



# IBO Operational Guidelines

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*Commentary on authorship and current version of these rules:*

These guidelines were compiled through the efforts of the IBO Guide workgroup, established during the AB-meeting of 2016 and in collaboration with the Steering Committee. Group members (in alphabetic order): Andrew Treharne, Burkhard Schroeter, Charles Douthwaite, Dennis Kappei, Gérard Cobut, Lena Bänziger, Lenka Libusová, Linus Meier, Roel Baars (editor).

This document is based on “A Guide to the International Biology Olympiad”, edition 28.0, July 2017 and is in compliance with the “International Biology Olympiad e.V. Articles of Association”.

The latest revisions were undertaken due to requested changes to these guidelines as discussed during the AB meeting 2021 and as presented and accepted during the AGM 2021 on 14 October 2021.

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# 1. Introduction and history

## 1.1. Introduction

(1) The International Biology Olympiad (IBO) is an annual competition for secondary school students. (2) Their skills in tackling biological problems, and dealing with biological experiments are tested. (3) Interest in biology, inventiveness, creativity and perseverance are necessary.

## 1.2. Aims of the IBO

(1) The IBO competition aims at secondary school students who are interested in biology. (2) In bringing together gifted students, the IBO challenges and stimulates students to expand their talents, and to promote a career in science. (3) The objectives of this competition are to:

- (4) Stimulate active interest in biological studies;
- (5) Promote networking and understanding between biology students;
- (6) Promote and exchange ideas about biology education.

## 1.3. History

(1) The biology competition between Czechoslovakia and Poland from 1985 to 1989 was the forerunner of the future IBO. (2) The positive experience from the International Olympiads in other natural sciences and mathematics prompted the idea of an International Biology Olympiad, for which UNESCO asked Czechoslovakia to take the initiative. (3) Six countries (Belgium, Bulgaria, Czechoslovakia, the German Democratic Republic, Poland and the Soviet Union) founded the IBO Competition in 1989 (Prague and Brno), and held the first competition in Olomouc in July 1990. (4) Notwithstanding some initial difficulties, this Olympiad was a great success. (5) More countries joined quickly in the following years and the number of participating countries still increases steadily. (6) Soon after the first IBO, a Coordinating Center was established in Prague to function as the administrative headquarters of the IBO. (7) In 2017, the IBO became an officially registered association with its seat in Kiel, Germany.

## 2. IBO Structure

(1) The IBO is organized as an international association, officially named “International Biology Olympiad e.V.,” registered in Germany at the register of associations at the local court in Kiel. (2) Its Articles of Association govern the legal aspects of the IBO Association, including membership, the General Assembly and the Steering Committee. (3) The Articles of Association are available online. (4) These Operational Guidelines complement the Articles of Association.

### 2.1. General Assembly

(1) The General Assembly (GA) comprises all the members of the association. (2) Its legal role is described in the Articles of Association, §10. (3) The General Assembly is the ultimate authority for all decisions of the IBO Association. (4) In addition, the GA is responsible for changes to these operational guidelines.

### 2.2. Steering Committee

(1) The Steering Committee (SC) operates as the managing board of the association. (2) Its legal role is described in the Articles of Association, §12. (3) In addition, the Steering Committee is responsible for the following matters:

- (4) Defining tasks for, and supervising of the IBO Office and Coordinating Centre;
- (5) Enforcing the rules of the IBO Competition and taking the appropriate measures in case of violation in accordance with the Articles of Association, §6;
- (6) Making decisions in urgent, unregulated cases;
- (7) Call for electronic voting;
- (8) Ensuring all members are treated fairly and equally;
- (9) Communicating all decisions to the GA or Jury.

(10) The Secretary of the Steering Committee will keep minutes of internal SC communications, and archive them.

### 2.3. IBO Office

(1) The IBO Office exists to support the IBO Association in the broadest sense. (2) It fulfills the following functions on behalf of, and under the authority of the SC:

- (3) Providing information for all members;
- (4) Maintaining public relations for the IBO with other institutions;
- (5) Promoting contact with non-IBO member countries;
- (6) Coordinating the invitation of observers from non-IBO member countries by the future host country;
- (7) Maintaining a list of current contact information of country coordinators, their deputies, observers and organizations taking part in the IBO Competition;
- (8) Collecting materials and information regarding the IBO and other biological competitions, including descriptions of National Biology Olympiads or similar competitions used to select IBO competitors;
- (9) Reporting about its activities at the General Assembly;
- (10) Fund raising for the IBO Association;
- (11) Perform and coordinate IBO-related research.

## 2.4. Coordinating Centre

(1) The Coordinating Centre (CC) is the former primary secretariat of the IBO Competition. (2) With the establishment of the IBO Office, most tasks have been taken over by the IBO Office, as described above. (3) The CC will support the IBO Office in its functions and will be actively involved in transferring its knowledge to the IBO Office. (4) The CC is responsible for the yearly organization of the IBO Advisory Board meeting, and the annual handing over of the IBO Cup. (5) In case the IBO Office is unable to fulfill its functions, the CC serves as a fallback option.

## 2.5. Host

(1) The term 'host' or 'host country' refers to the organization and organizers of the IBO Competition in the country concerned (see also Articles of Association, Definitions). (2) The host is responsible for most of the preparation of the IBO Competition, including arranging the venue and setting the exams. (3) The host works in close collaboration with the SC, the IBO Office and CC to organize the competition according to the IBO standards, but also in case of problems.

## 2.6. Advisory Board

(1) Every autumn the Coordinating Centre organizes an Advisory Board (AB) meeting as a platform for information exchange between the two previous and the two future hosts of the IBO Competition. (2) Together with the SC these parties can discuss various topics regarding the preparation of the competition, and benefit from each other's experience and views. (3) Additionally, representatives from all members of the association are invited to join the meeting for discussion and to propose recommendations regarding the competition rules and regulations. (4) Interested members should apply to attend four weeks in advance and submit their proposals no later than 14 days before the meeting. (5) Minutes of the AB meeting will be sent to all members. (6) Any recommended change must be approved by the GA according to §2.1, possibly by electronic vote.

## 3. IBO Competition

### 3.1. Description

(1) The IBO Competition takes place each year in July in one of the member countries of the IBO Association. (2) It is organized by the Ministry of Education or by another recognized institution of the organizing country (only the term ‘organizer’ is used in the subsequent text). (3) All disciplines of biology are acceptable for the IBO Competition. (4) More widely oriented topics should enable the competitors to apply not only their knowledge and skills, but also their ability to think independently and solve problems.

### 3.2. Structure

#### 3.2.1. International Jury

(1) Delegates from each participating country form the International Jury. (2) The Jury translates the examination papers and approves the questions, answers and marking scheme. (3) The Jury members verify and approve the marking process and the final scores of their students. (4) These deliberations are kept confidential until the official announcement of the results.

#### 3.2.2. Chairman of the Jury

(1) The International Jury is chaired by a representative from the host country, who directs the jury sessions and oversees the discussion and voting procedures.

#### 3.2.3. Inspectors

(1) An inspector is anyone, appointed specifically by the International Jury, who is present during an examination to check whether everything proceeds in accordance with the rules. (2) One or more inspectors should be present during every examination, and they must not interfere with the proceeding of the examination. (3) Inspectors will be recruited among jury members, including (but not limited to) past and future IBO organizers, members of the SC and observers. (4) The host country will provide an initial training for the inspectors and criteria to report on the examinations. (5) The inspectors deliver a report of their findings to the International Jury. (6) Where there are reasonable grounds to suspect instances of cheating, the SC is informed first.

## 3.3. Participation

### 3.3.1. Prerequisites

(1) The primary requirement to participate in the IBO Competition, is to be a member of the IBO Association (see the Articles of Association §4 – 6 for details). (2) The requirements for membership are summarized here for convenience:

- (3) A member of the IBO Association must be the organizer (person or organization) of a National Biology Olympiad (NBO), and be legitimized as such by an official document issued by the Ministry of Education, or equivalent;
- (4) A member must provide an up-to-date description of their NBO and contact details;

- (5) A member must follow the rules of the IBO Association, the operational guidelines in this document, and the decisions of the GA;
  - (6) A member must pay a yearly membership fee to the IBO Association.
- (7) Decisions on membership of, and exclusion from the association are taken by the GA, usually during the Annual General Meeting, which is held during the IBO Competition.

### 3.3.2. Observer

(1) In addition to the association membership rules, a (candidate) member is first required to send a representative to the IBO Competition as an observer for at least one year, before it may bring students as competitors.

(2) Provided all requirements are met, the association membership can be confirmed by the GA in the observing year. (3) Participation with students is possible in the year(s) after. (4) A member who has fulfilled its duties, but has not participated in the competition for three consecutive years must first send an observer again.

### 3.3.3. Exclusion

(1) A member of the IBO Association will be excluded from the IBO Competition when it has neglected to fulfill its duties (§3.4.1), or during any period of suspension as a member of the IBO Association. (2) Details of the exclusion (including its duration) will be decided by the GA, following proposals by the SC. (3) In addition, specific Jury members and competitors who have cheated will be banned for life.

(4) Termination of membership from the IBO Association, either by resignation or exclusion, leads to automatic exclusion from the IBO Competition (see Articles of Association §6 for details on the termination of association membership).

### 3.3.4. Invitations

(1) Every year, all members receive an invitation from the host to participate in the competition.

(2) Members will not receive an invitation if their membership requirements are not met. (3) The list of invitations is confirmed during the AB meeting.

(4) Providing there is sufficient accommodation and in consultation with the Steering Committee, candidate members may be invited by the host to apply for membership of the IBO Association and become observers in the upcoming competition.

### 3.3.5. Delegation

(1) A standard member delegation comprises at most four students and two jury members.

(2) The delegation may be extended with additional jury members.

### 3.3.6. Collaboration

(1) When two members cooperate in organizing a single national competition, both members are equally eligible to participate in the competition. (2) Specific arrangements have to be formulated in advance and need to be approved by the General Assembly.

### 3.4. Member duties and rights

(1) In addition to the obligations for membership of the association (see §1 and the Articles of Association §5), a member has the following duties and rights. (2) Neglecting to fulfill these duties will lead to exclusion from the IBO Competition (§3.3.3).

#### 3.4.1. Duties

- (1) Members must comply with any deadlines set out by the host in the invitation letter, in particular, the dates for (i) registration, (ii) payment of the participation fee and (iii) cancellation.
- (2) A Member not making full payment of the participation fee by the date specified in the invitation letter will be taken to have withdrawn their intention to attend unless they have made other arrangements for payment satisfactory to and agreed in writing by the host. Non-payment of the participation fee where the host has agreed other arrangements for payment will result in suspension of the non-paying Member.
- (3) Member delegations need to arrange and finance their own travel plans, including travel visa, and obtain sufficient insurance for travel, accidents and health care;
- (4) Members must assure that the NBO competition from which their IBO competitors are selected, is eligible to all regular secondary schools for general education in the country concerned;
- (5) Members should supply the host organizers with the signed student declaration forms (§5.2);
- (6) Members should refrain from any political, ethnic and religious propaganda during the competition;
- (7) Members and all their delegation members should adhere to the principles of fair-play.

#### 3.4.2. Rights

- (1) Members have the right to participate in the competition;
- (2) A member may indicate that it wants to be the host of an IBO competition, and is encouraged to do so;
- (3) Members may send test questions to the host for use in the theoretical tests. (4) The host may set guidelines, e.g. for the desired format and quality control. (5) Questions must be provided copyright-free and available for non-commercial use.

### 3.5. Competitor duties and rights

(1) Participation in the competition is restricted to competitors who:

- (2) Are the winners of the NBO in the current school year in the country they represent;
- (3) Are students of a regular secondary school<sup>1</sup> for general education in the country they represent;
- (4) Are not trained or instructed within a selected group of 50 or fewer students, including the IBO team, for a period longer than two weeks;
- (5) Are born on 1 July or later of the year of the competition minus twenty;

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<sup>1</sup> Main reference: [Unesco ISCED-11](#)



- (6) Have participated fewer than two times in the competition;
- (7) Have not obtained a diploma allowing them to study at a university or equivalent institution, before 1 January of the year of the competition;
- (8) Have not started to study at a university or equivalent institution as regular or full-time students;
- (9) Have not been observers or jury members in previous competitions.

(10) Competitors are required to provide a signed declaration confirming above points (see Appendix 1) before they can be admitted to the competition.

(11) Competitors are required to adhere to the principles of fair-play and should not receive any assistance with the IBO Competition.

(12) Competitors should not bring large objects with them on stage during the award ceremony, for example a national flag. (13) These objects may obscure other competitors, which is discourteous, and draw the attention away from the individual accomplishments.

(14) It is not allowed for competitors to be in possession of a telephone, computer, or other means of telecommunication during the competition. (15) Students may contact jury members and / or parents in the case of a (medical) emergency.

(16) Students can be excluded or disqualified from the IBO Competition if above regulations and restrictions are not met.

### 3.6. Financial matters

(1) The membership fee for the IBO Association (see Articles of Association §7.1) is determined by the General Assembly. (2) The host sets the participation fee for the IBO Competition and must indicate them one year before the competition at the latest. (3) There must be a single fee for a standard delegation. (4) Additional fees may be charged for additional jury members, or visitors. (5) The host will cover the expenses for the stay during the competition, including accommodation, meals, and excursions, but is not supposed to cover the travel expenses of the members to and from the IBO Competition country.

(6) The host country will cover the participation fees for the representatives of the IBO Office, the CC and the chairperson of the IBO to be present during the IBO Competition.

### 3.7. Examinations

#### 3.7.1. General remarks

(1) The IBO Competition consists of both theoretical and practical (experimental) examinations. (2) The recommended duration of each part is four to six hours with a break for refreshment. (3) There must be at least a one-day interval between the two examinations. (4) The points available for each question must be available to the participants. (5) Error carried forward must be applied for marking of all exams where applicable.

(6) Because not all organisms have a common name in all languages, it is recommended to include a description of the organism, or the scientific (Latin) name in addition to the common name. (7) This may help in the translation process. (8) Knowledge of the scientific names of organisms should not be required for the successful solution of a question.

(9) An extensive essay on how to write high quality exam questions is available online (authored by Hans Morélis, The Netherlands): [Designing a reliable IBO Theory examination](#).

(10) All examinations will be kept under embargo for two years after the IBO Competition.

(11) Afterwards they will be published online on the IBO website under a Creative Commons license (CC BY-NC-SA, Attribution-NonCommercial-ShareAlike). (12) The host country shall ensure that the copyright of all figures and image items in IBO exams resides with the host and/or IBO e.V.

### 3.7.2. Practical exams

(1) The tasks in the practical examination should concentrate on the evaluation of the competitors' ability to solve biological problems using the skills and methods commonly used in biological laboratories. (2) The host must indicate the general topic of the practical papers for the following IBO one year before the competition at the latest.

(3) Instructions will be provided to the students before or during the examination for any practical procedure involving specialized technical equipment to prevent faulty operation and damage to the equipment. (4) Lab safety regulations need to be observed at all times.

(5) No experiments should be carried out which cause the suffering or death of vertebrates.

(6) Handling of species protected by law in the host country or by International Conventions (i.e. CITES) is not permitted. (7) Animal dissection is allowed on invertebrates, fish and vertebrate parts or organs that are available for consumption. (8) Animals used for dissection should be dead before being submitted to the competitors.

(9) An overview of relevant practical skills is given in Appendix 2.

### 3.7.3. Theoretical exams

(1) The IBO theoretical tasks should test the competitors' understanding, processing skills and application of biological knowledge. (2) Questions should require understanding, rather than knowledge.

(3) Theoretical questions should cover the following topics in the indicated proportions.

<b>I</b>	<b>Cell biology</b>	<b>(20 %)</b>
	Structure and function of cells and their components	
	Microbiology	
	Biotechnology	
<b>II</b>	<b>Plant anatomy and physiology</b>	<b>(15 %)</b>
	(with emphasis on seed plants)	
<b>III</b>	<b>Animal anatomy and physiology</b>	<b>(25 %)</b>
	(with emphasis on vertebrates and especially man)	
<b>IV</b>	<b>Ethology</b>	<b>(5 %)</b>
<b>V</b>	<b>Genetics and Evolution</b>	<b>(20 %)</b>
<b>VI</b>	<b>Ecology</b>	<b>(10 %)</b>
<b>VII</b>	<b>Biosystematics</b>	<b>(5 %)</b>

### 3.8. Pre-check of exams / subgroup

(1) A Subgroup from the International Jury is appointed to review the practical and theoretical examinations prior to the IBO Competition in strict confidentiality. (2) The Subgroup works closely together with the host country on this task.

(3) The Subgroup comprises at least six jury members, including a member of the SC. (4) The host is recommended to choose the Subgroup members from a list of volunteering jury members during the previous IBO Competition, but also keeps the option to choose its own members. (5) The International Jury should be informed about the composition of the Subgroup.

(6) Membership of the subgroup will be limited to 3 years (counting begins in 2015).

(7) Members leaving the subgroup are eligible to serve again after an absence of at least one year. (8) Members of the Subgroup should not be involved in the selection or training on a national level, except if the Subgroup meets directly prior to the IBO Competition.

(9) The Subgroup reports on their findings at the beginning of the jury sessions.

### 3.9. Jury operations

#### 3.9.1. General

(1) The host country is responsible for the preparation of the Competition and will provide examination papers, solutions and criteria for evaluation of answers. (2) The examination materials become valid only when approved by the International Jury. (3) The complete set of examination materials shall be provided at the start of each corresponding translation session.

(4) The content and background of the practical exams shall be summarized in brief presentations at the start of the translation session. (5) The main language of the IBO Competition is English. (6) The competitors must have the opportunity to receive all tasks translated into their native language.

(7) The individual papers, tasks and answer sheets of the competitors will be assessed and marked by the authors of the competition tasks and solutions.

#### 3.9.2. Voting

(1) Any issue regarding the examination may be brought up for a vote. (2) The vote should be anonymous and remain anonymous. (3) Electronic voting has a strong preference. (4) Each country has one vote and in the event of a tie, the Chairman has the casting vote. (5) After the Jury members have met the competitors, no questions should be deleted or changes to the exams made, unless a two-thirds majority of the Jury agree.

#### 3.9.3. Exam discussion

(1) All changes in the exams have to be communicated to the jury. (2) The reasoning behind a major change should be given. (3) Proposed changes by the jury cannot be ignored; if the scientific committee does not agree with a change, it should be brought up for a vote. (4) Due to time constraints for translation, it is important to prevent that exams or questions that have been finalized are changed again. (5) This is important in particular when some delegations are not present in the jury room anymore.

### 3.9.4. Results and awards

(1) The International Jury should vet and approve the official results together with awards to individual competitors before the official announcement by the host. (2) The results will be proclaimed on an individual basis and not as a national team result. (3) Each competitor will obtain a certificate that recognizes his/her participation in the IBO. (4) Medals are awarded based on a mathematical procedure without discussion by the jury. (5) One Jury member is appointed by its peers to supervise this process. (6) One Jury member is appointed by its peers to observe the general marking process. (7) To facilitate this, the host country shall provide its strategy for collecting marks and data integration at the start of the translation sessions. (8) In addition to medals, the award of other prizes is possible, if agreed upon in advance by the jury. (9) Medals and prizes must not be of significant material value.

(10) The final ranking of the competitors is based upon their equally weighted scores for the theoretical and practical tasks according the  $t$ -score method. (11) First, the  $t$ -score of the average of the  $t$ -scores of the individual practical tasks is calculated. (12) Second, the  $t$ -score of the summed score of both theoretical tasks is calculated. (13) The final score of the competitor is the sum of these two. (14) As a last step, the score is rescaled as follows: final score =  $50 + 10 \times$  final  $t$ -score.

(15) Applying an unequal balance between the theoretical and practical tasks requires the approval of the International Jury. (16) The awards are determined according to the cutoffs below, where  $n$  is the number of competitors, and  $\lceil n \rceil$  is the ceiling function (e.g  $\lceil 4.1 \rceil = 5$ ,  $\lceil 4.9 \rceil = 5$ ). (17) The maximum number of awards equals  $0.7 \lceil n \rceil + 2$ .

<b>Gold medal</b>	$w = \lceil 0.1 n \rceil$	The last gold medal winner is the one preceding the largest gap out of the three following the top $w$ competitors.
<b>Silver medal</b>	$x = \lceil 0.3 n \rceil$	The last silver medal winner is the one preceding the largest gap out of the three following the top $x$ competitors.
<b>Bronze medal</b>	$y = \lceil 0.6 n \rceil$	The last bronze medal winner is the one preceding the largest gap out of the three following the top $y$ competitors.
<b>Certificate of Merit</b>	$z = \lceil 0.7 n \rceil$	The last certificate of merit winner is the one preceding the largest gap out of the three following the top $z$ competitors.

(18) It is possible to perform a re-calculation and medal re-determination after the IBO, mainly in cases of disqualification, or procedural errors. (19) This will not reduce the medals that other competitors received during the IBO.

## 4. Host Country

### 4.1. Becoming a future IBO host

(1) Only members of the IBO Association can apply to host a future IBO Competition. (2) Every member of the IBO Association can apply to host a future IBO Competition. (3) To be officially accepted as a future host, a member must:

- (4) Provide an official letter from the Ministry of Education or similar body confirming the commitment of the country to host an IBO;
- (5) Nominate the organizations and involved bodies (e.g. universities) with their main tasks;
- (6) Nominate the institution, that guarantees the availability of the required finance necessary to carry out the IBO;
- (7) State the year, prospective site and putative fee;
- (8) The GA approves the organizing country at least two years ahead.
- (9) In consideration of being invited to host the IBO Competition, the host will be required to enter into a contract of indemnity with the IBO Association in respect of potential liabilities arising from the IBO Competition and to produce evidence of satisfactory insurance or other security in respect thereof.

### 4.2. Duties of the host

(1) The organizers of the IBO Competition will:

- (2) Send invitation letters (including an announcement about financial contributions of participants and observers) and information on the practical tasks for the IBO Competition to the confirmed IBO Association member countries (see §3.3.4). The invitation letter should set out (i) the closing date for registration; (ii) the date by which full payment must be received and (iii) the latest date for cancellation in order to obtain any refund of monies already paid;
- (3) Prepare the competition examinations and answer key;
- (4) Conduct the marking of the participants' results;
- (5) Provide a digital system for the translation and taking of the exams, in consultation with the SC and the IBO Office;
- (6) Archive the marked and assessed original papers, exams and answer sheets of the competitors for a period of two years;
- (7) Provide materials and other requirements necessary for the competition;
- (8) Observe secrecy and confidentiality during the competition;
- (9) Enforce observance of safety regulations by all competitors;
- (10) Supervise the competition in cooperation with the International Jury;
- (11) Prepare a final report including an evaluation of the competition, and a statistical analysis of the results, within one year after the competition;
- (12) Provide three daily meals, except on the official day of arrival (only dinner) and official day of departure (only breakfast).

- (13) The host provides the total raw scores per task for each individual competitor to their team leaders for final approval.

(14) Please refer to the online [Guidelines for the Host Country](#) for further details.

## 5. Appendices

### Appendix 1: Template for Declaration form for Competitors

**IBO host  
Logo**

## **INTERNATIONAL BIOLOGY OLYMPIAD Declaration form for competitors**



Please fill in CAPITAL LETTERS.

Country: \_\_\_\_\_

First name: \_\_\_\_\_ Family name: \_\_\_\_\_

Date of Birth: \_\_\_\_\_ (dd-mm-yyyy)

I, as a competitor of the IBO \_\_\_\_\_ in \_\_\_\_\_ declare that:  
(year of IBO) (location of IBO)

- I am (I was until \_\_\_\_\_) a student of a regular secondary school for general education in the country concerned
- I have not obtained a diploma allowing to study at a university or equivalent institution before the 1st of January of the actual competition year;
- I am one of the winners of the National Biology Olympiad of the current school year of the above-mentioned country;
- I was not trained or instructed within a selected group of 50 or fewer students comprising the IBO team for a period longer than two weeks;
- I was born on the 1st of July of <the IBO year minus 20> or later;
- I have not participated already twice in the IBO;
- I have not yet started study at university or equivalent institution as regular or full time student;
- from 14:00 on the day before the Practical task until the end of the Theoretical task I will have registered and hand in my personal electronic communication devices;
- I agree to be photographed or filmed during the IBO; the organizers may use those images freely for IBO promotion purposes (no commercial use);
- I understand that I can be disqualified if I don't comply with one of the above-mentioned declarations.

Date and signature of competitor

### **SCHOOL INFORMATION**

Name of school \_\_\_\_\_

School address \_\_\_\_\_

School phone and fax \_\_\_\_\_

School e-mail \_\_\_\_\_

Name of school principal \_\_\_\_\_

I as the principal of this school declare that the information given by the above-mentioned student is entirely correct.

Date and signature of the principal \_\_\_\_\_

(Please certify with the school stamp)

## Appendix 2: List of practical skills

The following list gives a non-exhaustive overview of the practical skills that can be tested during the IBO Competition.

*N.B. The current list is partly outdated and may not reflect the effective syllabus of the IBO Competition accurately. The list is under review and will receive a thorough update in the near future.*

### I. Science Process skills

- Observation;
- Measurement;
- Grouping or classification;
- Relationship finding;
- Calculation;
- Data organization and presentation: graphs, tables, charts, diagrams, photographs;
- Prediction / projection;
- Hypothesis formulation;
- Operational definition: scope, condition, assumption;
- Variable identification and control;
- Experimentation: experimental design, experimenting, result / data recording, result interpretation and drawing conclusions;
- Representing numerical results with appropriate accuracy (correct number of digits).

### II. Basic biological skills

- Observation of biological objects using magnifying glasses;
- Work with a microscope (objective max. 45×);
- Work with a stereomicroscope;
- Drawing of preparations (from a microscope, etc.);
- Exact description of a biological drawing using tables of biological terms marked with a numerical code.

### III. Biological methods

Competitors should be familiar with the following methods. If a method requires specific information regarding specialized technical equipment, instructions will be provided.

#### A. Cytological methods

- Maceration and squash technique;
- Smear method;
- Staining of cells and slide preparation.

#### B. Methods to study plant anatomy and physiology

- Dissection of plant flower and deduction of flower formula;
- Dissection of other plant parts: roots, stems, leaves, fruits;



- Free-hand sectioning of stems, leaves, roots
- Staining (for example lignin) and slide preparation of plant tissues;
- Elementary measurement of photosynthesis;
- Measurement of transpiration.

#### *C. Methods to study animal anatomy and physiology*

- Dissection of invertebrates;
- Whole-mount slide preparation of small invertebrates;
- Elementary measurement of respiration.

#### *D. Ethological methods*

- Determination and interpretation of animal behavior.

#### *E. Ecological and environmental methods*

- Estimation of population density;
- Estimation of biomass;
- Elementary estimation of water quality;
- Elementary estimation of air quality.

#### *F. Taxonomic methods*

- Use of dichotomous keys;
- Construction of simple dichotomous keys;
- Identification of the most common flowering plant families;
- Identification of insect orders;
- Identification of phyla and classes of other organisms.

### **IV. Physical and chemical methods**

- Separation techniques: chromatography, filtration, centrifugation;
- Standard tests for monosaccharides, polysaccharides, lipids, protein (Fehling,  $I_2$  in KI (aq), biuret);
- Titration;
- Measuring quantities by drip and strip methods;
- Dilution methods;
- Pipetting, including use of micropipettes;
- Microscopy, including use of counting chambers;
- Determination of absorption of light;
- Gel electrophoresis.

### **V. Microbiological methods**

- Preparing nutrient media;
- Aseptic techniques (flaming and heating glass material);

- Inoculation techniques.

## **VI. Statistical methods**

- Probability and probability distributions;
- Application of mean, median, percentage, variance, standard deviation, standard error, t-test, chi-square test.

### Appendix 3: Setting up a National Biology Olympiad

The committee responsible for the NBO may belong to the Ministry of Education, teacher association, university or any educational authority (see the following diagram). The four IBO competitors are selected through rounds of local and / or national competition and may be trained together in scientific and biological skills in preparation for the IBO.

The use of complete tasks of former IBOs in national test rounds and for training purposes is encouraged.

