Dyslexia Skills

Scientific Report Writing

Trudi Wurr
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Contents

Title

The main purpose of the title is to sum up your work in a single phrase or sentence.

- Avoid obvious phrases, like ‘The role of’, ‘Studies of’, ‘An examination of”, ‘An investigation into’, ‘Research into’, and ‘An experiment on’. Titles with these words are often too long or not descriptive enough.

‘Tamoxifen inhibits the G1 phase cell cycle progression of malignant human breast epithelial cells in vitro’.

- This title is effective because it tells the reader **where** the work was done, **which species** was studied, **which type of cell** was studied and **how** the growth was blocked.

- Make it short and informative to catch the reader’s attention.

- Focus on concepts not specifics.

Abstract or Summary

The main purpose of the abstract is to give a summary of the entire report for quick reading of your reasons for doing the work, your methods, your findings, and your conclusions.

According to Day, **"the abstract should (a) state the principal objectives and scope of the investigation, (b) describe the methods employed, (c) summarise the results, and (d) state the principal conclusions."**

Or consider: context, aim, result, conclusion.

The abstract

- Needs to make sense when read independently of the rest of the report
- Should not include references to authors, tables, figures etc.
- Should not include new information that isn't in the rest of the report.
- Is written in the past tense in a single paragraph.
- Gives information in the same order as the report.
- Only uses a sentence to describe the methods.
- Is generally around 200-300 words long.
- Should not start with the same sentence as the introduction.
- May be easier to write after you have written the full report.

Introduction

The main purposes of the introduction are to:

state the research problem clearly,
establish your hypothesis,
provide justification for the work,
state the methods and results briefly, and
state the major conclusions.

The introduction

Starts big, then focuses on the specific question.

- Must include **a clear hypothesis**, based on current theory, which states what you expect your experiment to reveal.
- Should include **a literature review** of what has already been published in your area. This should start broadly to put your topic into a wider context, then focus on your specific research problem.
- Ideally **gives a good reason for doing the work** e.g. having identified a gap in knowledge. If this is not possible (i.e. non original work for part of a module) you justify doing your experiments by giving current background information about your research problem.
- **Briefly states** what **methods** were used in a sentence or two.
- **Briefly states major conclusions and future implications** – they are discussed in more detail in the discussion section.
- Introduces your study species and explains why it is a good model system.
- Ends by outlining your question, and giving specific aims or predictions.
- Uses the present tense to talk about current problems, past tense for methods and results and future tense for future implications.

Materials and Methods

The main purpose of the materials and methods section is to provide an extensive protocol for your experiment which can be repeated by others.

This section should be chronological and informative, providing:

- details of the experimental design,
- details of the controls used, including their purpose,
- details of the data recording techniques,
- exact quantities and purities of reagents,
- technical specifications of the apparatus,
- specific methods of the sample preparation,
- accurate nomenclature (names and terms)
- precise details of any subjects/samples included in the study, and details of the sampling protocols including :

  details of the study site (if data were collected in the field) – basic information on location, habitat, weather

  details of the study species/system – discuss only in light of its relevance to your study.

- End by detailing your statistical analysis include sample size information, stats package used, including the reason for their choice.

Additionally:

- if there are a lot of specifications in your methods section, it is sometimes better to present them in a table.
- **explain any assumptions** that have been made in the experiments, and give details of the units of measurement.
- it is unlikely that the methods you are using are new; therefore, **references should be cited for your techniques.**
- include subheadings for the different techniques used in your work, such as 'Western blotting for SHP-1 in COS-7 cells'. Try to match the headings in your methods section with those in your results section.

Results

The main purpose of the results section is to present your data in a manner that is easy to read and interpret.

- Present results in the same order as set out in the intro and methods, using the same wording/ subheadings.
- **Describe the relationships between the data** without discussing the implications – this comes in the discussion section.
- Follow each result with a statistic
  e.g. (Paired t-test: $t=3.35$, $n=74$, $p<0.001$)
- Don't give too many degrees of accuracy (2 decimal places)
- Be consistent e.g. P or p throughout
- P values of 0.000, should be reported as $p < 0.001$
- **Don't exclude results that don't fit** – but include suggestions for why they were different in the discussion section.
- Qualitative data –where relevant, provide specific details of qualitative data, such as appearance, location, texture and odour. For example, 'a small quantity of white, powdery precipitate appeared at the bottom of the flask after 90 seconds'.
- Quantitative data - do not present all your raw data, **a representative sample is usually adequate.** Interpret and analyse your data so that others can understand it. Ensure that your statistics are meaningful, and provide P values.
- Large quantities of data should be presented in tables or figures.
- **Describe the important data from your tables and figures** within the text of the results, without repeating the numbers.

Tables, graphs and figures

tables
can represent quantitative data
can represent qualitative data to allow direct comparison between elements.
represent precise numerical data

graphs
can represent quantitative data
identify a trend

Labelling figures and tables

Titles

- Use a brief, descriptive phrase.
- The **title for a table** is usually **above** the table, whereas **the title for a figure** is usually **below** the figure.
- Generally, figure titles and table titles should be in bold fonts; however the font should not be larger than the font of the text.
- If you use the 'Insert Caption' option in MS Word, it will position the caption in the appropriate place and enable you to make tables of figures/tables automatically.

Numbering

- Graphs, and any other figures, are generally labelled as 'figures' within a scientific report or paper.
- Each figure or table in your report should have a number, which precedes the title.
- Number your tables and figures separately, for example, Table 1, Table 2, Figure 1, and Figure 2. MS Word allows you to specify a label of 'table' or 'figure'.
- Check that your tables and figures appear in the correct order. Using the Insert Caption option in MS Word will mean tables or figures are automatically renumbered if you insert others beforehand.

Legends

- Include a legend consisting of **a few lines**. It should provide brief details of the experiment associated with that particular table or figure. **This helps the table or figure to stand alone.**

- Symbols can be used within a graph to indicate different elements within a scatter graph or line graph, or to show which data points are statistically significant.

- Symbols are usually defined within the graph itself if there is space, or are defined in the legend at the bottom of the graph, directly after the title.

- A single asterisk is typically used to denote a statistical significance of $P < 0.05$, and a double asterisk is typically used to denote a statistical significance of $P < 0.01$.

Design of tables

- Arrange your tables such that **similar elements read vertically,** not horizontally. This will make your table easier to read.

- Use as few vertical and horizontal lines in a table as possible.

- Do not provide standard conditions for your experiments in a table unless they vary for the data that is included in the table.

- **Only give significant figures in a table**, and ensure that there is consistency in terms of figures, notation, and symbols.

- Ensure that units for numerical data are included in a table.

- Only **include noughts** in a table **if there are actual zero readings** – you can use dots or dashes to indicate that there is no data for a particular cell in a table. Alternatively, the abbreviations ‘ND’ (no data) or ‘NT’ (not tested) may be used, but ensure that these abbreviations are defined in the legend.

Design of graphs

The best graphs are the simplest graphs.

- In terms of size, a good graph strikes a balance between its legibility and its size. A graph should be **small but clear**.

- Show error bars whenever possible. Indicate in the legend whether your error bars are plus or minus the standard deviation or the standard error (± SD or ± SE). **Your error bars can significantly change the interpretation of your results**. Also, your results will be taken more seriously if you can show the degree of error in your measurements.

- Limit your use of colours and patterns. Most scientific journals only publish black and white graphs.

Choosing the right type of graph

- Line graphs are effective for showing trends.

- Bar charts are effective for showing relative proportions.

- Pie charts are effective for showing proportions of a total.

- Combined charts are effective for showing correlations, for example, a few bar charts or line graphs may be combined, or a bar chart and line graph may be combined.

Discussion

The main purposes of the discussion are to:

discuss the relationships between your results,
discuss how the results relate to your initial objectives and hypotheses,
describe the shortcomings of your work,
describe the implications of your work,
provide major conclusions supported with evidence, and
suggest future applications of your research findings.

- Start with a summary paragraph, reiterating your question and main findings. This may be all someone reads!
- It is important to **discuss your initial hypotheses** in terms of whether your results provide adequate support for them.
- **Include anomalies** or negative results **– try to explain them** based on the theories you have learnt.
- **Discuss how your results are similar or different from published findings**, and attempt to explain any differences, with support from references.
- If it is impossible to find a good explanation for your results – simply admit it. It is better to admit uncertainty, rather than create poor, unsubstantiated excuses.
- **State all of your conclusions**, and build on them by providing evidence from your data and from the literature.
- End with a concluding paragraph to summarise the key findings and their implications.
- Most of the discussion should be written in the present tense. When you discuss your data, write in the past tense, and when you discuss future implications of your work, write in the future tense.

References

The main purposes of the references are to:
acknowledge sources in order to avoid plagiarism, and

strengthen your arguments with support from the existing literature.

Every piece of information that is included in your report, excluding your original data, should be referenced, preferably from peer-reviewed sources. Make clear how the information is relevant.

Acknowledgements

The main purpose of the acknowledgements is to thank those who were directly involved in your work.

Remember, in most reports this section tends to be very brief, a few lines at the most. Identify those who provided you with the most support, and thank them appropriately.

Appendices

The main purpose of the appendices is to present additional data that is too extensive to be included within the main body of the text.

Appendices are not included in all scientific reports; however they are frequently included in the back of theses.

Adapted from ELE resource for module BIO2422 by Lena Wilfert and Josie Orledge and *Scientific Report Writing from* the Skills Team, University of Hull www.hull.ac.uk/skills

The Hull guide made extensive reference to this book -

Day, R.A. (1998), How to Write and Publish a Scientific Paper, Westport: Oryx Press.

There is a copy in the library at Penryn. Shelf number 808.0665 DAY