5th INTERNATIONAL BIOLOGY OLYMPIAD

VARNA 3-10 JULY 1994

PRACTICAL TEST
(ANSWER KEY)

SCORE POINTS .....

Name .....

Participant .....

Country .....

JURY MEMBERS

No of the participant: .....

PRACTICAL TEST

I. SECTION CYTOLOGY AND HISTOLOGY

Total points: 36 points.
Time: 45 min.

TASK 1.

There are two cyto-slides (**No1** and **No2**) infront of you. They illustrate the process of mitosis of plant and animal cells.

1.1. Scrutinize the slides carefully and point out the main differences between the process of mitosis of plant and animal cells. Mark each of the following statements with a "+" if correct and a "-" if incorrect:

A. In animal cells the cytokinesis is carried out formation of the cell plate.
B. The devision spindle in plant cells is formed without the participation of the centrioles.
C. The devision spindle in animal cells is formed with the participation of the centrioles.
D. The devision of plant cells takes place without a division spindle.
E. The devision of the plant cell goes on by means of a contractile ring.
F. The devision of the animal cell is accomplished by means of a contactile ring.
G. the cytokinesis in plant cells is carried out by a cell wall, built up by the remnants of the devision spindle.
H. the devision of plant cell is accomplished by a cell wall, a product of the Golgi apparatus.

TASK 2.

Slide **No3** is a section of the spinal cord of a cow, stained with Cresil violet.

2.1. Locate scrutinize carefully the neurons. Scrutinize the cytoplasm of the neuron. You will find in it more intensively stained spots. They correspond to a cell organelle, actively synthesizing proteins.
Which is this organelle. Mark the correct answer with a circle:

A. Golgi apparatus;
B. smooth endoplasmic reticulum;
C. rough endoplasmic reticulum;
D. Ribosomes devided in small and big subunits, clustered in different spots of the cytoplasm.

2.2. Look carefully at the neuron nuclei, which are lightly stained. You will find a darker structure in some of them. This is the nucleolus. Define why the nucleolus is stained by the same dye that stain the cytoplasm organelles too. Mark the correct answer with a circle:

A. because proteins are actively synthesized in the nucleolus;
B. because there is a great amount of compact DNA;
C. because the ribosomes subunits are formed in the nucleolus.

TASK 3.

Slides **No4** and **No5** are sections of an organ. The shape of the cells that built this organ are polyhedrical (3-dimensional polyangular).

3.1. Having in mind the shape of the cells, define the organ:

A. heart;
B. brain;
C. lungs;
D. liver.

3.2. Look at the slides **No4** and **No5**. Both are stained with Feulgen stain. This is a method for proving DNA. Why the nuclei on slide **No4** are not stained. Mark the correct answer with a circle:

A. The cells on slide **No4** have undergone final differentiation and there are no nuclei in them;
B. The cells on slide **No4** are pretreated with an enzyme that decomposes DNA;
C. The cells on slide **No4** are pretreated with an enzyme that decomposes RNA;
D. The cells on slide **No4** are pretreated with an enzyme that decomposes particularly the nucleic proteins.

TASK 4.

4.1. There are three slides - blood spreads, numbered 6, 7, 8. The slides are stained with Giemsa (after Romanovski).
Scrutinize the slide **No6**. Bearing in mind that Giemsa dye is a mixture of two simple stains - methyl-blue (basic dye, staining in blue) and eosine (acid dye, staining in red) define to which of the following groups the stained blue nucleus belongs. Mark the correct answer with a circle:

A. acidophilic structures;
B. basophilic structures;
C. neutral structures.

4.2. Look at slides **No6** and **No7** paying attention to the red blood cells. Define the classes to which the animal species which blood is used for the slides belong. Which one of the following statements is correct? Mark the correct answer with a circle:

A. Slide **No6** is from a mammal, and slide **No7** is from a bird;
B. Both slides are from mammals;
C. Slide **No6** is from blood of an amphibia, and slide **No7** is from a mammal;
D. Both slides are from blood of birds.

4.3. Minimizing of the erythrocytes in the course of evolution is considered to be a progressive feature because: (Mark the correct answer with a circle)

A. the surface area to volume ratio is higher for smaller erythrocytes;
B. in smaller erythrocytes the haemoglobine is much more active.
C. smaller erythrocytes form clots rarely.

4.4. Leukaemya is a desease that causes a several times increasing of the number of one of the main blood cells groups. Define which one of the slides **No7** or **No8** is made from blood of an ill man. Mark the correct answer with a circle:

A. slide **No7**;
B. slide **No8**;
C. neither of the slides;
D. both slides.

No of the participant: .....

PRACTICAL TEST

II. SECTION BIODIVERSITY

Total: 33 points.
Time: 45 min.

The two largest classes of phylum Molluska are Snails (Gastropoda) and Mussels (Bivalvia, Lamellibranchia).

The Class Gastropoda includes about 90 000 species. Its body consists of a foot, visceral mass, mantle cavity and a shell. The shell is entire, conical and usually spirally curved. (Fig. 1).

The Class Bivalvia includes about 20 000 species. They have a laterally flatten body and reduced head. Their shells consist of two valves, which binds on the back-side by means of an elastic bond, called **ligament** and **teeth apparatus**, consisting of definite number of teeth. In most of the mussels the teeth of the one half of the shell enter the respective cavities of the other and on the opposite (Fig. 2).

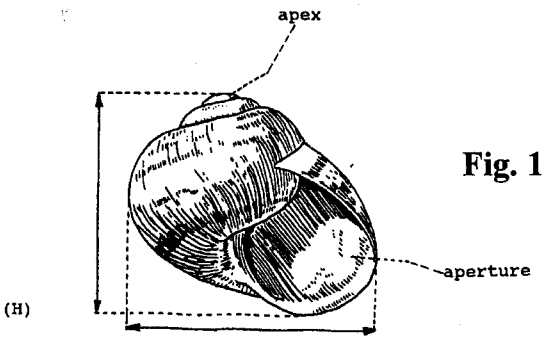


Fig. 1. Drawing of a snail shell

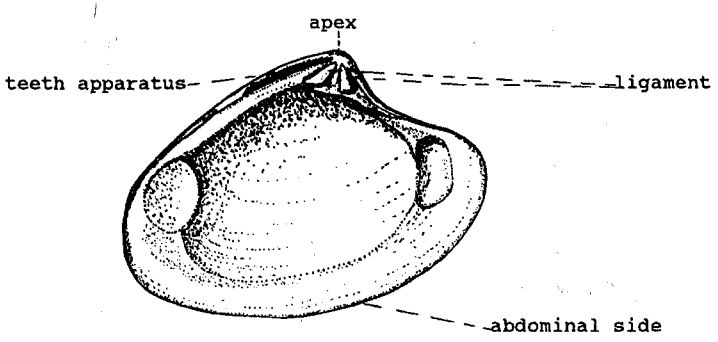


Fig. 2. Drawing of the inner surface of a mussel shell.

TASK 1.

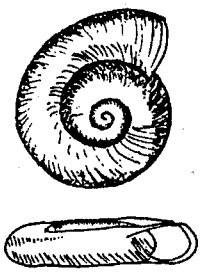
Shells of sea, fresh-water and land snails are infront of you. They are numbered from No7 to No12. Define the genus to which they belong having in mind Fig. 1 and the morphological features, based on the shell peculiarities that are used for the identification of Gastropoda species:

MORPHOLOGICAL FEATURES:

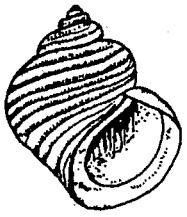
A. Shape of the shell:
According to their shape the shells are:



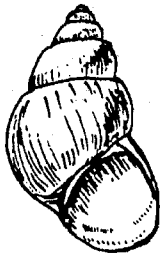
conical **(1a)**



discoid (flattened) **(1b)**



oval **(1c)**



spindle shaped **(1d)**

B. Thickness of the shell wall:
According to the thickness of their walls the shells are:
thinwalled **(2a)** and thickwalled **(2b)**

C. Surface of the shell:
It could be smooth **(3a)** and rough **(3b)**

D. Colour of the shell:
The shells are: light (white) **(4a)**
dark (brown, greenishbrown) **(4b)**.

E. Height/breadth ratio (H/B):
It could be: H/B > 1 **(5a)** or H/B < 1 **(5b)**.

Using Table 1, identify the snail shells from **No7** to **No12**. The genera to which these snail shells belong are listed in the table. Each shell from the respective genus is characterized by a combination of morphological features, marked with a figure and a letter (given above).
You have to read carefully this information and to write down in Table 2 the number of the shell which features corresponds to these of the respective genus. To ease your work do the following:

A. classify the shells firstly by shape, and afterwards following the other features.
B. measure with the rulers the height (H) and the breadth (B) of the shells. Calculate the ratio H/W.

Table 1.

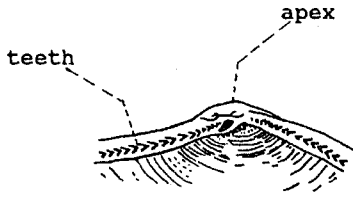
Genus	Combination of morphological features					No.
	shape	thickness	surface	colour	H/W	
PATELLA	1a	2b	3a	4b	5b	.....
RAPANA	1c	2b	3b	4b	5a	.....
PLANORBIS (CORETUS)	1b	2a	3a	4b	5a	.....
HELIX	1c	2a	3a	4b	5a	.....
ZEBRINA	1d	2a	3a	4a	5a	.....
HELICELLA	1b	2a	3a	4a	5a	.....

TASK 2.

The following morphological features of the shell are important for the identifying of the Bivalvia species: teeth apparatus of the shell, shape, size, surface, colour and lustre.

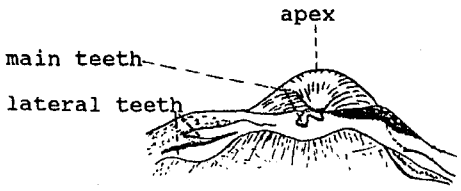
Morphological features:
A. Teeth apparatus type:
Taxodontous type: it is built of approximately similar in shape teeth, arranged one next to the other **(1a)**.
Heterodontous type: it is built of some triangular, just below the apex of the shell teeth - the main teeth and some lamella thin-shaped teeth - the lateral teeth **(1b)**

Desmodontous type: there are no teeth, but they are replaced by a spoon-like structure - hondrophor **(1c)**.
Disodontous type: the teeth are reduced (they are missing)**(1d)**.



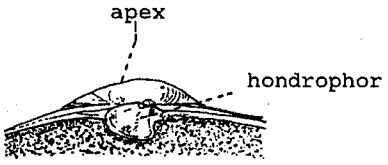
(1a)

Taxodontous



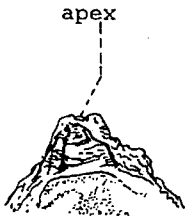
(1b)

Heterodontous



(1c)

Desmodontous



(1d)

Disodontous

B. Shape of the shell:

C. Surface:
- the shells can be smooth on their outer surface and only the stribes of growing to be distinguished **(3a)**.
- there are concentric ribs or lamelles on the surface **(3b)**.
- there are radial ribs on the surface **(3c)**.

D. Colour of the shell:
- light (white, yellow, light brown) **(4a)**;
- dark (black, dark blue, dark brown) **(4b)**

E. Lustre:
- shining (glazed) **(5a)**;
- not shining (opal) **(5b)**

Using **Table 2**, identify the genus of the mussel shells numbered from 1 to 6. The six genera to which the shells belong are inlisted in the Table. Each shell from the respective genus is characterized by a combination of morphological features, marked with a figure and a letter (given above).
You have to read carefully this information and to write down in the table the number of the shell which features coinsides with these of the respective genus. To ease your work do the following:

A. Classify the shells by the type of the teeth apparatus;
B. Classify the shells by shape, type of the surface, colour and lustre.

Table 2.

Genus	Combination of morphological features					No.
	teeth apparatus	shape	sculpture	colour	luster	
CUNEARCA	1a	2b	3c	4a	5b	.....
DONAX	1b	2b	3a	4a	5a	.....
CARDIUM	1b	2a	3c	4a	5b	.....
MYA	1c	2b	3a	4a	5b	.....
MYTILUS	1d	2c	3a	4b	5b	.....
OSTREA	1d	2a	3b	4a	5b	.....

No of the participant: .....

PRACTICAL TEST

III. SECTION PHYTOECOCLOGY

Total points: 20 points
Time: 45 min.

Different plant groups take part in the formation of herbaceous communities (legumes, grasses, composites, umbellifers and others). The quantitative participation of the grasses, legumes and the other palnt groups determines the forage value of the herbaceous association. It is "VERY GOOD" when the legumes prevail, "GOOD" when the grasses prevail and "AVERAGE" when the percentage of composites and umbellifes predominates over the legumes and grasses.

TASK 1.

Here is a total of ..... plant specimens of different plant groups. They are collected from an area of about 0.1 m^2 (10x10 cm^2). To determine the weight of the plant material a pair of scales is at your disposal.

1.1. Classify the plants from the paper dishes into the four groups mentioned above on the base of their structure. Put each group on the given paper plates.

1.1.1. Calculate the percentage of each plant group from the whole plant material.
1.1.2. Put the calculated data in columns 2 and 3 in the table below.
1.1.3. Evaluate the forage value of this herbaceous community following the answers of the task. The forrage value indicate with "+" or "-" in the boxes below the Table.

1.2. Calculate the primary production only of each plant and legumes in this herbaceous association. To do this:

1.2.1. Determine the weight of each group and calculate their primary productivity (kg/m^2).
1.2.2. Fill the data in columns 4 and 5 of the Table.

TABLE in which the results from the phytoecological task are to be presented:

Plant group	Quantitative participation of plant groups		Weight of each group (g)	Primary production (Kg/m2)
	Number of individuals	%		
1	2	3	4	5
Grasses				
Legumes				
Composites				
Umbellifers				

Forrage Value: Very Good ☐ Good ☐ Average ☐

No of the participant: .....

PRACTICAL TEST

IV. SECTION ZOOECOLOGY

Total: 35 points.
Time: 45 min.

A great number of soil living animals inhabit the forest soils. They play a significant role for the maintanance of biodynamics of soil, transformation and recycling of substances and energy. The soil fertility depends, to a great extent, on their species diversity, number and biomass.

From one site from a deciduous forest with the following parameters: area - 0.5x0.5 m and 5 cm thickness of the soil layer, invertebrates of different phyla and classes that live in the upper ground layer are collected. They are fixed in a solution of 70 % ethyl alcochol and are in front of you.

TASK 1.

Pour out the fixed organisms in the petri dishes infront of you.

1.1. Scrutinize carefully with a magnifying glass the soil invertebrates in the soil specimen and separate them in phyla and classes (See Table I) in the watch glasses.

1.2. Determine the number of the individuals of each class and insert the results in the column 3 of Table 1.

1.3. Calculate the percentage of individuals from each class from the total number of individuals in the specimens and put the data calculated in column 4.

Phyla	Classes	Number of individuals	% of the sample
1	2	3	4
Worms (Vermes)	Bristle-footed worms (Oligochaeta)		
Molluscs (Mollusca)	Naked snails (Gastropoda)		
Arthropods (Arthropoda)	Crustaceans (Crustacea)		
	Multipedes (Myriapoda)		
	Insects (Insecta)		

TASK 2.

The influence of each organism in an association or ecosystem depends on the species to which it belongs, as well as on the individuals which take part in the ecosysytem.

The number of individuals or biomass of the population per unit area or volume determine the density of the population.

Using the data in Table 1. calculate:

2.1. The number of individuals from each class per $1m^2$ and put the results in the column 2 of Table 2.

2.2. Determine the weight of the individuals from each class and put the calculated data (in grams) in column 3.

2.3. Determine the biomass of each class of soil invertebrates in g/m^2 and put the calculated data in column 4.

Classes	Number within 5 cm of the surface (per 1 m2)	Weight (g)	Biomass (g/m2)
1	2	3	4
Bristle-footed worms (Oligochaeta)			
Naked snails (Gastropoda)			
Multipedes (Myriapoda)			
Crustaceans (Crustacea)			
Insects (Insecta)			