

# Task 1

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## Introduction

During this part of the competition you prove that you can accomplish a scientific investigation independently. The goal is to find out more about the behavior and attitudes of these often-unknown little weird animals called **Planaria**.

## The goal of this experiment

We would like to see if you are able to figure out an experiment yourself, do it and finally analyze your results before going ahead with the conclusions. It is crucial to read first some information about the creatures you will investigate and - as well - about the procedure of such an assessment.

As you will see, your teacher must support you during the Planarian hunting for safety reasons and she/he is welcome to support you as an *advisor* during the process of defining the design of your experiment.

**Before you do anything else, please read ALL instructions for ALL parts (1-5) carefully! You find clear instructions how to proceed during your investigations (see also aspects 1 - 3 for parts 3-5). At the end of this document you find the scoring list where you see, what we judge.**

## What you have to do...

### Part 1

#### Getting some background information: Studying the literature

Search for information about Planaria. Try to find out as much as possible. To get your first points you will have to write down a **short** text about the relevance of these at first view unspectacular flatworms. Integrate following aspects and create a reference list as described on the next page:

- A** Planaria in modern sciences. Why are they of interest?
- B** Why are Planaria important understanding evolutionary processes?
- C** How can Planaria be helpful in respect of investigation of aquatic ecosystems?

An important aspect will be the citation of your sources and the establishing of a bibliography (reference list) at the end of your paper. Please read the following instructions how to cite carefully and use the added examples as model for your own list:

### **„In-text“ citations: Superscripted numerical markers**

To let the reader know where you have used a piece of information in your work, please use the superscripted numerical marker. Here is an example:

“Monkey prefer ripe bananas to unripe bananas<sup>(1)</sup>. This is due to the extra sugars present in ripe bananas<sup>(2)</sup>, and scientists think that monkeys may have a similar range of tastes to humans<sup>(3)</sup>. It has yet been unproven whether or not monkeys find it funny when someone slips and falls on a discarded banana skin<sup>(1)</sup>.”

### **Bibliography (reference list)**

Supply complete details of the source you have used – so that the reader could find them easily to check them or learn more. You can add the bibliography at the end of Part 1. You must list your sources in the order in which they are used in your piece of work. The very first source you cite in your text listed in position 1 in your bibliography, the second in position two and so on. If you use a source again later on, cite it in the text with the same number as the first time you used it. You don't need to write the same source twice in your bibliography. Here an example referring to the “in-text” citations above:

1. Taylor, S. 2006. *Monkey Nutrition Handbook*. 2<sup>nd</sup> edition. pp 198-199. Primate Press, Bandung.

2. Triandafillou, A. 2011. *Livestrong* – Article: “Nutritional difference in ripe bananas”. Retrieved February 22, 2013 from [www.livestrong.com](http://www.livestrong.com).

3. Murphy, R. et al. 2005. “A Study into the taste pallet of primates”. *Monkey Journal*, vol. 2, issue 12. Dec.2005. pp 12-15.

## Part 2

### Finding and catching Planaria

The goal is to find about 20-30 Planaria in a stream, a brook or in a pond. You might find them in floating water under stones or in ponds on plant material. You may even attract them - check the literature!

**During this part a teacher must be with you to prevent an unexpected experience!**

Please make sure that the place you are looking for Planaria is safe, the water shallow and you wear adequate footgear. Support and help yourself in your group by assisting with bins or small containers to transfer the Planaria. The easiest way to do so is to use a small paint-brush. Twist it sideways so the Planarian finally sits on your brush, and then shake it carefully into the water of your container before searching for your next flatworm. Be careful not to confound Planarian with leeches.

- Take two pictures of your class (with your teacher) during the “Planarian Hunting” and another two of the Planaria you caught. The pictures should be meaningful and sharp.
- Keep your Planaria in an adequate container, floating the original river-water by an air-pump equipped with a frit to disperse the air bubbles best. Add some small river stones to provide your worms with an adequate ‘feeling home-situation’.
- Do not forget your Planaria during your investigations. Look after them and finally bring them back “home” to the place where you caught them originally. Think about feeding them and let us know in the ‘Materials and Methods’ part which decision you made on which grounds.
- Describe shortly where you have found your Planaria and add some interesting observations you made during your expedition.
- What to do if you don’t find any Planaria? Please ask other teachers of your school if they have any experiences in finding Planaria. Feel free to contact other experts which might be helpful.

## Part 3

### Design of your experiment

Try to figure out a design for an experiment to find out more about the needs and the aversions of these animals. How can they realize what's going on, how do they react to certain stimuli? How can you quantify these reactions? It is finally all about the behavior of Planarian.

We are looking for visionary and fanciful ideas which can be transformed in an experimental design and finally in an experiment which should **not be too complicated to conduct**. Please consider that it is important to repeat your experiment and to analyze your results in time.

Think carefully about an interesting question. A design is made not only by describing an experiment in words, we would appreciate to see as well sketches and tables. Give us a short inside view how your ideas evolved.

Take your time to discuss your ideas with your biology teacher. Your teacher may support you in establishing an interesting design for your investigations. As soon as you know, what you will investigate, your teacher is not allowed to support you anymore.

#### Aspect 1: Defining the problem and selecting variables

- As a result of Part 1 you identify a specific research question.
- You define the **variables**. Variables are factors that can be measured and/or controlled.  
**Independent variables** are those that are **manipulated**, and the result of this manipulation leads to the **measurement** of the **dependent variable**.  
A **controlled variable** is one that should be **held constant** so as not to obscure the effects of the independent variable on the dependent variable.
- Example: 'How does the speed of movement of chloroplasts in *Elodea* cells vary with light intensity?' The **independent variable** is the **light intensity**; the **dependent variable** is the **speed of movement**. Relevant **controlled variables** would include **temperature, preparation of *Elodea* cells, sample size and light quality**.

#### Aspect 2: Controlling variables

- You describe carefully how the control of the variables is achieved. (Materials and methods).
- If a standard measurement technique is used, it should be referenced.
- Example: While planning an investigation to study the effect of light wavelength on the rate of photosynthesis in *Cabomba*, you may have adapted method to measure the rate of photosynthesis taken from a textbook. A standard reference would then be expected as a reference, for example, "Freeland, PW (1985) *Problems in Practical Advanced Level Biology*, Hodder and Stoughton".

### **Aspect 3: Developing a method for collection of data**

- The planned investigation should anticipate the collection of sufficient data so that the aim of research question can be suitably addressed and an evaluation of the reliability of the data can be made.
- Be sure you will collect enough data in part 4, so an error analysis involving the calculation of a mean value and a standard deviation is possible.
- Example: When trying to determine the optimum pH of an enzyme, using a range of pH values between 6 and 8 would be insufficient. Using a range of values between 3 and 10 would be better, but would also be insufficient if only three different pH values were tested in the range.

## **Part 4**

### **Data collection and processing**

In parts 1-3 you have collected a lot of information about Planaria and made a design for your experiment you are going to investigate. Now it's time to transfer your idea into a setup for a challenging experiment. You may feel what it means to be a scientist 😊. It is absolutely crucial to collect enough and reliable data!

#### **Aspect 1: Recording raw data**

- Raw data is the actual data measured.
- Within tables of quantitative data, columns should be clearly annotated with a heading, units and an indication of the uncertainty of measurement. The number of significant digits should reflect the precision of the measurement.

#### **Aspect 2: Processing raw data**

- Data processing involves, for example, combining and manipulating raw data to determine the value of a physical quantity (such as adding, subtracting, squaring, dividing), and taking the average of several measurements and transforming data into a form suitable for graphical representation. It might be that the data is already in a form suitable for graphical presentation. If the raw data is represented in this way and a best-fit line graph is drawn, the raw data has been processed. Plotting raw data (without a graph line) does not constitute processing data.

#### **Aspect 3: Presenting processed data**

- You are expected to decide upon a suitable presentation format yourself (for example spreadsheet, table, graph, chart, flow diagram and so on). There should be clear, unambiguous headings for calculations, tables or graphs. Graphs need to have appropriate scales, labeled axes with units, and accurately plotted data point with a suitable best-fit line or curve (not a scatter graph with data-point to data-point connecting lines). You should present the data so that all the stages to the final result can be followed. The way how you present your data is not only a matter of design. It should be meaningful and prove that you didn't choose the type of diagram by chance.

- You should include a treatment of uncertainties and errors with your processed data, where relevant.

## **Part 5**

### **Conclusion and evaluation**

Your data is now available. How to proceed? It is up to you now, to find an interpretation.

Although your results may fit with your hypothesis, be prudent in concluding and try to reconsider premature deductions. Nevertheless – this part may be very satisfactory 😊.

#### **Aspect 1: Concluding**

- Analysis may include comparisons of different graphs or descriptions of trends shown in graphs. The explanations should contain observations, trends or patterns revealed by the data.

#### **Aspect 2: Evaluating procedures**

- The design and method of the investigation must be commented upon as well as the quality of the data. You must not only list the weaknesses but must also appreciate how significant the weaknesses are. Comments about the precision and accuracy of the measurements are relevant here. When evaluating the procedure used, you should specially look at the processes, use of equipment and management of time.

#### **Aspect 3: Improving the investigation**

- Suggestions for improvements should be based on the weaknesses and limitations identified in aspect 2. Modifications to the experimental techniques and the data range can be addressed here. The modifications proposed should be realistic and clearly specified. It is not sufficient to state generally that more precise equipment should be used.

Most of the aspects in part 3-5 are based on the “IBO Diploma Programme Biology Guide”, 2009. International Baccalaureate Organization, Peterson House, Malthouse Avenue, Cardiff Gate, Cardiff, Wales GB CF23 8GL, United Kingdom, [www.ibo.org](http://www.ibo.org).

## Scoring List

Part	Subject	Score (%)
1	Searching the literature, background information (For your short text and the correct references to the literature you can get 10% of the total score).	10
2	Finding the Planaria (For finding your Planaria in a stream, brook or pond, getting them out of the water and bringing them to your class-room you get 15% of the total score, if you can provide us with the following data: coordinates/maps, date, 4 informative pictures* and short description of your expedition.	15
3	Design (If you fulfill all 3 aspects perfectly you will get 15% of the total score).	15
4	Data Collection and processing (If you fulfill all 3 aspects perfectly you will get 20% of the total score).	20
5	Conclusion and evaluation (If you fulfill all 3 aspects perfectly you will get 15% of the total score).	15
Layout	Layout (If all pictures and tables are labeled and numbered correctly and the quality of your charts and diagrams is convincing, if your layout is pleasant and consistent, you will get 10% of the total score).	10
Extra Points	Extra-points for a fanciful and exiting approach (You will get these extra-points (15% of the total score) if you convinced us with a unique, interesting idea which finally ended in a successful investigation and meaningful results).	15
Total		100

\* Send us your most impressive picture of a Planarian/of Planaria if you want to be part of the additional and optional photo competition "Mister Planarian".

## Don't forget...

### Reference List

Do not forget to **list** your **references** at the end of your documentation according to the guidelines explained in part 1.

### Activity List

Do not forget to add the **activity list** to your documentation! Each class needs to report which member was or is responsible for which portion or aspect of the work. Each person in the class must have participated at least once (during the entire competition) in the experimental portion.

Therefore, **take 2 digital photos showing the class involvement**. Place them next to the activity list in your documentation file at the very end.

### Expected documentation and further information

- Create **one single** PDF file (the size of the PDF file must not exceed **6 MB!**) containing all your answers, solutions, pictures, other documenting material and the activity list. Use page numbers and use a new page at the beginning of each part:

Front page: name of school, name of class and number of task

Page 1: Table of Contents

Page 2: Part 1

Page 3: Part 2

Page 4-5: Part 3

Page 6-9: Part 4

Page 10-11: Part 5

Page 12: Reference List

Page 13: "Activity List" including pictures

- Use font size 11-12.  
You are free to choose the font, but it should be easily readable.
- Name the file following strictly these conventions:
  1. Name of School
  2. Name of Class (same as on application form or homepage)
  3. Number of Task
  4. Date (year/month/day)

→ Please use underlines instead of spaces!

Here is an example: **Kantonsschule\_Muster\_Class3b\_Task\_20120308.pdf**

<b>Closing Date of Task 1:</b>	<b>Thursday, 28.03.2013, 16:00</b>
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