INTERNAL ASSESSMENT

Introduction

In this chapter you will be guided through the process and expectations of an independent investigation. This is a task that allows you to meet the requirements of the internal assessment (IA) component of the IB biology course. The aim is that you investigate something about the living world that genuinely interests you so that you can adopt a personal approach in your assessment.

The internal assessment

Experimental work is not only an essential part of the dynamics of scientific knowledge it also plays a key role in the teaching and learning of science. You will produce a single investigation that is called an internal assessment. Your teacher will assess your report using IB criteria, and the IB will externally moderate your teacher's assessment.

Your investigation will consist of:

- reading and making preliminary observations to develop curiosity
- selecting an appropriate topic
- researching the scientific content of your topic
- defining a workable research question
- adapting or designing a methodology
- obtaining, processing, and analysing data
- appreciating errors, uncertainties, and limits of data
- writing a scientific report 6–12 pages long receiving continued guidance from your teacher.

Planning and guidance

After your teacher introduces the idea of an internal assessment investigation, you will have an opportunity to discuss the topic of your investigation with your teacher. In dialogue with your teacher you can then select an appropriate topic, define a workable research question, and begin to do research into what is already known about your topic. You will not be penalized for seeking your teacher's advice.

It is your **teacher's responsibility** to provide you with a clear understand of the IA expectations, rules, and requirements. Your teacher will also provide you with continued guidance at all stages of your work. Your teacher will help you develop a topic, then a research question, and then an appropriate methodology. Your teacher will provide guidance as you work and they will read a draft of your report, making general suggestions for improvements or completeness. Your teacher will not, however, edit your report or give you a tentative grade for your report until it is finally completed. After this you are not allowed to make any changes.

It is **your responsibility** to appreciate the meaning of academic honesty, especially authenticity and intellectual property. You are also responsible for initiating your research question with the teacher, seeking help when in doubt, and demonstrating independence of thought and initiative in the design and implementation of your investigation. You are also responsible for meeting the deadlines set by your teacher.

Academic honesty

The IA is your responsibility, and it is your work. Plagiarism and copying others' work is not permissible. You must clearly distinguish between your own words and thoughts and those of others by the use of quotation marks (or another method like indentation) followed by an appropriate citation that denotes an entry in the bibliography.

Although the IB does not prescribe referencing style or in-text citation, certain styles may prove most commonly used; you are free to choose a style that is appropriate. It is expected that the minimum information included is: name of author, date of publication, title of source, and page numbers as applicable.

Types of investigations

After you have covered a number of biology syllabus topics and performed a number of hands-on experiments in class, you will be required to research, design, perform, and write up your own investigation. This project, known as an **internal assessment**, will count for 20% of your grade. You will have 10 hours of class time, you will consult with your teacher at all stages of your work, and you can research and write your report out of class. Your IA investigation cannot be used as part of a biology extended essay.

The variety and range of possible investigations is large, you could choose from:

Traditional hands-on experimental work. This could involve extending some of the protocols that you undertook as part of the syllabus or you might investigate in a practical way an experiment relevant to some of the concepts you have learned through the course.

Database investigations. A database is a mass of information that can be searched through the use of query. You may obtain data and process and analyse the information for your investigation. Examples might include GenBank, the Allele Frequencey Database (AlFreD) or the Audubon Christmas bird count.

Simulations and Models. It may not be feasible to perform some investigations in the classroom, but you may be able to find a computer simulation. The data from a simulation could then be processed and presented in such a way that something new is revealed. For example the Game of Life simulation allows the exploration of emergent properties.

Combinations of the above are also possible. The subject matter of your investigation is up to you. It may be something within the syllabus, something you have or will study, or it can be related to the syllabus or outside the syllabus. The depth of understanding should be, however, commensurate with the course you are taking. This means that your knowledge of IB biology (either SL or HL) will be sufficient to achieve maximum marks when assessed.

The assessment criteria

Your IA will be a single investigation and the report will be 6–12 pages long. The report should have an academic and scholarly presentation, and demonstrate scientific rigor commensurate with the course. There is the expectation of personal involvement and an understanding of biology, and there is also the expectation of setting your study within the known academic context. This means you need to research your topic and find out what is already known about it.

There are six assessment criteria, ranging in weight from 8–25% of the total possible marks. Each criterion reflects a different aspect of your overall investigation.

Criterion	Points	Weight
Personal engagement	0–2	8%
Exploration	0–6	25%
Analysis	0–6	25%
Evaluation	0–6	25%
Communication	0–4	17%
Total	**0–24**	**100%**

The IA grade will count for 20% of your total biology grade. The criteria are the same for standard and higher level students. We will now consider each criterion in detail.

PERSONAL ENGAGEMENT. *This criterion assesses the extent to which you engage with the investigation and make it your own. Personal engagement may be recognized in different attributes and skills. These include thinking independently and/or creatively, addressing personal interests, and presenting scientific ideas in your own way.*

For maximum marks under the personal engagement criterion, you must provide clear evidence that you have contributed significant thinking, initiative, or insight to your investigation. Your research question could be based upon something covered in class or an extension of your own interest.

For example, you may have a 'green thumb' and you enjoyed the practicals that you did with plants in class. You could turn your botany talents to growing a number of plants for your study. Personal significance, interest, and curiosity are expressed here.

You may also demonstrate personal engagement by showing personal input and initiative in the design, implementation, or presentation of the investigation. Perhaps you designed an improved method for measuring the rate of an enzyme controlled reaction or devised an interesting method for the analysis of data. You are not to simply perform a cookbook-like experiment or repeat an experiment that is commonly carried out in most practical work programmes without any modifications.

The **key** here is to be involved in your investigation, to contribute something that makes it your own.

Example

A personal approach to design

A student is interested in diving and wants to investigate the slowing of the heart when a diver holds their breath underwater (bradycardia). She takes her pulse on the surface and then after holding her breath for 30 s at the bottom of a swimming pool. There is a reduction in the pulse rate. She takes her pulse using the simple method of feeling her radial artery and counting for 30 s. The student wants to find out how rapidly the pulse falls, whether it falls suddenly or gradually and whether it stabilizes at a lower rate. She needs to monitor the heart rate continuously for one minute or more underwater. For this she needs an electronic probe, but the equipment that her teacher offers her has to be kept dry. If the student designs her own method for this, she will certainly have demonstrated a personal approach.

EXPLORATION. *This criterion assesses the extent to which you establish the scientific context for your work, state a clear and focused research question, and use concepts and techniques appropriate to the course you are studying. Where appropriate, this criterion also assesses awareness of safety, environmental, and ethical considerations.*

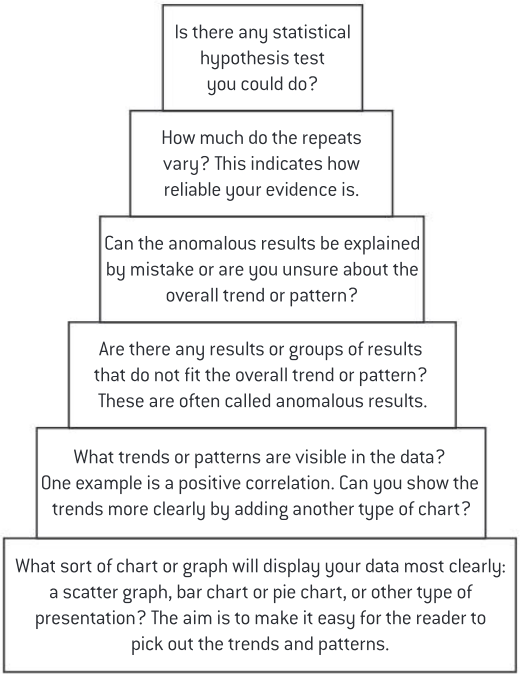
For maximum marks under the exploration criterion, your topic must be appropriately identified and a relevant and fully focused research question is described. Background information about your investigation must be appropriate and relevant, and the methodology must be appropriate to address your research question. Moreover, for maximum marks, your research must identify significant factors that may influence the relevance, reliability, and sufficiency of your data. Finally, if safety, environmental, and ethical considerations are relevant to your investigation, then your work must demonstrate a full awareness of these issues.

The **key** here is your ability to select, develop, and apply appropriate methodology and produce a scientific work.

ANALYSIS. *This criterion assesses the extent to which your report provides evidence that you have selected, processed, analysed, and interpreted the data in ways that are relevant to the research question and can support a conclusion.*

For maximum marks under the analysis criterion, your investigation must include sufficient raw data to support a detailed and valid conclusion to your research question. Your processing of data must be carried out with sufficient accuracy. Moreover, your report must show evidence of full and appropriate consideration of the impact of measurement uncertainty on your analysis. Finally, for maximum marks, you must correctly interpret your data, so that completely valid and detailed conclusions to the research questions can be deduced.

The **key** here is to make an appropriate and justified analysis of your data that is focused on your research question.



Example

Observations and questions

Two gerbils were being kept in a biology laboratory and the person who cleaned the laboratory started giving them a peanut each when she cleaned the lab each morning. After a few weeks, she noticed that when she entered the lab the gerbils came over to the front of the cage, stood on their back legs and waited for their peanut. When other people came into the lab at other times they did not do this.

This observation suggests some interesting questions.

1. Were the gerbils able to recognize the cleaner and if they were, what were the recognition features?
2. If clothes of different colour, but the same design were worn, was she still recognizable?
3. Was the time of day critical to recognizing the cleaner?
4. Could the gerbils predict the arrival of the cleaner before she actually came into the lab?
5. Could sight, sound and/or smell be used for recognition?

A simple observation can lead to interesting and worthwhile questions.

EVALUATION. *This criterion assesses the extent to which your report provides evidence of evaluation of the investigation and results with regard to the research question and the wider world.*

For maximum marks under the evaluation criterion, you must state a detailed conclusion that is described and justified, that is entirely relevant to the research question, and fully supported by the data presented. You should make a comparison to the accepted scientific context if relevant. The strengths and weaknesses of your investigation, such as the limitation of data and sources of uncertainty, must be discussed and you must provide evidence of a clear understanding of the methodological issues involved in establishing your conclusion. This means not only identifying limitations, but also discussing the implications and consequences of these limitations. Finally, to earn maximum marks for evaluation, you must discuss realistic and relevant improvements and possible extensions to your investigation. The **key** here is different than the previous criterion for analysis. The focus of evaluation is to incorporate the methodology and to set the results within a genuine scientific context while making reference to your research topic.

Your evidence is strong if you answer "yes" to these questions	*Your evidence is weak if you answer "yes" to these questions*
Are your results consistent enough to give you reliable evidence to use to answer the research question?	Are your results variable or are there many anomalous results that can't easily be explained?
Was the design of your experiment successful so that only it gave precise and accurate results?	Were there faults in the experimental design which limited the precision or the accuracy?
Were all the variables controlled satisfactorily so that only the independent variable was varied?	Were there uncontrolled variables, which introduced uncertainties into your interpretation of the results?
Is there only one explanation that fits all the evidence and answers the research question?	Are there alternative explanations that would also fit the evidence and which you cannot refute?
Can you support each part of your answer to the research question with experimental evidence or by reference to other published data?	Are there parts of your answer to the research question which are unsubstantiated or uncertain and which need further investigation?

COMMUNICATION. *This criterion assesses whether the investigation is presented and reported in a way that supports effective communication of the focus, process and outcomes of the investigation.*

For maximum marks under the communication criterion, your report must be clear and easy to follow. Although your writing does not have to be perfect, any mistakes or errors should not hamper the reader's understanding of the focus, process, and outcomes of your investigation. Your report must be well structured and focused on the necessary information, the process and outcomes must be presented in a logical and coherent way. Your text must be relevant without wandering off onto tangential issues. Your use of specific biology terminology and conventions must be appropriate and correct. Graphs, tables, and images must all be appropriately presented. Your lab report should be 6–12 pages long. Excessive length (beyond 12 pages) will be penalized under the communication criterion.

The **key** here is to demonstrate a concise, logical, and articulate report, one that is easy to follow and is written in a scientific context.