

IV School of Biological Sciences Bioscience Olympiad

1. Blitz.

Write short (not more than ½ of a page) answers to questions A-E below.

- A. What types of movement that are possible in water are not possible on land? Why?
- B. It is known that coverings of many dinosaurs formed thorns, plates, crests or horns. What could be the functions of such formations?
- C. Some plants (e.g. oxalis, mimosa) fold their leaves after they have been touched. What could be the adaptive roles of this reaction?
- D. Schoolboy Peter was helping to clean cages in the Belfast Zoo. He was not careful and was bitten by a mouse, hedgehog, ferret, monkey, beaver, tortoise, flea, and even by his workmate schoolgirl Mary. If you had to choose, which bite(s) is/are the most dangerous and why?
- E. The following are special types of questions on "exclusion". It is required to find and exclude an item with certain property different from the rest of the items on the list. Sometimes, these questions have more than one correct answer. For example, from the following list: 1. *Sphere*, 2. *Triangle* 3. *Cube*, a triangle could be excluded since it is the only 2D shape. However, a sphere could also be excluded because it is the only object without vertices. Any organism from below can be excluded from the list. Try to substantiate "exclusiveness" of each and every organism (specify, why an organism could be singled out).

SUNDEW

ELK

OTTER

DOG

NOCTULE

2. What animals eat organisms that are many times larger in size than they are? How can they do it?
3. Hares change their fur when winter comes. How do they “know” when it is the right time to change? What experiments could you do to test your hypotheses?
4. In some species of birds and arthropods males bring “nuptial gifts,” such as food or other objects, to the female before mating. How could this peculiar behavioural pattern come about during evolution and what is the adaptive purpose of it?
5. Seeds of wheat grown in zero gravity (on the International Space Station) are bigger and have larger supplies of nutrients than seeds of wheat grown on Earth. Suggest as many hypotheses as you can to explain this observation.
6. A PhD student from Queens University Belfast, Leo McFist, caught a cockroach in the water sink in the lab at the Medical Biology Centre. He put the whole cockroach into a sequencer. This instrument can determine nucleotide sequences of DNA molecules. After the sequencer finished its work, Leo found that some of the identified DNA sequences corresponded to the genomes of other organisms. What organisms did these genome fragments come from, and what may have been their source?
7. Some genes encoding cellular proteins are located in the nucleus and some are in the mitochondria. Why did some animal genes stay in the mitochondrial DNA while it was theoretically possible to relocate them into the nuclear DNA?
8. *Bonus question*: Please formulate your own question for the next year Bioscience Olympiad.

Guidelines

Remember, that there is no single "right" answer to these questions. You are expected to suggest as many hypotheses, explanations, examples as you can or design experimental approaches in order to test your hypotheses. This is not a standard school test and all of you have free access to the internet and any literature. We do not test you factual knowledge, but the ability to think and analyse facts that are already known from your school curriculum as well as from the given question. Do not copy/paste info from the internet or Wiki – it would not help much. Think about the cause-and-effect relation and do not mix them up. Most of the questions imply a wide range of answers (not only yes/no or a single "right" explanation), formulation of several hypotheses and various reasoning. It makes it possible to give different marks to every question. In other words, the most "common" hypothesis/idea present in the most scripts is given small score, while rare ideas are given higher score. However, it is not necessary that most rare idea is given the highest score, it depends on its "depth" and "biological correctness". Questions and brief model answers from the previous Olympiads can be found at the Olympiad webpage (<http://www.qub.ac.uk/Olympiad>).

Please send your answers as a Word document file (not PDF). If possible, save it as an MS Word 2003 file (.doc). It must be submitted in Verdana or Arial Type Face size 10, 1.5 spacing and 2 cm margins. Please enter your school name and team members' names at the first title page. There is no page limit, but please keep it appropriate. Answers should be clearly numbered and each answer has to be started on a new page. Pages in the document should be numerated (center/bottom). Figures and pictures should be included into the document (however check the printing resolution of the images prior to sending and size of the entire document). In the past years we received files which were not properly formatted and very hard to read. Please follow these guidelines about required fonts, breaks, page numbers etc. correctly as this year there will be a penalty given.

Regarding teams: we are looking for mixed teams containing at least one GCSE student, one lower 6th/AS-level student and one upper 6th/A2 student. Schools have a free choice on the other team members (maximum team size is 5). One team per school.

You have to submit your answers before 00:01 24 September

All this info and general information is available at: <http://www.qub.ac.uk/Olympiad>

You can contact Dr Alexander Galkin via e-mail olympiad@qub.ac.uk

Good luck!