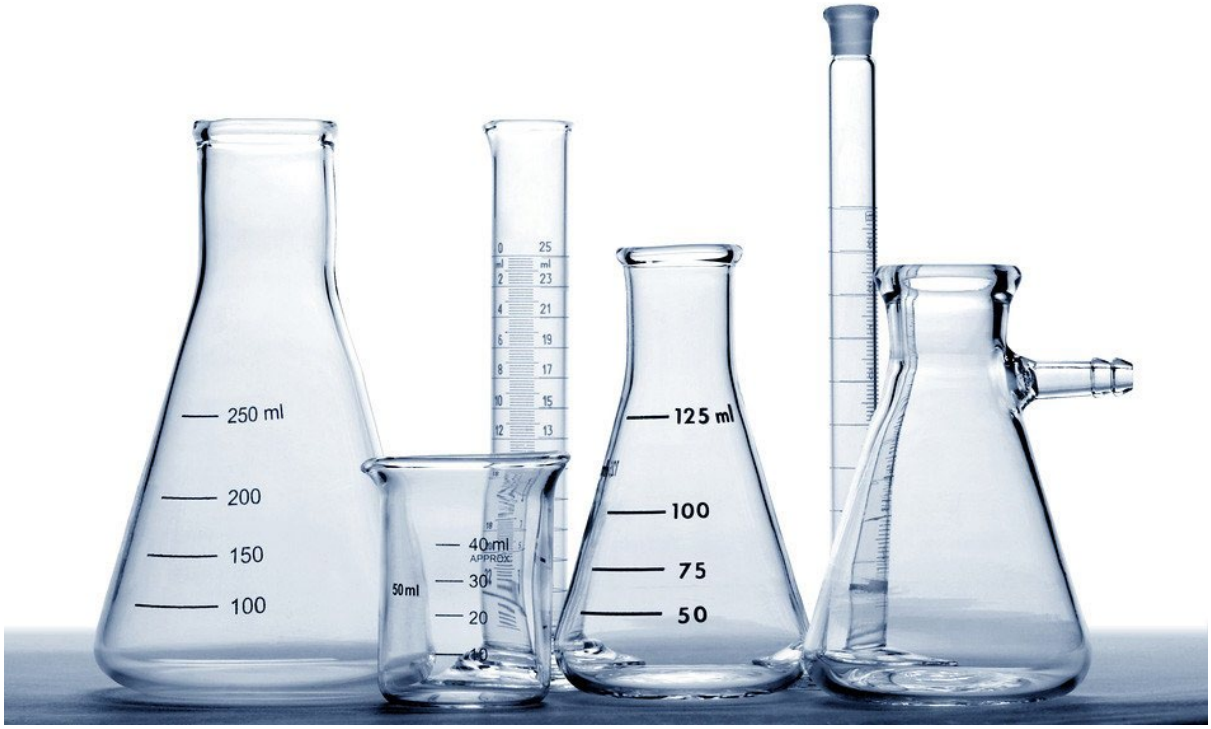

Writing lab reports: Aims and hypotheses

Before beginning your experiments, you must define the core objectives and predictions of your study so you know what exactly to test for, what data to collect and how to analyse and interpret this data. These goals and predictions will form the basis for your **aims and hypotheses** which are positioned at the very end of the introduction to your lab report.

The research aim

The aim is a statement of research intent written in broad terms. It indicates the main goals or overarching purpose of a research project. Aims tend to be quite brief and to the point. They often use strong verbs such as *investigate, define, quantify, establish,* or *determine*. They are usually written in present tense ("The aim of this study is to...") or past tense ("The aim of this study was to...").

Importantly, your aim should logically flow from the background information and the research gap you presented earlier in your introduction.

Tips

- Use one clear sentence.
- Avoid predictions (save that for your hypothesis).

Examples

- The aim of this investigation is to assess the impact of fertiliser runoff on algae growth in freshwater samples.
- The aim of this study was to investigate how temperature affects the solubility of potassium nitrate.
- This experiment aimed to investigate how auditory distraction affects EEG markers of attention.
- The aim of this experiment is to investigate whether providing retrieval-practice quizzes to students improves learning compared to rereading notes.
- The aim of this study was to determine whether access to public transport is associated with employment outcomes in outer-metro suburbs.

What is a hypothesis?

A hypothesis is a specific statement of the predicted results in a scientific study. When we have more than one prediction we call them **hypotheses**. Your hypothesis/es are usually placed directly after the aim in your lab report.

A hypothesis is generally constructed around:

- The **independent variable (IV)** – the thing you manipulate in an experiment (or compare different levels of in observational work).
- The **dependent variable (DV)** – the outcome you are interested in.

A simple way of thinking about a hypothesis is:

If {a change is made in the IV}, **then** {a specific change in the DV will be observed}.

Examples

"***If*** *{students attend office hours during semester}, **then** {they will attain higher exam scores than students who do not attend office hours.}"*

"***If*** *{freshwater samples are exposed to higher levels of fertiliser runoff}, **then** {they will show greater algae growth compared to samples with lower or no fertiliser runoff}."*

Although we usually write it something like this:

"It is hypothesised that students who attend office hours during semester will attain higher exam scores than students who do not attend office hours."

"We hypothesised that freshwater samples that are exposed to higher levels of fertiliser runoff will show greater algae growth than samples with lower or no exposure to runoff."

Strong hypotheses

A strong hypothesis should be:

Measurable and testable

A scientific hypothesis must involve variables that can be observed, quantified or recorded in a reliable way. If you can't collect data about the variables, you can't meaningfully examine your prediction. A strong hypothesis should also be testable, meaning you can design a procedure or analysis that tests the expected relationship between your variables.

Falsifiable

A hypothesis must be formulated such that it is possible for empirical evidence to contradict it. In other words, there must be at least one possible outcome in which the data do not align with the prediction. In scientific research we call this 'falsifiable'.

Grounded in past research

A strong hypothesis should follow logically from what has already been established in the scientific literature.

Examples of the range of ways hypotheses are expressed

- Students who complete retrieval-practice quizzes will demonstrate higher test performance than students who spend the equivalent amount of time rereading their notes.

- We predict that as temperature increases, the solubility of potassium nitrate will increase.
- It is predicted that freshwater samples exposed to higher levels of fertiliser runoff will show greater algae growth than samples with lower or no fertiliser runoff.
- It was hypothesised that auditory distraction will reduce EEG markers of attention (e.g., reduced P300 amplitude) compared to a no-distraction condition.
- It was hypothesised that outer-metro suburbs with shorter average walking distance to the nearest public transport stop will have higher employment rates.

More on hypotheses

As you move through your science degree, you may be required to consider different and more complex forms of hypotheses.

Simple vs Complex Hypotheses

Hypotheses can vary in complexity depending on the number of variables involved and the nature of the predicted relationships.

A **simple hypothesis** predicts a relationship between one independent variable and one dependent variable. These are the most common in introductory laboratory research, as they are straightforward to test and interpret. For example:

Higher levels of auditory distraction will reduce recall accuracy.

In this example, there is only one IV (level of auditory distraction) and one DV (recall accuracy) and the hypothesis predicts a directional relationship between the two.

A **complex hypothesis** predicts relationships involving two or more independent variables, two or more dependent variables, or multiple pathways between variables. These are common in real-world scientific research, where outcomes are shaped by multiple interacting factors.

Example of a complex hypothesis:

Students' exam performance will be predicted by a combination of their retrieval-practice frequency, sleep quality, and stress levels, such that:

H1: Greater retrieval-practice frequency and higher sleep quality will each be associated with better exam performance.

H2: Stress will be negatively associated with exam performance.

H3: The positive effect of retrieval practice on exam performance will be stronger for students with high sleep quality, and weaker for students experiencing high stress.

Null and alternative hypotheses

You may have heard reference to null and alternative hypotheses. In many areas of science, the null hypothesis (H_0) and the alternative or research hypothesis (H_1) are used to frame statistical testing. Although they may not always be written explicitly in your reports, they remain important concepts for understanding how scientific inference works.

Null Hypothesis (H_0)

The null hypothesis represents the assumption that no effect, difference, or relationship exists between the variables being studied. It provides a baseline against which the observed data can be compared. Statistical tests evaluate whether the evidence is strong enough to 'reject' the null hypothesis.

Alternative (Research) Hypothesis (H_1)

The alternative hypothesis proposes that an effect, difference, or relationship does exist. It reflects the researcher's expectation or theoretical prediction.

Summary

An aim is a broad statement of research intent that does not make any predictions. Your hypothesis/es are specific, measurable, testable predictions of your expected results.

Your aims and hypotheses should not come as a surprise to your readers! They should naturally flow on from the information you have presented earlier in your introduction. If you have logically presented the case for your study, your readers will understand the rationale for what you will be investigating and what you predict will happen.