential specific character of future IBO's will again be to utilize certain regional biological peculiarities with exact formulation of the IBO preparatory texts and preparation of the competitors accordingly.

The criticism that practical systematic knowledge prevailed in the scoring is analyzed in detail in the result analysis of the 1st IBO. Generally, it can be concluded that the highest score for concrete knowledge was 120, for deduction of data and partial conclusions 113 and for acquired biological techniques and skills 95.

iii) The jury will have to respect separation from the competitors both as to the place and to the time, in order to have enough time for working appropriately. Also the presence of a representative from other than the organizing country in the jury for the whole time of the competition is considered essential, to ensure final collective decisions in all cases.

V. Changes in the Organization Rules.

1) The following modifying changes were approved on July 1, 1990:

i) wording of § 10, art. 1 OR:
For correct solutions of the theoretical and practical parts approximately identical scores can be obtained.
Note: For the 1st IBO the score ratio of 359 : 340 points was suggested for the practical and theoretical parts. After text modifications the score for the theoretical part was further reduced (see I/3).

ii) Duties of the coordinators (§ 5, art. 3d OR) were supplemented as follows:
The coordinators are urgently asked to forward their suggestions for the theoretical part of IBO to the Coordination Centre in Prague by the end of November each year.

2) In the course of the 1st IBO the following formulations and modifications of the OR were suggested by the observers' group. The data will be further processed by the Coordination Centre and submitted for approval at the next meeting of coordinators.

3) On behalf of the observer group, UNESCO and IUBS representatives, prof.

Schaefer suggested that an International Scientific Advisory Board (ISAB) should be established. This would organize and consult in advance the orientation and content especially of the theoretical part of IBO. The establishment of such a Board was supported by Belgium, Czechoslovakia and GDR, while Bulgaria and the Soviet Union voted against. Poland did not take part in the voting, yet later supported this suggestion. All the observers present (6 countries) supported the motion (the Australian observer was not present at these negotiations). The Coordination Centre will convoke the Board; the Board was tentatively appointed for 1 year.

4) The 1st IBO observer countries were recommended as ordinary participants of the next IBO. By September 10th, 1990 these countries should confirm their participation in the 2nd IBO by a letter of their Ministries of Education or similar institutions. A copy confirming their participation will be sent to the Coordination Centre in Prague. The Ministries of Education or similar institutions in the applying countries will appoint one person as IBO coordinator of their country and send the information about this to the Coordination Centre in Prague.

5) Belgium preliminary applied as organizer of the 3rd IBO; a binding application will be confirmed by a letter to the Coordination Centre by December 31st, 1990.

6) The Soviet Union as the 2nd IBO organizer submitted a general concept of the practical part of the competition, which will be oriented on the determination of certain botanical and zoological objects.

5. THEORETICAL PART OF THE 1ST IBO - PART T1

Dear competitors,

The tasks marked with the numbers 1 - 100 are similar in form. For a given question you are provided with 4 possible answers (A - D). Your task is to select one of these (only one answer is correct) and by encircling the appropriate letter to indicate the correct answer. If, when checking your answers you need to change an answer, then mark the final correct answer with a square.

You have a time limit of 90 minutes for these 100 questions.

1. A relict is
   A) A rapidly spreading organism not indigenous to the given area
   B) The term for an organism causing dangerous disease
   C) A genetically unstable hybrid
   D) An organism which in the given area is a remainder from earlier times, when it was widespread

2. As a result of intensive nitrogen fortilisation this has spread to a number of biotypes not typical for it:
   A) Coltsfoot (Tussilago)
   B) Viper's Bugloss (Echium)
   C) Wild Hop (Urtica dioica)
   D) Dandelion (Taraxacum officinale)

3. The highest gross primary production is typical of the ecosystem:
   A) beech wood
   B) meadow forest
   C) mountain pine forest
   D) briar and oak grove

4. A community of water organisms with striking active movement is known as:
   A) plankton
   B) benthos
   C) nekton
   D) pleuston

5. Indicate which ecological group is referred to: The plants which have a thin, fragile stalk with reduced mechanical tissue, inside the stem are large intercellular spaces. The leaves are fleshy with a thin cuticle, ...
   A) mesophyte
   B) hygrophyte
   C) xerophyte
   D) thermophyte

6. The marking of territory is particularly significant for:
   A) finding a partner
   B) genetic adaptation
   C) a successful struggle for survival
   D) competition within a species

7. Putrefactive bacteria are ranked among:
   A) producers
   B) consumers of the 1st order
   C) consumers of the 2nd order
   D) destroyers (reducers)

8. Acid rain has a negative influence on nature and simultaneously:
   A) influences the quality of solar radiation
   B) increases the movement of Ca^{2+} and certain metals in the ecosystem
   C) increases the amount of H_2O_2 in the atmosphere
   D) causes smog

9. The eutrofication of water is caused by high content of:
   A) potassium and CO_2 in the water
   B) nitrogen and phosphorous in the water
   C) sodium and calcium in the water
   D) saccharides in the water

10. The dominant of the herbal layer of an oak and hornbeam wood may be:
   A) Deadly Nightshade (Atropa Belladonna)
   B) Rejuvenating woodland beech (Fagus sylvatica)
   C) Dactylorhiza majalis
   D) Greater Stitchwort (Stellaria Holostea)

11. A mountain spruce forest is, in comparison with a field of maize:
   A) more stable, does not require additional energy to survive
   B) more stable, but requires considerable input of additional energy
   C) less stable, requires great amount of additional energy to survive
   D) less stable, but due to high capacity for self regulation does not need additional energy

12. Solar energy is best used per surface unit by
   A) a field of wheat
   B) meadow woodlands
   C) a stand of warf pine (Pinus mugo)
   D) a water meadow

13. The Silver Birch (Betula pendula) is among the trees which are:
   A) strongly light loving
   B) shade loving
   C) indifferent to light
   D) light and shade loving

14. Mushrooms (Fungi) have the following relationship to light:

A) they require it unconditionally for growth
B) they do not require it for growth, but many types need a certain amount of light for spore production
C) they have no need whatever of light for existence
D) apart from exceptions they require it (light has a positive influence, for instance, on rate of growth and colouring of gills)

15. Light is for the germination of seeds
A) necessary only for some plant species
B) quite essential for all parasytic plants
C) an essential factor only for light loving plants
D) is not a limiting factor for germination in any species

16. Relation of insufficient light and yellowing of leaves
A) no influence
B) slows it down, especially at higher temperatures
C) slows it down, especially at lower temperatures
D) speeds it up, especially at higher temperatures

17. Algae and infusoria (Parametium) live together in a solution placed in the light. The infusoria (Parametium) consumes 0.10 mol of glucose in a week, the algae 0.12 mol. The weekly production of glucose amounts to 0.25 mol.
What is the net production of oxygen per week in this medium?
A) 0.03 mol
B) 0.60 mol
C) 1.32 mol
D) 0.18 mol

18. Synanthropic is the term used for
A) enriching of local flora and fauna with species from other geographical territories
B) domestic (domesticised) animal
C) organisms transferred by man from original territories
D) animals and plants living in close relationship with man

19. Phototaxis is
A) the ecological link of a certain species to a shaded or unshaded site
B) the amount of light in a certain unit of time required for the development of a given species
C) orientation (e.g. of insects) evoked by light
D) relation between growth of insect larvae and light conditions

20. What is an edaphone
A) instrument for repelling insects (e.g. mosquitos) with sound waves
B) community of all organisms living in the soil
C) part of the hearing apparatus of a grasshopper
D) part of the hearing apparatus of a mosquito

21. A monophagus is
A) a cell capable of swallowing up foreign particles (e.g. microorganisms)

B) an animal which takes in food only during a single stage of development
C) an animal with the highest degree of specialization as regards type of food
D) a virus attacking only narrowly specialized eukaryotic cells

22. A predator is
A) a beast of prey living wild which kills and eats other animals
B) an animal living on or in the body of another animal and feeding on it
C) an animal which on or in its body carries the germs or development stages of other animals
D) a species of animal whose existence signals the later existence of another species

23. A feromone is
A) a chemical substance, containing mainly iron compounds, from which the body covering of insect is made
B) a hormone enabling relations between individuals of one species of insects
C) a chemical dye based on iron which gives rise to the metallic sheen of some groups of insects
D) a hormone enabling relations among individuals of various species of insects

24. The expression mimicry means
A) the microscopic feeler hairs on an insect's body
B) the special protective similarity of some species of insects to others
C) the state into which some species of insects fall under the influence of external stimuli signalling danger
D) the behaviour of the females of some groups of insects, intended to attract the male

25. By the concept of population we mean
A) a set of individuals of one species including developmental stages on a certain territory
B) a set of individuals of one species on a certain territory without stages of development
C) set of individuals of all species in a common environment
D) set of individuals on certain territory which are not genetically related

26. The genetic balance of a population in the sequence of generations is expressed by the Hardy Weinberg Law, which expressed mathematically is
A) $H = 2pq$
B) $p^2 + 2pq + q^2 = 1$
C) $(p+q) = (p - q)$
D) $(p+q) . (p - q) = p^2 - q^2$

27. The basic unit of an eukaryotic chromosome consisting of DNA and protein is
A) a nucleotide
B) a nucleoside
C) a nucleosome
D) a nucleoid

28. All the given factors are mutagenous with the exception of

A) "gamma" radiation
B) UV radiation
C) acridine dye
D) acetic acid

29. A caryotype is
A) the crossing of chromosomes during meiosis
B) the marking of sex chromosomes
C) characteristics of type of cell core, i.e. procaryotic type, etc.
D) characteristics giving number, shape and construction of all chromosomes of an individual

30. In a monohybrid with complete dominance the fenotype splitting proportion in F_2 is (parents were homozygotes)
A) 3 : 1
B) 1 : 2 : 1
C) 9 : 3 : 3 : 1
D) 1 : 1

31. With regard to sex chromosomes a normal woman is equipped with
A) XY
B) XX
C) YY
D) XO

32. A new pink flowering plant with genome Cc was planted on an island. It is an annual, self polinating and has four seeds a year. If in its progeny there appears a plant with white flowers, then this plant is:
A) polyploid
B) homozygotically recessive
C) a hybrid with incomplete dominance
D) a mutant

33. In a case where one parent has blood group O and the other AB, the children may belong to the group:
A) O, AB, A, B
B) A, B
C) O, AB
D) Ab

34. In the interbreeding of individuals with genotypes AABb and aaBb there cannot occur in further generations the genotype:
A) AABb
B) AaBb
C) AaBB
D) Aabb

35. The Biogenetic Law (onthogenesis is an abbreviation of phylogenesis) was formulated by:
A) E. Haeckel

B) G. Cuvier
C) J.B. Lamarck
D) Ch. Darwin

36. Among the oil soluble vitamine is
A) Vitamin K
B) Pyridoxin
C) Thiamine
D) Vitamin C

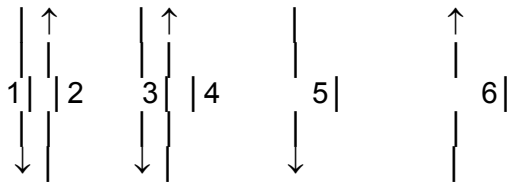
37. Which tree releases alelopatic substances into the environment?
A) Beech (Fagus silvatica)
B) Sallow willow (Salix caprea)
C) Thorned acacia (Robinia pseudoacacia)
D) Lime tree (Tilia cordata)

38. During which activity is most energy released?
A) photolysis
B) glycolysis
C) Krebs cycle (the cycle of citric acid)
D) final oxidation in the respiration chain

39. Some substances enter a photosynthesizing cell ---- and some leave the cell
A) glucose and CO_2 ---- water and O_2
B) glucose and O_2 ---- water and CO_2
C) water and O_2 ---- glucose and CO_2
D) water and CO_2 ---- glucose and O_2

40. Which of the given actions are linked with the primary processes of photosynthesis (with the light phase)

NADP ATP CO_2 excited chlorophyll



NADPH2 ADP $C_6H_{12}O_6$ chlorophyll

A) 1, 3, 6
B) 1, 4, 6
C) 2, 3, 6
D) 2, 4, 5

41. The energic effect of anaerobic glycolysis are 2 molecules of

A) lactic acid
B) pyruvic acid
C) ATP
D) ethanol

42. In the photosynthesis of C_3 plants the acceptor of CO_2 is:
A) 3-phosphoglycerolaldehyde
B) ribulose-1,5-biphosphate
C) phosphoenolpyruvic acid
D) feredoxin

43. Photorespiration is a process typical of
A) all plants without exception in roughly the same intensity
B) mainly C_4 plants
C) mainly C_3 plants
D) this process is not typical for plants

44. The following has a marked capacity for vegetative reproduction:
A) orache (A. triplex)
B) plantain (Plantago)
C) coltsfoot (Tussilago)
D) chicory (Cichorium)

45. Gametophyte is in the life of plants a generation which
A) creates gametes through the process known as meiosis
B) arises from gametes
C) arises as a result of the combining of gametangia
D) is created by cells with a haploid number of chromosomes in the nucleus

46. Not among the trees with only one type of flower is the
A) hazel (Corylus)
B) poplar (Populus)
C) larch (Larix)
D) walnut (Juglans)

47. An angular stem, symmetrical flowers in tight inflorescences (odd numbered whorls), two longer and two shorter stamens characterize the family of
A) mustard (Brassicaceae)
B) poppies (Papaveranceae)
C) dead nettles (Lamiaceae)
D) figworts (Scrophulariaceae)

48. Willows (Salix) are polinated by .... and the seeds are broadcast by ....
A) the wind - the wind
B) the wind - animals
C) insects - water or animals
D) insects - the wind

49. Mycelium is not formed by
A) Mucor mucedo

B) Claviceps purpurea
C) Puccinia graminis
D) Saccharomyces cerevisiae

50. A common trait of Cyanophyta and Rhodophyta is
A) more or less the same cell construction
B) more or less the same colouring
C) production of starch during photosynthesis
D) in reproduction similar single cell units are formed

51. Apart from the single cotyledon monocotyledonous plants can be further characterized by the following traits:
A) cambium, replacement roots, perianth
B) cambium, main root and side roots
C) scattered vascular bundles, main root and side roots, perianth
D) scattered vascular bundles, replacement roots

52. The flower of Ranunculus is characterized by
A) the arrangement of K and C in rings, A and G in spiral, free pistils
B) arrangement of P in rings, A and G in spiral, free pistils
C) arrangement of all parts in rings, free pistils
D) arrangement of all parts in spiral, pistils grown into the receptacle

53. In plants with enclosed seeds the seed originates from
A) the ovary and sepals
B) the ovary
C) the ovule
D) a fertilized egg cell

54. Diatoms (Bacillariophyceae) are single cell organisms
A) feeding mainly heterotrophically and living in colonies
B) moving with the aid of flagella or pseudo feet
C) forming a double cell wall of $CaCO_3$
D) forming a cell wall of SiO_2

55. With the transition of plants from a watery environment to the dry land there occurred in phylogenesis mainly the improvement of
A) mechanical tissues and the method of reproduction
B) assimilation tissues and conductive tissues
C) covering tissues and assimilation tissues
D) reproduction and conductive tissues

56. The first cellular organisms on Earth probably developed around
A) 2 milliards years ago
B) 3 - 4 milliards years ago
C) million years ago
D) 800 million years ago

57. Sclerenchym is tissue formed by cells
A) with thin cell walls

B) with cell walls thickened only in the corners of the cell
C) with considerably thickened cell walls
D) considerably elongated in one direction

58. In rhyniophytes (Rhyniophyta) there occurred the phylogenetically most original type of vascular bundle, which is
A) radial
B) concentric with woody centre
C) concentric with pith centre
D) collateral

59. Stores are amassed in the plant cell (e.g. in plants with covered seeds) in
A) all types of plastides
B) mitochondria
C) amyloplasts
D) chloroplasts

60. The white colour of flowers is conditioned by
A) the reflection of light from the air in the intercellular spaces
B) the perfect absorption of light falling on them by petals or sepals
C) the presence of specific white colouring (from the group of hydrochromes) dissolved in the vacuoles of the cells
D) the gathering of a large number of leukoplasts

61. Plasmodesms is the term for
A) membranes surrounding the vacuoles, more precisely the connection of several vacuoles in one cell
B) the combination of the cytoplasm of neighbouring plant cells
C) opening in thickened cell walls
D) opening in the nuclear covering (nuclear membrane)

62. The greatest osmotic pressure is shown by the cells of
A) hygrophytes
B) mesophytes
C) xerophytes
D) hylophytes (salt loving plants)

63. Which cellular organella acts directly on the formation of the nuclear covering (nuclear membrane)?
A) DNA
B) RNA
C) endoplasmic reticulum
D) the Golgi apparatus

64. For the stoppage of bleeding there is also need of
A) iron ions
B) calcium ions
C) ascorbic acid
D) citric acid

65. The respiratory muscles in man are
    A) the internal crosswise stomach muscle and diaphragm
    B) the external and internal intercostal muscles and direct stomach muscle
    C) the external and internal intercostal muscles and diaphragm
    D) large and small chest muscle and diaphragm

66. The surface of the membrane of a nerve cell when at rest is
    A) electropositive
    B) electronegative
    C) electroneutral
    D) without electric charge

67. The composition of lymph (sap) is similar to the composition of blood plasma. Select the correct statement:
    A) proteins are lacking in lymph
    B) there are more proteins in lymph than in plasma
    C) there are less proteins in lymp than in plasma
    D) the difference is in the quality of Na ions

68. The semilunar valves separate
    A) the chambers of the heart from the arteries
    B) the left ventricle from the right atrium
    C) the right ventricle from the atrium
    D) hollow veins from the right atrium

69. Progesteron is eliminated by
    A) the Graafian follicle
    B) the corpus luteum (Yellow body)
    C) the maturing egg
    D) the ovulating egg

70. The biosynthesis of proteins takes place in all cells of the human organism with the exception of
    A) the cells of the pancreatic gland (pancreas)
    B) the cells of the mucous membrane of the intestines
    C) mature red corpuscles (erythrocytes)
    D) white blood corpuscles (lymphocytes)

71. The veins (trachea) of the altered root of mistletoe (Viscum) grows through a pine (Pinus) branch, for instance, into the
    A) pithy part of the vascular bundle (phloem)
    B) the woody part of the vascular bundle (xylem)
    C) the pith of the branch
    D) the immediate surroundings of individual vascular bundles, but do not penetrate them

72. Sexual reproduction in Infusoria with gene recombination takes place by:
    A) encystation
    B) strobilation
    C) conjugation

D) longitudinal splitting

73. The mesoderm appears first in phylogenesis in the
A) jellyfish (Scyphozoa)
B) (Turbellaria)
C) (Tracheata)
D) annelids (Annelida)

74. The symbiosis between termites (Isoptera) and the micro organisms living in their intestines and feeding on cellulose is an example of
A) competition
B) predation
C) mutualism
D) commensalism

75. Various tissues and organs are formed from the ecto- , meso- and endodermis. Which combination is correct?

	Ectodermis	Mesodermis	Endodermis
A)	brain and spinal fluid	blood	lungs
B)	brain and spinal fluid	large intestine	lungs
C)	skin	bones	kidneys
D)	epidermis	liver	heart

76. The human organism does not synthesize and must therefore acquire from food
A) purines
B) pyrimidines
C) fructose
D) aromatic amino acids

77. Caterpillars of the Cabbage White (Pieris brassicae) form a chrysalis:
A) underground near a nutritions plant
B) on various objects above ground (trees, posts, walls)
C) on a food plant
D) do not make a chrysalis because it is an insect with imperfect metamorphosis

78. Colorado Beetle (Leptinotarsa decemlineata) was brought to Europe from North America
A) in 1925
B) in 1938
C) in 1947
D) in 1914

79. Crickets chirp
A) by rubbing their front wings together
B) by rubbing the front wing against the back leg
C) by means of a special organ on the lower side of the thorax
D) by pushing collected air out through the stigmata

80. Rotators (Rotatoria), like all roundworms (Nemathelminthes), do not have a developed ..... system

A) digestive
B) elimination
C) respiratory
D) nervous

81. Halters are
A) moisture loving ribbonlike shapes of the spores of horsetails (Equisetum)
B) part of the mandibles of some beetles
C) the reduced wings, for example, of the mosquito (Culex)
D) the sensitive cilia on the rear part of the body of homoptera

82. Which type of parasitic "worms" has a stage of development with life in fresh water?
A) roundworm (Ascaris lumbricoides)
B) nematode worm (Trichinella spiralis)
C) beef tapeworm (Taeniarhynchus saginatus)
D) liver rot (Fasciola hepatica)

83. Parthenogenesis can occur in all the following organisms with the exception of
A) rotators (Rotatoria)
B) insects (Insecta)
C) crustaceans (Crustacea)
D) spiders (Arachnida)

84. What is the largest number of elements of which an insect's leg may be made up?
A) 5
B) 6
C) 9
D) 15

85. Planorbis breathe
A) through gills hidden by part of the shell so that they are actually within the body
B) through 2 gills (external)
C) through a lung sac formed from the wall of the shell hollow
D) through a single gill (ctenidium) near the anal opening

86. In maturity the following has preserved the dorsal cord (chorda dorsalis)
A) Ascidiaceae (sheat fish)
B) sturgeon (Acipenser)
C) lamprey (Petromyzones)
D) tuna (Protopteridae)

87. The most primitive placental mammals are
A) insect eaters (Insectivora)
B) marsupials (Marsupialia)
C) rodents (Rodentia)
D) (Monotremata)

88. In herbivores the food returns to the mouth for cudding from
    A) the crop (ingluvies)
    B) the honeycomb (reticulum)
    C) the second stomach (rumen)
    D) the psalterium (omasum)

89. European species of amphibians live on a diet which is
    A) mainly animal
    B) mainly vegetable
    C) for the young vegetable, for adult animal
    D) for young frogs mixed, for others animal

90. The brown frog (Rana temporaria) has teeth
    A) on the upper and lower jaw
    B) on the upper jaw and roof of mouth
    C) on the lower jaw
    D) has no teeth at all

91. The cloaca is
    A) the sexual organ of fish, amphibians and some reptiles
    B) a spiral surface in the intestines of sharks and some fish
    C) a common opening for the digestive, eliminatory and sex organs
    D) in water birds a gland serving for the oiling of feathers

92. European species of lizard can threaten the health of man
    A) by bitting with teeth and poison gland
    B) as an intermediary host to some intestinal flatworms (Platyhelminthes)
    C) by bitting and infecting wound with poisonous secretions from the mouth
    D) they are not at all dangerous

93. Zoochoria is
    A) the broadcasting of seeds or fruits by activity of animals
    B) an infectious disease carried by animal fur
    C) the science of the spreading of animals on Earth
    D) use of animals for "biological warfare" with other animal species

94. In European amphibians the fertilization of eggs takes place
    A) in the water outside the female's body
    B) in the female's body
    C) in frogs outside the female's body, in salamanders and newts inside the body
    D) in frogs and newts in the water, in salamanders in the female's body

95. The nest of the great Tit (Parus major) is usually situated
    A) in the fork of a branch of a thick bush
    B) mostly under a bush on the ground in grass
    C) is usually woven of grass stalks and hung on branch 3 m above ground
    D) in a hollow tree

96. Of the following mammals one does not hibernate:
    A) the Great Dormouse (Glis glis)

B) the European hedgehog (Erinaceus europaeus)
C) the common mole (Talpa europaea)
D) the big eared bat (Plecotus auritus)

97. Which bird of prey lives mainly on smaller birds?
A) the buzzard (Buteo buteo)
B) the marsh harrier (Circus aeruginosus)
C) the kestrel (Falco tinnunculus)
D) the sparrow hawk (Accipiter nisus)

98. Articulates (Arthropoda) are linked in development to
A) molluscs (Mollusca)
B) (Cnidaria)
C) annelids (Annelida)
D) (Pararthropoda)

99. The coracoid process is developed in
A) the sparrow (Passer)
B) the bat (Myotis)
C) the newt (Triturus)
D) the mole (Talpa)

100. L. Pasteur discovered
A) vaccination against smallpox
B) the originator of psittacosis
C) the treatment of rabies
D) bacteriophagus

Table 1

Key to correct answers for the IBO test

	1	2	3	4	5	6	7	8	9	0
0 - 10	D	C	B	C	B	D	D	B	B	D
11 - 20	A	B	A	B	A	D	D	D	C	B
21 - 30	C	A	B	B	A	B	C	D	D	A
31 - 40	B	B	C	A	A	A	C	D	D	B
41 - 50	C	B	C	C	D	B	C	D	D	B
51 - 60	D	A	C	D	D	B	C	B	C	A
61 - 70	B	D	C	B	C	A	C	A	B	C
71 - 80	B	C	D	C	A	D	B	A	A	C
81 - 90	C	D	D	C	C	C	A	C	D	B
91 - 100	C	D	A	C	D	C	D	C	A	C

6. GENERAL RECOMMENDATIONS FROM THE 1ST ISAB MEETING, HELD IN PRAGUE, FEBRUARY 18 - 21, 1991

I. Based on the detailed comparison of all available biology textbooks and syllabuses, the following agreement was reached:

The theoretical part of the IBO examination should cover the following seven topics in the indicated proportion:

Topic:	Appropriate percentage of points:
1. Cell Biology	25 %
2. Plant Anatomy and Physiology	15 %
3. Animal Anatomy and Physiology	15 %
4. Ethology	5 %
5. Genetics and Evolution	15 %
6. Ecology	15 %
7. Biosystematics	10 %

The detailed description of these topics is listed in the Appendix of the Organization Rules.

Regarding the exam questions, it is recommended that the majority of questions should test students' understanding, science process skills and application of their biological knowledge. The questions testing only knowledge should be as few as possible and they should not exceed 25 % of the total points.

II. In the practical part, it is preferrable that the tasks require drawing conclusions and utilization of biological skills.

For the practical part, students should not be asked to name or identify plants or animals due to geographical differences of fauna and flora. In case the questions require naming, it should be adequate to name the major groups of organisms instead of the names of organisms themselves, with the exception of organisms that the participating countries are informed about in advance in the Preparatory Text for the particular IBO.

III. It is recommended to state in the examination papers (practical as well as theoretical) after approval of the test questions by the Jury the maximal obtainable points for each particular question.

Questions have to be clearly and not ambiguously stated and they have to lead to one single answer, so that the Jury does not need to discuss the specialized biological problems of the tasks.

It is recommended not to use separate answer sheets. Students should indicate their answer directly on the papers used for the test.

IV. In order to increase the objectivity of the evaluation of both the theoretical and the

practical parts, it was recommended:

a) to include only those questions that could be evaluated objectively, especially in relation to the fact that competitors respond in their native language (preferentially, use of tables and clear single solutions are recommended);
b) to reduce the Jury's work as much as possible by minimizing questions that invite free responses from competitors in national terminology, or even in their own formulations (e.g. not to use open questions);
c) In the discussion about the evaluation of the tasks, analyse each question in such a way that the answer to the question can be marked as follows:
    2 points for complete correct solution
    1 point for partial but correct solution
    0 point for wrong or absent solution

    In case of a more simple question, 1-0 point can be used. In case of a more difficult question, requiring substantial creative activity of competitors, the double point evaluation can be used, i.e. 4-2-0, or 2-0 respectively.

V. One important objective of the ISAB meeting is to discuss the preparation of the theoretical and practical part of the following IBO.

VI. It was agreed by all members present at the 1st ISAB meeting that the discussions during the meeting and the recommendations formulated from those discussions are very useful for quality improvement of future IBO's. A small group meeting, like ISAB, is practical for problem solving and recommendation formulation involving IBO. Therefore the continuation of ISAB is highly recommended.

7. CONCLUSIONS OF THE 5TH MEETING OF COORDINATORS OF THE IBO, PRAGUE, DECEMBER 19 - 20, 1991

At the meeting were present coordinators or their deputies:

Name	Country
Jan Fronk	Poland
Annett Hartmann	Germany
Mehmet Cakmak	Turkey
Sachka Mladenova	Bulgaria
Hans Morélis	Netherlands
Jan Stoklasa	_SFR
Usanee Yodyingyuad	Thailand

Coordinators from Belgium sent their conclusions in the written form.

The head of the Coordinating Centre:

Jitka Macháçková _SFR

Further participants were:

Name	Country
Olga Riegertová	_SFR
Tomáš Soukup	_SFR
Helena Náb_lková	_SFR
Vít_zslav Bi_ík	_SFR
Pavel Eliáš	_SFR

I. Conclusions and Recommendations:

Coordinators present at the meeting agreed:

1) On the conclusions from the 2nd IBO in Machackala (see II.)
2) On the activities of the Coordinating Centre
3) On the organizators of the 4th IBO in 1993 in The Netherlands, the 5th IBO in 1994 in Germany and the 6th IBO in 1995 in Thailand.
4) They approved the changes in the Organization Rules (OR)
5) They accepted after discussion the material prepared by ISAB in February 1991 (see chapter 6) and a detailed recommendation concerning the content of the theoretical part of the IBO, reviewed by Drs. J. Morélis and Dr. J. Stoklasa. This material will be attached as an appendix to the OR and will be distributed by the Coordinating Centre to all coordinators and observers.
6) They accepted Turkey as the participant of the next IBO under the conditions of the OR.
7) Coordinators agreed that non-national teams can take part in IBO out of the official

competition. The organizer can, however, ask for financial contribution in such case.

8) They sent a fax asking Greece to reevaluate its ability to organize the 3rd IBO.
9) In the case of changes of the organizing country in 1992 coordinators understand that some points related to the time scale of the IBO preparations cannot be fulfilled according to the OR.
10) Coordinators agree to sent the official confirmation of their Ministry about their participation at the 3rd IBO until the 15th February.
11) They have elected Hans Morélis as a chairman of coordinators until the next IBO in 1993 in The Netherlands.
12) Coordinators express their disappointment about the omittance of financial support to the 1st IBO by UNESCO due to misunderstandings, especially while the developments concerning the IBO and the function of the Coordinating Centre clearly demonstrate the impact and necessity of the IBO.
13) In the case that Greece does not confirm until the 20th January their ability to organize the 3rd IBO, coordinators ask Czechoslovakia to organize the 3rd IBO. They approved the preliminary proposal of the general orientation of the practical part as suggested by Dr. J. Stoklasa.
    The theoretical part will be chosen from the questions sent to the Coordinating Centre by participating countries until the 15th February. In case that more proposals of the general orientation will appear, the coordinators approved the Central Committee of the Czechoslovak Biological Olympiad to choose one proposal and to decide about the local organizer of the 3rd IBO. The coordinators understand that both Czech and Slovak Ministry of Education are supposed to garantee this IBO.
14) Coordinators ask the Coordinating Centre
    a) to prepare the approved version of the OR
    b) to prepare the recommendations of ISAB materials defining the scientific contents of IBO and distribute these materials to all coordinarors with the conclusions from this meeting
    c) to write official letters asking the Ministries of Education of future organizing countries to support the IBO
    d) to send all materials to UNESCO, IUBS, to the secretaries of the IO in Mathematics, Physics, Chemistry and Informatics, to all countries participating as observers in the preceeding IBO and ask them to inform their colleagues responsible for biology in their country.

II. Conclusions concerning the Second Olympiad in Makhachkala

(Protocol corresponsing the 4th meeting of coordinators) from Coordinators' meeting in Prague, 19 - 20th December, 1991

1. The organizers broke several of the rules of the IBO and suggestions of the ISAB.
2. Minor points have to be clarified in the rules.

ad 1. Contents of the tasks:

A) theoretical and practical parts have to be balanced both in difficulty as well as in scores obtainable
B) theoretical tasks should be as variable as possible
C) tasks have to be prepared very carefully to avoid ambiguities
D) evaluation rules (number of points obtainable for each task) should be

given to the competitors beforehand

E) questions should check reasoning rather than pure factual knowledge
F) the scientific content has to follow ISAB suggestions in both parts (theory and practice)
G) detailed taxonomic questions have to be avoided due to geographic variation
H) the competition tasks should be similar to preparatory ones.

Organisation:

A) plenty of time has to be available for discussion and translation of the tasks before the competition
B) international jury must have access to their students' works and must be able to observe the actual work of the competitors
C) suggested tasks sent in by coordinators should be used by the organizers
D) care must be taken to make exchange of information among competitors impossible
E) coordinators should meet and discuss an Olympiad immediately after its end and draw conclusions.

ad 2. A) we should delete the point in the rules about "pocket money"

B) the status of non-national teams (e.g. the British School from Brussels) has to be clarified.

In spite of some drawbacks the coordinators found the Second International Biological Olympiad very well organized and very attractive and want to express their thanks to the organizers.

8. THE TIME-TABLE OF OPERATIONS AND RECOMMENDED PROCEDURE FOR IBO ORGANIZATORS

1. Two years before the IBO, which they organize in their country, the organizers present at the meeting of coordinators a suggestion of a place of competition and organizing institution, already certified by Ministry of Education of their country.

2. Approved organizer will compile a team of specialists who will take part on organizing and preparing the main direction of the oncoming IBO.

3. One year before, the coordinator of the organizing country will present, at the meeting of coordinators the subject direction of the practical part.

4. The team of organizing country will prepare tasks of the practical part, including all elementary operations. These tasks should be evaluated according to the ISAB recommendations (2-1-0 points). Time allowed for the whole practical part should be about 4 hour. It is very important (whenever the material conditions will make it possible) that all competitors could work at the same task step by step or at least if half of competitors will start, for example, with tasks from botany and the second half with tasks from zoology and they should change after 2 hours. The team prepares protocol forms of competition so that results written by competitors could be evaluated by jury as simple as possible (emphasis on concrete or numeral data, pictures with description, completing the schemes, etc.). They will prepare detailed suggestions rating according to points (2-1-0). According to the sum of points from the practical part, a corresponding amount of points will be attributed to the theoretical part.

5. Coordinators from all countries will be expected to send to the Coordinating Center in Prague questions for the theoretical part by the end of November of the preceding year. According to the sum of points of the practical part (the same sum of points as the theoretical part) they will choose questions for the theoretical part from materials sent to the Coordinating Centre in accord with ISAB recommendations (1991).

6. The organizer will send the letter of invitation for IBO to all countries, which participated at the last IBO, 7 - 8 months before the competition and they will inform the Coordinating Centre about invited countries.

7. The registred country will certify participation of their competitors to the organizer in December - January and send a copy to the Coordinating Centre.

8. The organizer will send materials of preparatory tasks in the official language of IBO to registred countries in February - March. The preparatory text can help the competitors to obtain the idea of difficulty, extent and thematic direction, especially of the practical part (for example about biotop) and the other special requirements for knowledge and skill of the competitors.

9. The organizer will send to the Coordinating Centre and all registred countries the correct final information about time and place of IBO, arrivals and departures to the first place of accommodation in the organizing country and about the time-table of competition not later than 2 months before the date of IBO. Jury cannot be

accommodated at the same place as the competitors.

10. All registred countries will announce to the organizer (a copy to Coordinating Centre), the composition of each delegation and date and hour of their arrival and departure to the first place of accommodation in organizer's country 14 days before.

11. All delegation must arrive at the place of IBO one day before the competition starts.

12. The organizer will prepare the text of practical and theoretical parts and protocols for the results in official languages. If it is possible, they can prepare the materials in the native languages of the participating countries for speeding up the work of the international jury.

9. THE ORGANIZATION RULES

These rules were approved at the 5th IBO Coordinators' meeting in Prague, December 19 - 20, 1991.

§ 1. Aim of the Competition

The International Biological Olympiad (IBO) is a competition for secondary school students who are interested in biology. The purpose of this competition is:

a) to stimulate active interest in biological studies by the creative solution of biological and ecological problems,
b) to promote regular contacts between biology students,
c) to establish friendly relations between young people from different countries and thus to contribute to cooperation and understanding between nations.

§ 2. Organization Rules of the Competition

1) Founders of the IBO were Bulgaria, Czechoslovakia, GDR, Poland and the Soviet Union.

2) IBO takes place each year in July in one of the participating countries. IBO is organized by the Ministry of Education or by another analogous institution of the organizing country (only the term 'organizer' is used in the subsequent text).

3) The organizer can invite, on the recommendation of the Coordinating Centre which acts as a Secretariat of IBO (§ 4), deputies from other countries as observers. These countries can be accepted at the following meeting of coordinators (§ 5) as regular participants of the next IBO, if they agree with the conditions listed in the Organization Rules. The Coordinators can also accept the application of a given country to be present at the forthcoming IBO without having sent an observer to the previous olympiad, if there are special reasons.

4) The organizer of IBO ensures equal participation of all delegations and invites all countries which had previously entered the competition.

5) All principal questions regarding IBO are decided at the meeting of coordinators.

6) The official languages of the IBO are English and Russian.

§ 3. Selection of topics for the Competition

1) All disciplines of biology are acceptable for IBO. However, topics which are related to the subjects of biology in the last two years of secondary school attendance will be preferred. More widely oriented topics should enable the competitors to exhibit not only their knowledge and skills, but also their ability to think independently and creatively.

2) The scientific content of the theoretical part of the competition has to follow ISAB (International Scientific Advisory Board) recommendations approved by the 5th coordinators' meeting (appendix: Content of the T.P. IBO).
In the practical part no experiments should be carried out which deteriorate the living conditions of vertebrates.

§ 4. Coordinating Centre of the Competition

The Coordinating Centre of IBO has been established at the Institute of Children and Youth Prague of the Ministry of Education, Youth and Physical Training of Czech Republic (IDM MŠMT _R) in Prague (by the Department of Sciences and Technology). It fulfils these functions:

a) it collects and accumulates all materials and informations regarding IBO and other biological competitions,
b) it gathers all textbooks and syllabuses of biology currently used in the participating countries,
c) it promotes contacts with other countries,
d) it coordinates the invitation of observers from other countries by the future host country,
e) it accumulates all documentation about the competition,
f) it registers and renews addresses of coordinators and of institutions taking part in IBO and summons a meeting of coordinators' if necessary,
g) it collects test questions for the forthcoming IBO's.

§ 5. Coordinators of the Competition

1) The Ministry of Education or another organizing institution of IBO in each participating country appoints one coordinator of IBO (and will inform the Coordinating Center by an official letter).

2) The task of coordinators is to decide about the principal questions of IBO and to ensure that the requirements of the competition are in accordance with the biology textbooks of the participating countries.

3) Duties of the coordinators are as follows:
   a) to take part in the meetings of coordinators,
   b) to supply the Coordinating Centre with all current textbooks and syllabuses of biology,
   c) to participate in the preparation of competition tasks if IBO is organized in the coordinators' country,
   d) to forward their suggestions and questions for the theoretical part of IBO to the Coordinating Centre in Prague by the end of November each year.

4) Meetings of coordinators are summoned according to the needs, usually at time of IBO performance. The coordinators approve:
   a) changes in the Organization Rules,
   b) places (countries) organizing the forthcoming IBO(s),
   c) countries, which will take part in the subsequent IBO as regular participants and as observers,
   d) the general orientation of the subsequent year of IBO.

5) A representative of the Coordinating centre will take part in the coordinators' meeting without the right to vote.

6) Financial coverage of meetings of the Coordinators is provided according to § 12 of the Organization Rules.

§ 6. Time-course of preparation of the Competition

1) The meeting of coordinators approves the organizing country two years ahead. The regular alternation of all organizing countries should be respected.
2) The Ministry of Education or corresponding institution of the organizing country sends its confirmation to the Coordinating Centre that it accepts the responsibility for the organization of IBO.
3) The meeting of Coordinators approves the general direction and themes of the practical part of IBO presented by the organizer a year before.
4) The Ministry of Education (or similar organization) of the organizing country will send an official invitation to Ministries of Education of all participating countries by the end of November of the preceding year at the latest. Respective copies should be sent to the Coordination Center in Prague and to all the coordinators of all invited countries.
5) The invited countries have to confirm their participation by the end of January (6 months in advance).
6) The organizer sends out the preparatory tasks written in the official languages to all invited countries in February or March. The preparatory tasks should indicate the academic standards required for IBO solution.

§ 7. Delegations and their members

1) Each participating country is requested to send a delegation consisting of no more than four competitors (BO winners) and no more than two accompanying members (the competitors have to be bearers of the country's passport).
2) One of the accompanying members is the head of the delegation. Both accompanying members act as members of the International Jury.
3) Accompanying members must be able to translate the text of the written competition questions from English or Russian to the students' native language, to evalute competition tasks and to correct their solutions.

§ 8. The Competition and the Competition Tasks

1) the competition consists of two parts, theoretical and practical (experimental) examinations. The duration of each part should last for 4 to 6 hours with a break for refreshment. There might be an interval of one day between the two examinations.
2) The organizers are responsible for the preparation of the competition. The competition tasks are prepared by specialists who also indicate solutions and criteria of evaluation. All these materials become valid only when approved by the International Jury.
3) The competitors produce their solutions in their native language.
4) The organizer announces beforehand all safety precautions, including health care. He is also responsible for providing all participants with basic laboratory

and field facilities.

§ 9. The International Jury

1) The International Jury consists of a chairperson and of accompanying members of all delegations. The chairperson is appointed by organizing country.

2) The chairperson summons the members of the jury and directs the sessions of the International Jury. The International Jury decisions are taken on the basis of majority votes, in the presence of least 75 per cent of the jury members. In case of equal votes, the final decision is taken by the chairperson.

3) Rights and Duties of the International Jury:
   a) the International Jury is responsible for the course of the competition in adherence to the Organizational Rules,
   b) the International Jury discusses and approves, in advance, each competition topic submitted by the organizing country, the solution, and the marking scheme for evaluation and in case of any suggestions makes decisions about any necessary changes. Members of the International Jury translate the competition tasks into the students' native language,
   c) the International Jury evaluates the individual contributions and is responsible for the correct and unbiased evaluation of all scripts of the participants on the basis of identical criteria. The International Jury keeps the results of the evaluation secret until the official final announcement.
   d) the International Jury confirms the winners and decides about prizes and awards for the competitors,
   e) the International Jury members are obliged to keep all information about the competition tasks, results and evaluation secret until the official final announcement, they must not assist any of the participants during the competition.

§ 10. Evaluation and Prizes

1) The competitors can achieve approximately identical scores for the correct solutions of the theoretical and practical part.

2) The individual contributions will be assessed and corrected by the authors of the competition tasks and solutions. The International Jury makes the final decision concerning classification of the results. The corrected and assessed original scripts of the contributions will remain in the possession of the organizers.

3) The International Jury should announce the official results together with awards to individual students. The number of gold medals is limited to a maximum of 10 % of the number of participants, the number of silver medals will be limited approximately to 20 % of the number of participants and the number of bronze medals will be limited approximately to 30 % of the total number of competitors. In addition to medals, other prizes are being considered. The results will be proclaimed on an individual basis and not as a national team result.

4) Each competitor will obtain a certificate which recognizes his/her participation in the International Biological Olympiad.

§ 11. Duties of the Oganizers

The organizers will ensure:

a) presentation of the general direction and theme(s) of the practical part at the meeting of coordinators,
b) preparation and mailing of invitation letters and information on preparatory tasks of the IBO to all participating countries and to the Coordination Centre in Prague,
c) preparation of competition tasks, author's solution and evaluation for the International Jury,
d) material and other requirements necessary for the competition, in accordance with the approved Organization Rules,
e) translators and interpreters,
f) observation of secrecy and confidentiality during the competition and health insurance of all competitors of IBO.

§ 12. Financial Expenses

1) The country organizing the competition will expect each participating country to pay for all travel expenses of their competitors and accompanying persons to the first place in the host country and back. All other expenses of persons listed in § 7 in accordance with the organization programme, including the expenses for accommodation and board (3 times per day a minimum) for delegation members and interpretation will be covered by the host country.

2) Amount of pocket money should be given according to the possibility of the organizing country, which will inform beforehand (§6/4) other participating countries about its level.

3) The expenses of further participants and observers are to be covered by the delegating country or other organizer who will be obliged to share the increased organizational expenses (e.g. interpretation) by their registration fee. The organizer of the subsequent IBO can send two observers. The expenses of their stay will be settled in the same manner as for persons listed in § 7.

4) The organizing country can invite any experts as advisors. Their expenses can be included e.g. in the contract with UNESCO.

§ 13. Conclusion

1) The countries taking part in the competition are obliged to observe the Organizing Rules previously specified.

2) Changes in these Organization Rules can be made only at a meeting of the coordinators of IBO.

APPENDIX **CONTENT THEORTICAL PART 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 questions testing only knowledge should be as few as possible and they should not exceed 25 % of the total points.
After approval of the test questions by the International Jury the maximal obtainable points for correct answers (and incorrect answers if necessary) of each particular question have to be stated in the examination papers.

The Theoretical test should cover the following 7 topics in the indicated proportions:

I Cell Biology (25%)[1]
- Structure and function of cells
  * Chemical components
  * Organelles
  * Cell metabolism
  * Protein synthesis
  * Transport through membranes
  * Mitosis and meiosis
- Microbiology

II Plant Anatomy and Physiology (with emphasis on seed plants) (15%)
- Structure and function of tissues and organs involved in
  * Photosynthesis, transpiration and gasexchange
  * Transport of water, minerals and assimilates.
  * Growth and development
  * Reproduction (ferns and mosses included)

III Animal anatomy and Physiology (with emphasis on vertebrates) (15%)
- Structure and function of tissues and organs involved in
  * Digestion and nutrition
  * Respiration
  * Circulation
  * Excretion
  * Regulation (neural and hormonal)
  * Reproduction and development
  * Immunity

[1] Percentage representing points in the test

IV Ethology (5 %)

* Behavioral systems
* Causes of behavior
* Conflict behavior
* Learned behavior

V Genetics and Evolution (15%)

* Variation: mutation and modification
* Mendelian inheritance
* Multiple allelism, recombination, sex linkage
* Hardy-Weinberg principle
* Mechanism of evolution

VI Ecology (15%)

* Ecosystems
* Food relationships
* Energy flow
* Bio-geochemical cycles
* Succession
* Population structure and dynamics
* Biosphere and man

VII Biosystematics (10%)

- Structure & function; evolutionary and ecological relationships among typical organisms in major groups (Phyla and Classes only)

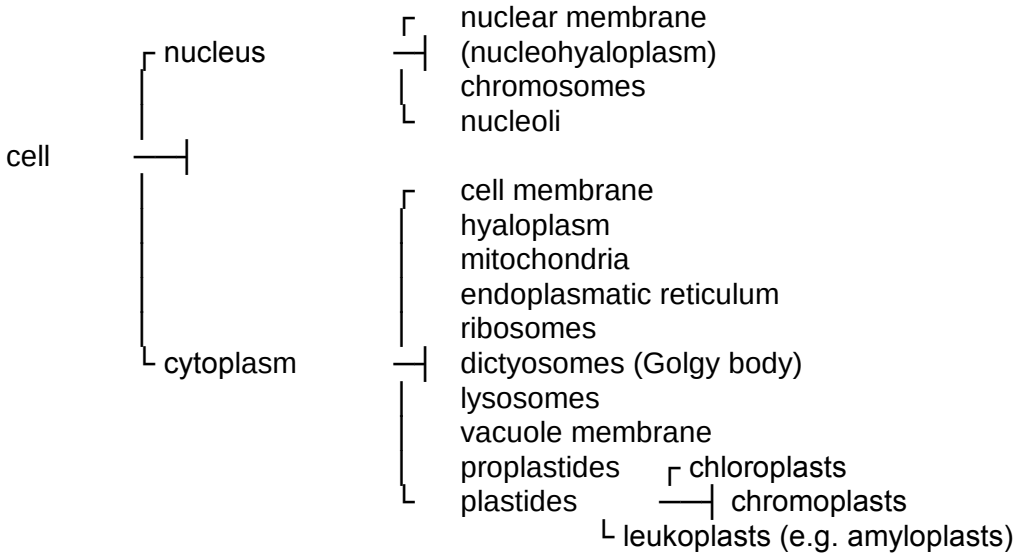
Questions concerning Biotechnology, Principles of Scientific Reasoning and Principles of Biological Methods should be included in the above topics.

I Cell biology : (25%)

Structure and function of cells

* Chemical components
  - Monosacharides; disacharides; polysacharides
  - Lipids
  - Proteins: amino acids, three letter symbol; architecture 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
    - ‘ Nomenclature
  - Nucleic Acids : DNA, RNA
  - Other important compounds
    - ‘ ADP and ATP
    - ‘ NAD^+ and NADH
    - ‘ $NADP^+$ and NADPH

* Organelles



Plant cells are surrounded with a cell wall

* Cell metabolism
  - Dissimilation of carbohydrates
    - ‘ Anaerobic dissimilation (anaerobic respiration) of glycose: glycolysis
    - ‘ Aerobic dissimilation (aerobic respiration) of glycose:
      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

Not yet specified.

II Plant anatomy and physiology (with emphasis on seed plants) (15%)

Structure and function of tissues and organs involved in:

* Photosynthesis, transpiration and gas exchange
  - Leaf : structure; function stomates

* Transport of water, minerals and assimilates
  - Root : structure (endodermis)
  - Stem : structure (vascular bundles)

* Growth and development
  - Apical meristems and cambium
  - Germination

* Reproduction (ferns and mosses included)
  - Asexual reproduction (clone forming)
  - Sexual reproduction
    ‘ Structure of flowers
    ‘ Pollination
    ‘ Double fertilisation
  - Alternation of generation in seed plants, ferns and mosses

III Animal anatomy and physiology (with emphasis on vertebrates) (15%)

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 chord 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 menstruation cycle
  - Fertilization
  - Formation of ectoderm, mesoderm, endoderm
  - Embryonic membranes
* Immunity
  - Antigens, antibodies

IV Ethology (5%)

* Behavioral systems
* Causes of behavior
* Conflict behavior
* Learned behavior

V Genetics and Evolution (15%)

* 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 (15%)

* Ecosystems
* Food relationships
  - Food web
  - Food chain
  - Trophic level
  - Producers, consumers and decomposers
* Energy flow
  - Pyramid of biomass
  - Pyramid of energy
* Bio-geochemical cycles
  - Carbon cycle
  - Nitrogen cycle
* Succession
* Population structure and dynamics
  - Age and sex structure of human population
  - Birth rate, death rate
  - Exponential growth
* Biosphere and man
  - Population growth
  - Pollution

VII BIOSYSTEMATICS (10%)

- Structure & function, evolutionary & ecological relationships among typical organisms in the following groups. The knowledge of the names of taxons below the level of families for plants, and orders for animals, nor the knowledge of latin names may not be a condition for a successful solution of the tasks, other than in the topic Biosystematics.

phylum
subphylum
classis
ordo
familia
genus

P R O K A R Y O T A

BACTERIA — Escherichia
CYANOPHYTA — Anabaena
PROCHLOROPHYTA

E U K A R Y O T A

RHODOPHYTA	Chondrus
PHAEOPHYTA	
Diatomeae	Navicula
Phaeophyceae	Sargassum
EUGLENOPHYTA	Euglena
CHLOROPHYTA	Chlorella
	Chlamydomonas
	Ulothrix
	Spirogyra
"PROTOZOA"	Amoeba
	Trypanosoma
	Plasmodium
	Paramaecium, Vorticella

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phylum	
subphylum	
classis	
ordo	
familia	
	genus

ZYGOMYCOTA	Mucor
ASCOMYCOTA	Claviceps, Penicillium
	Saccaromyces
BASIDIOMYCOTA	Agaricus

RHYNOPHYTA	Rhynia
BRYOPHYTA	
Hepaticopsida	Marchantia
Muscopsida	Polytrichum, Sphagnum
LYCOPODIOPHYTA	Lycopodium
EQUISETOPHYTA	Equisetum
POLYPODIOPHYTA	Pteridium
PINOPHYTA	Ginkgo
	Pinus
	Cycas
MAGNOLIOPHYTA	
Magnoliopsida	
Magnoliaceae	Magnolia
Ranunculaceae	Ranunculus, Pulsatilla
Rosaceae	Rosa, Malus, Prunus
Fabaceae	Pisum
Oleaceae	Syringa
Fagaceae	Quercus
Cactaceae	Opuntia
Brassicaceae	Brassica
Lamiaceae	Lamium
Solanaceae	Solanum
Asteraceae	Helianthus

	Liliopsida	
	Liliaceae	Lilium, Allium
	Orchidaceae	Orchis
	Poaceae	Zea, Triticum
	Arecaceae	Cocos
	Araceae	Monstera
PORIFERA		Euspongia
phylum		
subphylum		
classis		
ordo		
familia		
		genus
CNIDARIA		
	Hydrozoa	Hydra
	Scyphozoa	Aurelia
	Anthozoa	Corallium
PLATHELMINTHES		
	Turbellaria	Polycellis
	Trematoda	Fasciola
	Cestoda	Taenia
NEMATHELMINTHES		Ascaris, Trichinella
ANNELIDA		
	Polychaeta	Nereis
	Oligochaeta	Lumbricus
	Hirudinae	Hirudo
ARTHROPODA		
	Crustacea	Astacus, Daphnia, Cyclops
	Chelicerata	Araneus, Ixodes
	Tracheata	
	Chilopoda	Scolopendra
	Insecta	
	Thysanura	Lepisma
	Odonata	Libellula
	Orthoptera	Locusta
	Isoptera	
	Anoplura	Pediculus
	Heteroptera	Graphosoma, Gerris
	Homoptera	Aphis
	Coleoptera	Carabus, Leptinotarsa
	Hymenoptera	Ichneumon, Apis, Formica
	Diptera	Anopheles, Drosophila, Musca,
	Lepidoptera	Pieris, Bombyx
MOLLUSCA		
	Gastropoda	Helix
	Lamellibranchiata	Ostrea
	Cephalopoda	Sepia
ECHINODERMATA		
	Stellaroidea	Asterias
	Echinoidea	Echinocardium

phylum	*subphylum*	*classis*	*ordo*	*familia*	*genus*
CHORDATA					
	Urochordata				Ascidia
	Cephalochordata				Branchiostoma
	Vertebrata				
		Cyclostomata			Petromyzon
		Chondroichthyes			Scyliorhinus
		Pisces			
			Chondrostei		Acipenser
			Teleostei		Clupa
		Amphibia			
			Caudata		Salamandra
			Anura		Rana
		Reptilia			
			Testudinata		Testudo
			Crocodylia		Crocodylus
			Squamata		Lacerta, Vipera
		Aves			
			Struthioniformes		Struthio
			Sphenisciformes		Spheniscus
			Ciconiiformes		Ciconia
			Anatiformes		Anser
			Falconiformes		Falco
			Galliformes		Gallus
			Columbiformes		Columba
			Strigiformes		Strix
			Piciformes		Dryocopus
			Passeriformes		Parus
		Mammalia			
			Monotremata		Ornithorhinchus
			Marsupialia		Macropus
			Insectivora		Erinaceus, Talpa
			Chiroptera		Myotis
			Rodentia		Mus
			Carnivora		Ursus, Canis, Felis
			Proboscidea		Elephas
			Perissodactyla		Equus
			Artiodactyla		Sus, Bos
			Cetacea		Delphinus
			Primates		Cebus, Macaca, Hylobates, Pan, Gorilla, Pongo, Homo

Groups that are not in this classification, but have to be known are:

phylum	*subphylum*	*classis*

ordo
familia
genus

VIRALES	Bacteriophage
LICHENES	Parmelia, Cladonia

10. ADDRESSES OF COORDINATORS AND THEIR DEPUTIES, OBSERVERES AND INSTITUTIONS RELATED TO THE IBO

AUSTRALIA
Prof Rodney Jory
Australian National University
Department of Physics
Canberra 2601
Australia

BELGIUM
Dr Patrick Reygel
Department SBM
Limburgs Universitair Centrum
Universitaire Campus, gebouw D
B-3610 Diepenbeek
Belgium
Phone: 32-11-229 961
Fax: 32-11-223 284

Gerard Cobut
chairman PROBIO
avenue Louis Jasmin, 100
B-1150 Brussels
Belgium
Phone: 32-2-627 42 44
Fax: 32-2-646 44 66

Dr. Michel Asperges
Onderwijslaan 87
B-3590 Diepenbeek
Belgium

BULGARIA
Sacha Mladenova
Ministerstvo obrazovanii i nauk
st. Alex. Stambolisky 18
Sofia 1000
Bulgaria
Phone: 359-2-84 811/382
359-2-88 01 25
Fax: 359-2-87 12 89

CANADA
Janice Sullivan
c/o Biological Olympiad Office
306 Lawrence Avenue East
Toronto, Ontario
Canada M4N 1T7
Fax: 1-416-481 56 32

CZECHOSLOVAKIA
RNDr Jan Stoklasa
Department of Didactics
Faculty of Natural Sciences
Charles University
Vini_ná 5
128 44 Praha 2
Czechoslovakia
Phone: 42-2-292 151/254

GERMANY
Dr Ulrich Jüdes
IPN (Institute of Science Education)
University of Kiel
Olshausenstr. 62
D-2300 Kiel 1
Germany
Phone: 49-431-880 31 33
Fax: 49-431-889 15 21

Mrs Annett Hartmann
Johannes-Werner-Str. 9b
O-1197 Berlin
Germany

GREECE
Dr George Sakellaris
National Hellenic Research Foundation
Institute of Biological Research
48, Vas. Constantinou Str.
116 35 Athens
Greece
Phone: 30-1-723 99 65
Fax: 30-1-721 27 29

POLAND
Prof Henryk Sandner
Palac kultury a nauki Imeni Kopernika
pokoj 1916
Warszawa 00-901
Poland
Phone: 48-22-203 314

Jan Fronk
Institute of Biochemistry
Warsaw University
Zwirki i Wigury 93
02 089 Warsaw
Poland
Phone: 48-22-232 046

THE NETHERLANDS

Drs Hans Morélis
c/o Institute for Curriculum Development (SLO)
Postbus 2041
7500 CA Enschede
The Netherlands
Phone: 31-53-840 840/840 453
Fax: 31-53-307 692

Prof Dr P.A. Voogt
Centre for ß Didactics
Department of Biology
Princetonplein 5
3584 CC Utrecht
The Netherlands
Phone: 31-30-535 450/535 446
Fax: 31-30-531 601

RUSSIA

Vladislav Sivoglazov or RABT
Biologija Kibalchicha 6, building 4
a/ja 24 129278 Moscow
127 521 Moskva Phone: 7-095-283 15 83
Fax: 7-095-200 42 66
c/o Minister E.M.Dneprov or State Committee for Public Education
Ministry of Education Ljusinovskajastr 51
_istoprudnyj bulvar, 6 113833 Moscow M-230
101 000 Moskva Russia
Russia Fax: 7-095-230 20 89
Phone: 7-095-237 94 49

SOUTH KOREA

Prof Song-Chun Moon
Computer Science Dpt.
Kaist
Cheongryang P.O.Box 150
Seoul 130-650
South Korea
Fax: 82-2-960 67 43

SWEDEN

PhD Andreas Ehn
Kohagsvägen 11

S-756 53 Uppsala
Sweden
Fax: 46-18-324 484
46-18-503 510

THAILAND
Dr Sumonta Promboon
Faculty of Sciences
Srinakharinwirot University
Sukhumvit 23
Bangkok 10110
Thailand
Phone: 66-2-258 0310-13 (ext 203)
Fax: 66-2-258 3989

Dr Chaleo Manilerd
Director, IPST
924 Sukhumvit Road
Bangkok 10110
Thailand
Phone: 66-2-392 4021
Fax: 66-2-381 0750

Mrs Nantiya Boonklurb
Chief Biology Team IPST
924 Sukhumvit Road
Bangkok 10110
Thailand
Phone: 66-2-392 40 21

Mr Morakot Sukchoyiratana
Faculty of Science
Chieng Mai University
Chieng Mai 50002
Thailand
Phone: 66-53-221 699
Fax: 66-53-222 268

Dr Usanee Yodyingyuad
Faculty of Science
Chualalongkorn University
Bangkok
Thailand
Phone: 66-2-231 1949/50
Fax: 66-2-215 3635

TURKEY
Mehmet Cakmak
Özel Fatih Erkek Liseleri
Dolagh Bostan Sokah 21

Fatih-Istanbul
Turkey
Phone: 90-1-534 6926/6927

Mr. Melih Yalcineli
Physics Olympiad Trainer
Izmir ouel yamanlar lisesi
Temel Bilimler Arastirma
Gelistirme
Kurulu Baskanligi
7400/21 Sk.No.2
Ornekkoy-Karsiyaka
Izmir
Turkey

ZAMBIA
Dr C.E. Fitches
Zamstep Coordinator
c/o The British Council
Herold Place
Cairo Road
P.O.Box 34571
Lusaka
Zambia

IUBS-CBE
Prof Dr Gerhard Schaefer
Faculty of Education, Institute 9
University of Hamburg
Von Melle Park 8
D-2000 Hamburg 13
Germany
Phone: 49-40-4123 2171/2168
Fax: 49-40-4123 2112
Telex: 214 732

UNESCO
John Elfick
UNESCO
7, place de Fontenoy
757 00 Paris
France

Phone: 33-1-4568 0840
Fax: 33-1-4065 9405

COORDINATING CENTRE
RNDr Tomáš Šoukup, PhD
Institute of Physiology
Czech. Acad. Sci.
Videnská 1083
142 20 Prague 4
Czechoslovakia
Phone: 42-2-472 1151
Fax: 42-2-471 9517

Mrs Jitka Machá_ková
Institute of Children and Youth
Havlí_kovy sady 58
120 28 Prague 2
Czechoslovakia
Phone: 42-2-736 051-4
Fax: 42-2-691 1274

CHINA
Prof Ma Lailing
Biol. Dept. Peking University
ZIP code 100871
Beijing
P.R. of China
Phone: 86-1-25611 66 ext 7055 (O)

GREAT BRITAIN
Alan Shaw
Winchester Minister Court
L7 30C Liverpool
England

USA
Robert J. Olds
61 Wolf Place
07205 Hillside New Jersey
USA
Phone: 1-908 686 2543
Fax: 1-908 686 0827