ECOLOGY WRITING GUIDE

A quick-reference guide to the rules and conventions for writing reports and essays in ecology

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

Ecology writing guide

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Ecology writing guide

Writing and your career in science

> Good scientific writing is the most desired skill for employers of New Zealand science graduates.
>
> (Gray et al. 2005)

> If you can read, interpret and explain complex ideas clearly, you can achieve better grades, opportunities for employment and advancement, a greater impact on society, and lots of personal satisfaction.
>
> (Bonfiglioli et al. 2009)

We love our science and we love to communicate well. Join us for this crash course in scientific writing and gain the lifelong benefits! Do email us your ideas for improvements!

Best wishes with your writing,

Dr Anne Gaskett and Dr Liz Hardiman
a.gaskett@auckland.ac.nz --- liz.hardiman@auckland.ac.nz

Report writing

Overview

Reports usually contain the following sections, in this order:

Title	A concise description of what is covered in the report.
Abstract	A summary of the information contained in the report.
Introduction	Provides relevant background information and presents the aims and hypotheses of the study.
Materials and methods	A description of the materials and methods used to produce the results. Includes any statistical methods used to analyse the data.
Results	The collected data summarised as tables and figures with accompanying text describing what the data show.
Discussion	Where the data is interpreted and related to previous research.
Conclusions	A brief summary of your research findings.
Acknowledgements	Give credit to anyone who helped with the research eg, lab group members, supervisor, tutors, technicians, etc.
References	A list of information sources referred to in the report eg, journal articles, books, etc.

* Report contents and requirements may differ between tutors and labs. Follow the instructions given to you by your tutors.

Writing order

Suggested writing order:

1. **Materials and Methods/Results**
   - Methods are usually straightforward since you have already done the experiment.
   - In the results section, start with the figures and tables so you have something to write about.
2. **Discussion/Conclusions**
   - Once you know what your results are, it is easier to discuss the implications of those results.
3. **Introduction**
   - Write an introduction suitable for your results and implications.
4. **Abstract**
   - The abstract summarises the report. Write the abstract last so you can pick bits out of each section.

Ecology writing guide

Title

Choose a title that succinctly describes the project. A good title describes the **topic studied** and includes important keywords (eg, the **specific organism**, **location**):

> **Factors affecting the breeding success of the south polar skua *Catharacta maccormicki* at Edmonson Point, Victoria Land, Antarctica.**

It may describe the topic and the results:

> ***Sphagnum* moss disperses spores with vortex rings.**

Titles can pose a question:

> **How does climate warming affect plant-pollinator interactions?**

Sometimes jokes or plays on words seem to work well, but they may not make sense to international readers, or your sense of humour may not match that of your reader!

> **The missing stink: sulphur compounds can mediate a shift between fly and wasp pollination systems.**

Abstract

It is often easiet to write the abstract after writing the other sections of the report. The purpose of the abstract is to summarise the report concisely. Write your abstract as one or two paragraphs and do not cite references or refer to figures or tables.

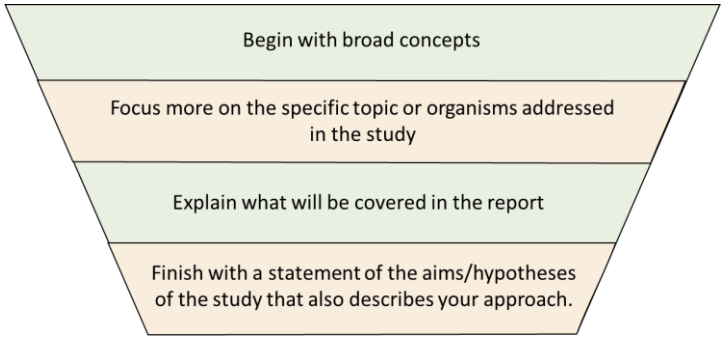
General abstract structure:

1. Begin with a statement describing the theoretical background of your study.
2. Briefly outline your aim/hypothesis.
3. Describe how you tested your aim/hypothesis.
4. State your main results in no more than a few sentences.
5. Summarise the outcome of the study and explain how it contributes to the topic investigated.

Introduction

The introduction provides enough background for the reader to understand the concepts and results, even if they are unfamiliar with the topic.

General introduction structure:



All information must be accompanied by citations showing the source from the literature (see References and citations).

For example, if your aims were:

1. to observe wrybills foraging
2. to compare your findings to published data
3. to discuss how modifying the beach might change their behaviour

You might end your introduction with something like:

> "This report investigates the foraging behaviour of the wrybill (*Anarhynchus frontalis*) near Miranda, New Zealand, compares this behaviour with other New Zealand shorebirds, and then addresses the potential impacts of beach modification on wrybill behaviour."

Materials and methods

A materials and methods section gives the reader the necessary information to replicate your study or experiment. It also shows a reader that you:

- participated in the lab/field trip
- performed the activities competently
- understood **how** and **why** the study was performed
- are presenting your own results

You may be given a list of materials and a set of instructions (ie, methods) in a laboratory or field manual. Do not copy these directly or provide a list of steps or bullet points. **Instead, summarise the methods in your own words in full sentences and paragraphs**.

If you are using methodology that has been used elsewhere (ie, if you are replicating a similar study in the literature), you should reference where the procedure was first used. Remember to include a brief explanation of the statistics that were used to analyse your data.

Example materials and methods

Here's an example modified from Buser et al. (2014)

Materials and methods

Drosophila flies and associated Saccharomyces yeasts *were collected by hand net at the Kumeu River and Goldie Estate vineyards, Auckland, New Zealand. We +tested whether yeast attractiveness correlated with greater dispersal for yeasts and increased reproduction for flies. In laboratory experiments (n = 6), we placed 200 Drosophila into a cage with agar plates treated with different yeast varieties (n=35), and sterile agar plates (n = 20). After each experiment, we +incubated the sterile plates and counted the number of Drosophila eggs laid and yeast colonies dispersed. Data *were analysed via ^Analysis of Variance (ANOVA) with the software program SPSS v.20.0 (IBM Corporation).

* Use of the passive voice to emphasise what was done.

+ The materials and methods section usually describes work that was done in the past so is generally written in the past tense.

^ Statistical tests and software used for data analysis.

Results

The results section is where you describe the outcome of your experiment/study. Be careful to only **describe the data**, all interpretation of data should be in the discussion.

This section includes two mutually supportive elements:

1. Text

The text highlights the important trends shown in your data, including statistical results used to analyse your data (usually presented in brackets).

2. Tables and figures (ie, graphs or diagrams)

Use tables and figures to summarise your raw data. Each figure or table should be referred to in the accompanying text. Number your figures or tables consecutively in the order they appear in the text. Place figures or tables as soon as seems practical after you refer to it. **Raw data** should be placed in an appendix section (if it is required).

Text

Here are some typical statements from the results of a study on spider mating by (Herberstein et al., 2005). Note how the statistical results are reported after each result is described.

Example results text

We observed a total of 44 copulations of *Argiope keyserlingi* males paired with females. The sizes of males allocated to the three treatments (control, fatigued and emasculated males; Table 1)were not significantly different (ANOVA: $F_{2,43} = 0.02$, $p = 0.98$). Males mated for significantly longer during their second copulation than during their first copulation (paired t-test: $t7 = 3.7$, $p = 0.008$; Figure 1).

- Trends shown in the table and figure are highlighted
- Statements backed up with statistical tests used to analyse data
- Table and figure referred to and numbered

Figures

Data

Use suitable graphs to display the data you have collected.

Discreet data (eg, counts) should be presented in a scatter plot or sometimes a bar graph.

Continuous data (eg, temperature, weight) should be presented in a line graph or histogram.

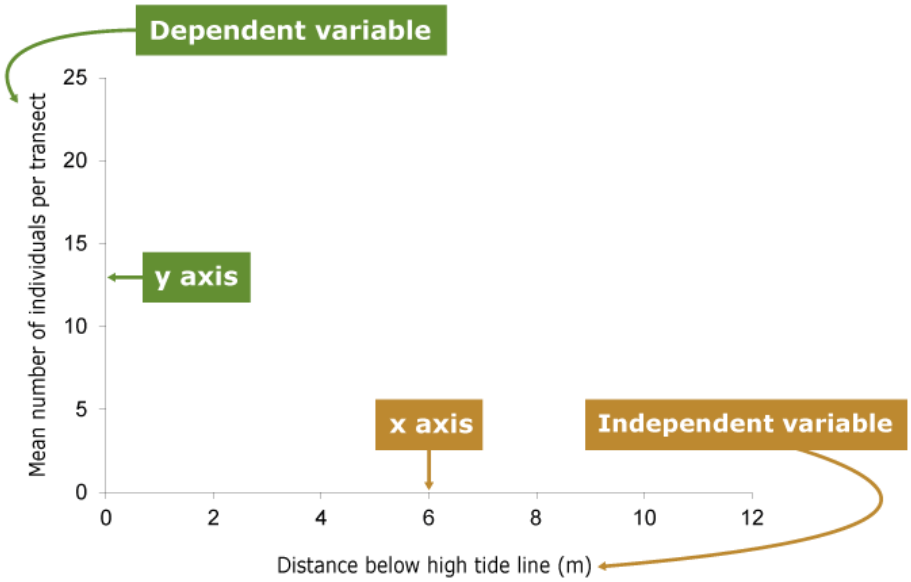
Error

If you **plot averages/means** or other calculated values, plot error bars showing the **standard error** or **standard deviation** of each mean value.

Variables

Independent variables are usually plotted on the *x* axis (horizontal axis). The independent variable is the variable set by the experimental design, eg, sampling times or distance along a transect at which measurements were taken.

Dependent variables are plotted on the *y* axis (vertical axis). The dependent variable is the measured variable, eg, weight measured at each time interval, or number of organisms recorded at each distance interval along a transect.



Labels

Label your graph axes clearly and specifically. For example, do not put a general term such as "number", instead write "mean seedlings per m^2", or "number of aggressive encounters per minute".

The **title** of the graph is included in the numbered figure caption (beneath the graph). Figure captions should contain enough information about the graph without the reader needing to check the main text.

Formatting

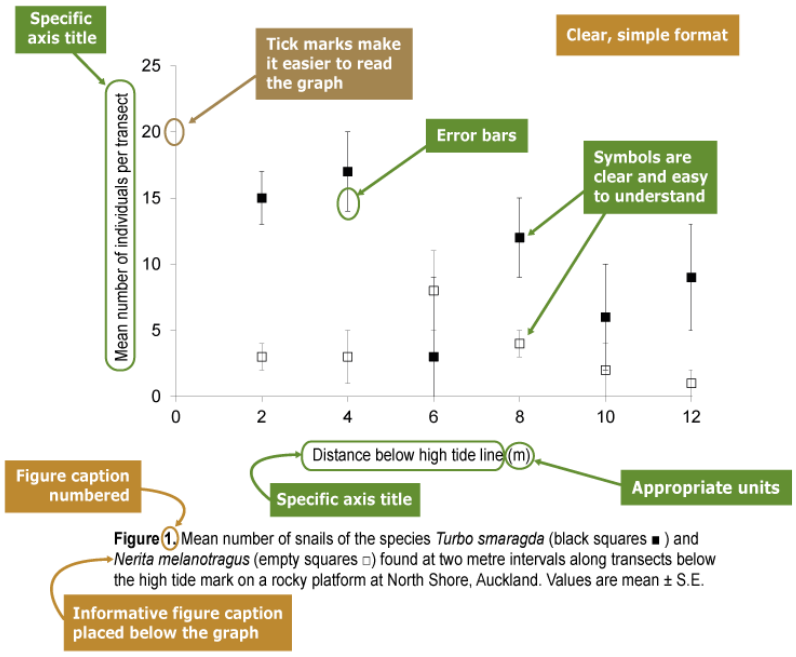
Beware of over-formatting and cluttering the graph. Check a figure in a published article and you will note they have:

- removed gridlines, borders, Excel legends, and colour backgrounds
- ensured data points are clear but small
- included all relevant information in the figure caption

Example figures

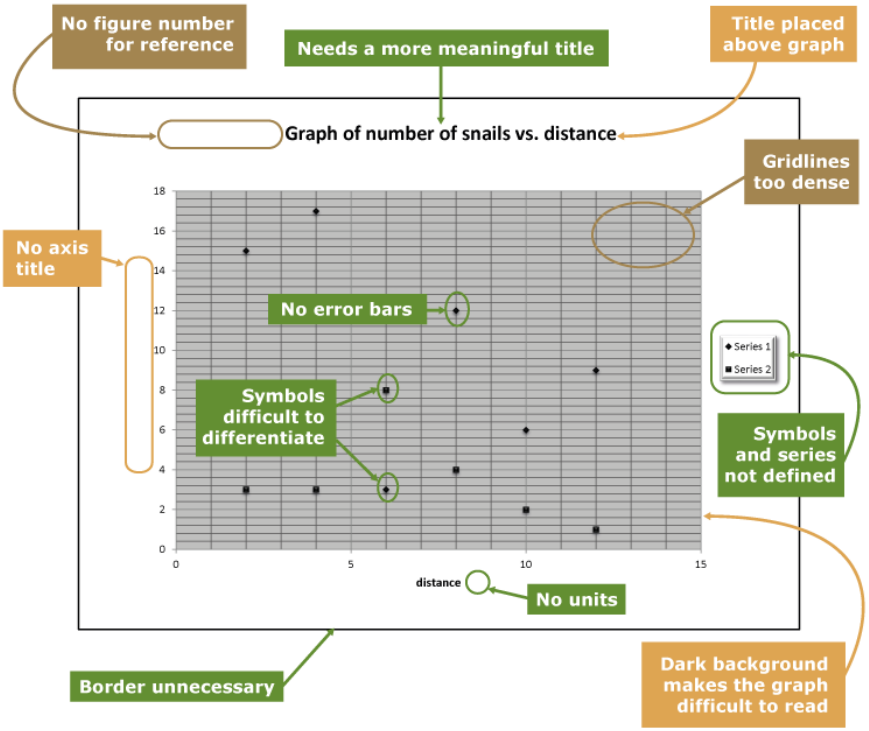
Professional-looking graph

The graph below has a clear, simple format and is easier to understand. The figure caption and labels are informative and include appropriate units.



Poor presentation of data

The formatting of the graph below makes it difficult to understand the trends in the data. A lack of specific titles and appropriate units makes the data meaningless.



Tables

Tables can be used to display data or statistical results (eg, means and standard errors). Like figures, if you want to include a table, you must refer to it in the text. Use a simple layout without vertical lines (Table 1) and avoid over-formatting your table (Table 2). Place a comprehensive caption **above** and any explanatory notes below the table. Make sure you provide full species names.

Compare tables 1 and 2 below. Which is easier to read and understand?

Table 1

Table 1: Relative amounts (mean ± S.E.) of volatile compounds identified from flowers of two morphs, 'pin' and 'thrum', of *Primula elatior* and *Primula farinosa* (Primulaceae), in the wild at Klausenpass, Switzerland. Modified from (Gaskett *et al.*, 2005).

	Primula elatior		*Primula farinosa*		*U (P-value)*
Compounds	Pin (n = 15)	Thrum (n = 15)	Pin (n = 16)	Thrum (n = 23)	
α-Pinene	0.75 ± 0.22	0.74 ± 0.22	0	0	320 (<0.001)
Sabinene	2.71 ± 0.44	2.05 ± 0.45	0	0	180 (<0.001)
Limonene	93.9 ± 1.13	94.1 ± 1.34	0.10 ± 0.10	0.31 ± 0.30	0.0 (<0.001)
Benzaldehyde	0.63 ± 0.44	1.10 ± 0.72	34.5 ± 2.46	36.4 ± 2.75	0.0 (<0.001)
Benzyl alcohol	0	0	29.5 ± 2.66	28.4 ± 2.31	15 (<0.001)
Benzyl acetate	0	0	8.41 ± 1.08	8.33 ± 1.00	60 (<0.001)

n = number of plants sampled. The statistics in final column compare the two species using data pooled from pin and thrum plants. The test statistics, *U* and *P-values*, are derived from Mann-Whitney U tests.

Table 2

Compounds	P elatior		P farinosa		*U (P-value)*
	Pin (n = 15)	Thrum (n = 15)	Pin (n = 16)	Thrum (n = 23)	
α-Pinene	0.75 ± 0.22	0.74 ± 0.22	0	0	320 (<0.001)
Sabinene	2.71 ± 0.44	2.05 ± 0.45	0	0	180 (<0.001)
Limonene	93.9 ± 1.13	94.1 ± 1.34	0.10 ± 0.10	0.31 ± 0.30	0.0 (<0.001)
Benzaldehyde	0.63 ± 0.44	1.10 ± 0.72	34.5 ± 2.46	36.4 ± 2.75	0.0 (<0.001)
4-Oxoisophorone	0	0	27.5 ± 2.28	26.6 ± 1.77	0.0 (<0.001)
Benzyl acetate	0	0	8.41 ± 1.08	8.33 ± 1.00	60 (<0.001)

Table 2: Volatiles. (Note the lack of information here!)

Discussion

The discussion is where you **interpret** your results in the context of the study aims and compare your findings to those published in the literature.

Structure your discussion to flow logically:

- Use subheadings to make it easier to write and follow.
- Answer any specific questions that were set for the assignment.
- Support your answers with citations and references from the literature.

Cover the aims of your study:

- What questions were you asking and how are they addressed by your data?
- Anything that appeared in your results section should be commented on in the discussion.
- Refer to figures in the results to illustrate your point.

Compare your data to other published results:

- Describe similarities and differences and don't forget to include citations.
- Are there explanations for why your data agrees or disagrees with the literature? Acknowledge limitations of the experiment, but don't overemphasise a lack of data or any sampling errors.

Suggest wider research or applications:

- Provide a few suggestions for future work or what experiments could be done to generate even more insight.
- Finish with some broader statements that show the wider significance of your work. For example, if your study was about the composition of plants in patches at Rangitoto Island, what can you say about how plants colonise new sites anywhere around the world?

Conclusions

You should include a brief conclusion (usually no more than a paragraph). This section "ties up all of the loose ends" by reiterating the findings that you came up with while you were discussing your data and the assignment questions. Do not reference here, and do not include any new information that you have not discussed previously.

Here's a conclusion to study in which we didn't find what we were expecting. We thought these NZ orchids would mimic fungi, to fool fungivorous insects into visiting and accidentally pollinating orchids. Instead, when modelled into a fly vision system, the orchid colours looked nothing like fungi colours!

In conclusion, we found no evidence for mimicry of fungal colours or strong fungal scents in a putatively brood-site deceptive orchid. Instead, we propose a deceptive pollination system based on exploitation of pollinator visual biases because the contrasting reflectance of *C. cheesemanii* orchids may be attractive against the dim background, or function as a sensory trap. Spectral modelling into the only available fly vision models produced different results and the limitations of these models suggest they should be used with caution.

References and citations

See referencing and citations section.

Acknowledgements

Here, you can thank all those that assisted with the research. You could include your lab mates, a demonstrator, and anyone who helped you with statistics or editing. For larger studies and theses, you can provide details of funding and permits.

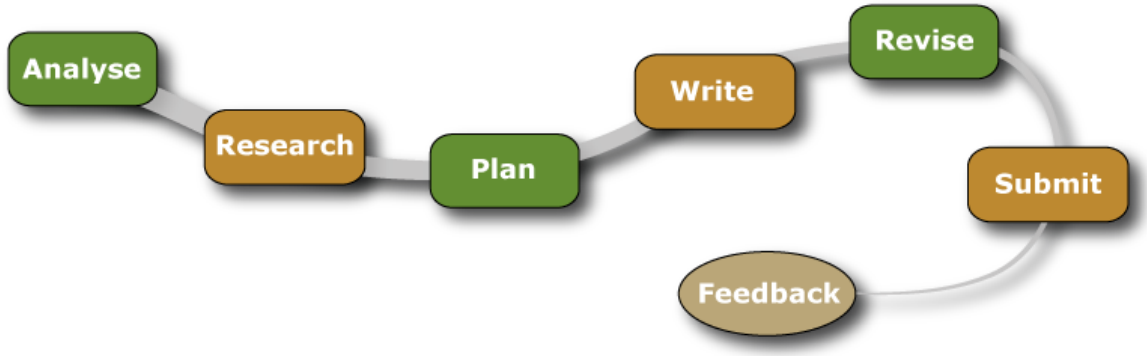
Here's an example:

Acknowledgments We thank Anjana Rajendram and the Waikato Stable Isotope team for analysis of stable isotope samples and Mauren Jaudal for help preparing samples. We thank Sandra Anderson, Joanne Peace, Bill Lee and two anonymous reviewers for helpful comments on the earlier manuscript. Lastly we thank John Allpress and Jill Brooking for access to dung beetle collection sites and The University of Auckland for financial support. Research was conducted under Department of Conservation research permit numbers AK-33027-RES, AK-33078-RES, AK-33217-RES and AK-32514-RES and Auckland Council research permit number WS478.

Ecology writing guide

Essay writing

The writing process



Analyse

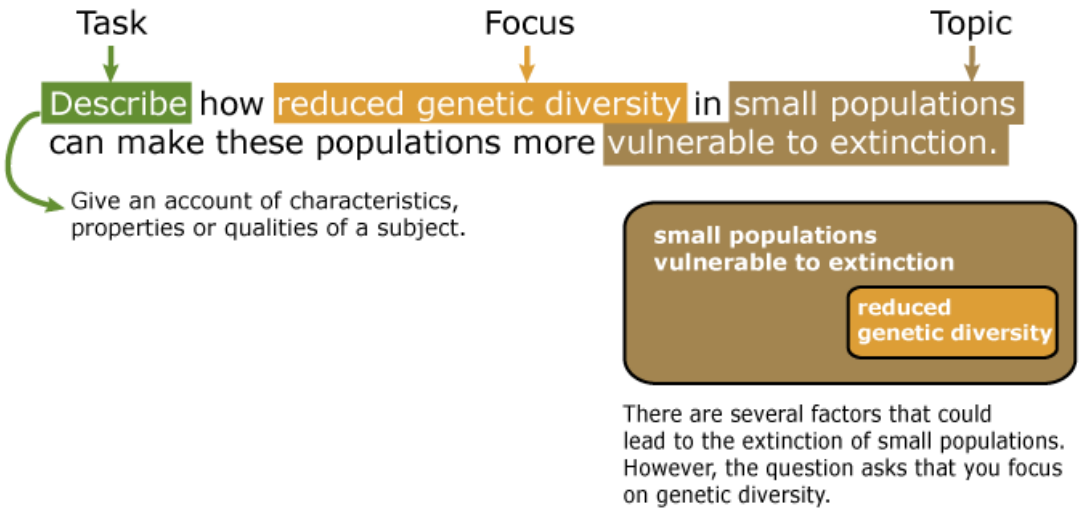
Analysing the question helps you clarify what is required, identify the topic and focus of the essay, and generate questions to guide your research.

Task – the key instruction word that tells you what you need to do. List of common task words and definitions.

Topic – broad subject area

Focus – area within the topic to concentrate on

Example



Generate questions

Once you have determined the task, topic and focus, jot down some **relevant questions** to help you **focus** your research.

Using the example above:

- What is a small population?
- What is genetic diversity?
- How does reduced genetic diversity relate to species extinction?
- How does genetic diversity affect fitness?
- Are there examples of small populations that became extinct due to reduced genetic diversity?
- Does reduced genetic diversity always lead to extinction in small populations?

Research

Finding information

Strategies for locating and evaluating information can be found in the research section.

Read articles effectively

Part of being a good scientist is critically evaluating research – your own and other people's. To score well in your essay your marker is looking for evidence of critical thinking. This goes beyond just summarising research papers. They want to see that you have read and understood the article, related it to the research topic and evaluated the strengths and weaknesses of the research.

Understanding how a research paper is structured can help you read articles critically and efficiently. If you know how an article is structured you can quickly find the required information. A research article is structured in the same way you structure your lab reports.

Resources

General structure of a journal article
How to read a scientific article [blog by Dr. Jennifer Raff]
Making notes from journal articles [template]
Subject guides: Biology [links to relevant databases]

Plan

Having a plan or an outline before you jump into writing can help you structure your essay and develop your ideas logically. In addition, an outline can make the writing process less daunting by breaking down the task into manageable chunks.

After researching and taking notes, jot down two or three main ideas you want to discuss in your essay. For each idea, note down evidence and examples that support these ideas. You may need to go back and do further research once you have your initial ideas. Remember to note the sources of your information.

What is a logical order to present your ideas? Can you link the ideas to each other and to your overall argument?

Organise your information

- Identify themes, concepts, issues and theories.
- Group related points.
- Rank in terms of importance, sequence, logic, or chronology.
- Identify information that helps explain and provides evidence for a main point.
- Consider possible transitions between ideas.

Create a writing outline/plan

- Order your ideas.
- Identify the relationship between ideas.
- Recognise any gaps in logic.
- Maintain control of your writing.

The outline should consist of:

- A thesis statement
- Main points or issues
- Sub points or issues
- Evidence

Write

Once you have your plan you can start developing your ideas into proper paragraphs. Don't worry about writing perfect prose at this stage. Just get the sentences down and then fix them during the revision stage.

What makes a good paragraph?

Each paragraph should have **one main idea**. This main idea is usually summarised in the **topic sentence,** which is often the first sentence (but not always).

All the sentences in a paragraph should:

- support the main idea (**unity**)
- develop the main idea in a logical fashion (**coherence**)

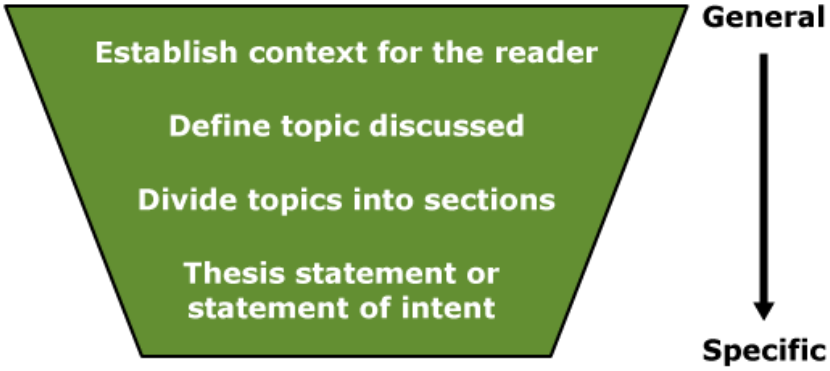
Introduction

An introduction should:

- Capture the reader's attention.
- Describe what the answer will cover.
- State how the answer is structured and define its parameters.
- Set a clear direction in response to the question – ie, your thesis statement should be stated.

An introduction should not:

- Ramble.
- Start a discussion (body paragraphs will do this where necessary).
- Ignore the terms of the question.
- Include irrelevant information.



Conclusion

The conclusion draws together the threads of the essay to arrive at some useful outcome or judgement.

A conclusion should:

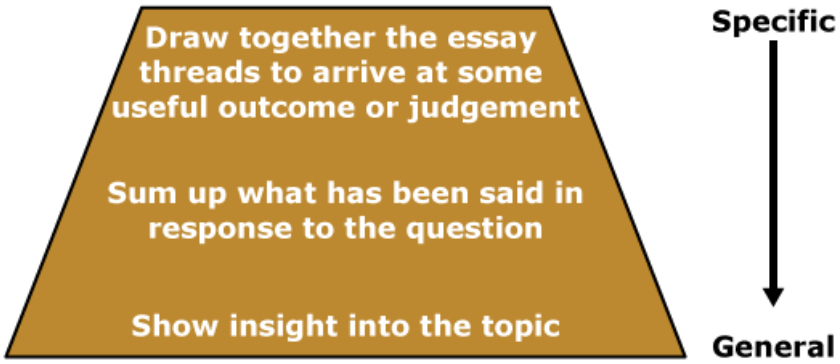
- Tie together comments made earlier in the essay.
- Sum up what has been said in response to the terms of the question.
- Make claims that carry some weight and are within the terms of the question.
- Show some insight into the topic.

A conclusion should not:

- Be a re-worded introduction.
- Continue a discussion.
- Bring in new material or supporting evidence.

Make your conclusion stronger by:

- Making a single statement which sums up your opinion.
- Raising a question that encourages the reader to think.
- Answering a question you may have raised in your introduction.
- Beginning with words other than "in conclusion".



Transitions

- Help connect sentences within and between paragraphs.
- Guide reader through text, demonstrate your train of thought, and logically progress your argument towards the conclusion.
- Add a note of authority to your writing.

Functions of common transition words

Revise

Put your essay aside for a day (hopefully you have left enough time!) and look at it with fresh eyes.

Go back to the question and the instructions. Have you answered the questions? Have you met all the requirements outlined in the instructions?

Structure

Read your essay aloud. Does the structure make sense? Are the ideas explained and developed logically? Have you used evidence and examples to convince your reader?

Editing and proofreading

Things to look out for:

1. Cluttered, wordy sentences
2. Sentence fragments
3. Run-on sentences
4. Comma splices
5. Subject-verb agreement
6. Parallel construction
7. Grammar and spelling errors

For examples of these and more, check out:

Twelve common errors: A student self-editing guide [University of Wisconsin-Madison]

Submit

Presentation

Good presentation implies you have put effort into the assignment, but fancy bindings, folders and colour printing will not influence your marks. Use plain A4 paper, stapled at one corner. Ensure your **name**, **ID number**, **course name and code** and **assignment title** are on the front. You can put your name and ID number in the header of every page, in case your pages become separated.

Use a simple font in a good size (eg, Times New Roman, 12 pt) and 1.5 line spacing. Use sub-headings and single spaces between paragraphs to make your essay easier for your marker to read. Make sure that every citation is referenced and that everything in your reference list is actually cited in the text. Referencing and citations

Submission

Check **where** and **when** to submit your assignment. Some lecturers accept electronic submissions, others prefer a paper copy. Paper copies are usually submitted at the **Student Resource Centre, Old Biology Building** on the **City Campus**. Courses run on the Tamaki Campus or at the Leigh Marine Laboratory may have different hand in locations.

Turnitin

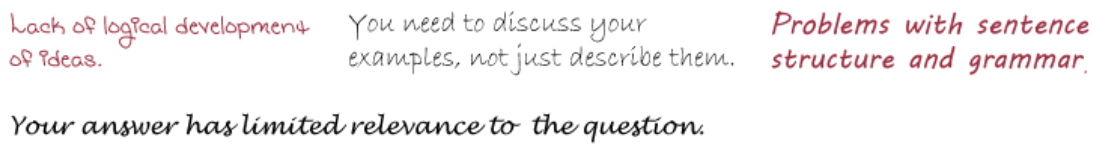
Many lecturers require you to upload your assignment to **Turnitin** before submission. **Turnitin** is anti-plagiarism software that checks for similarities between your assignment and webpages, electronic journal articles, e-books, as well as assignments from other students in your course, from previous years and from other universities around the world. Your lecturer should register all students in the class and provide you with a class login and password. You should get an automated email from Turnitin providing instructions.

Depending on the settings, you may be able to submit multiple copies of your assignment before the due date so you can check that your assignment has no problems with plagiarism. Often, the software gives a high "matching score" just because you used similar references with the same formatting. **Don't worry** – your lecturer will check every assignment and notice that this has occurred.

Information on using Turnitin and some Turnitin faqs.

Feedback

Assessments aren't just about marks. Your marker will often comment on the strengths and weaknesses of your essay. It is important to read this feedback so you can develop your skills for future assignments and improve your grades.



Get help with writing and study skills.

Research

Researching your topic

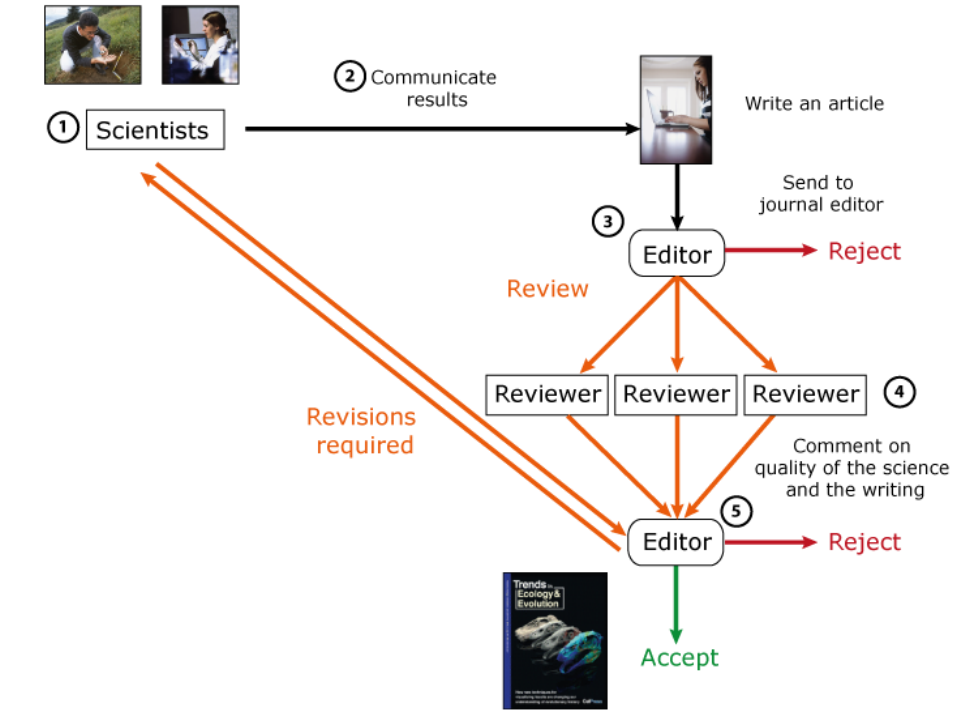
What makes a good reference?

Scientists must use peer-reviewed sources when writing. These include articles from scientific journals such as the *New Zealand Journal of Ecology*, *Trends in Ecology & Evolution* (*TREE*), or research articles in *Nature*. You can use chapters from scholarly books on specific topics, eg, (Clout, 2006) available from the Catalogue or e-book collections provided by Libraries and Learning Services.

Other sources of information include government reports, for example from the Department of Conservation (DoC) or the Auckland Council.

Avoid using non-peer reviewed websites like Wikipedia, your lecture notes, or course guides, as references in an essay or report.

Peer-review process



* Example of the peer-review process. Process may differ between journals and disciplines

1. Scientists collect, analyse and interpret data
2. Scientists communicate their findings by writing an article about their research. To communicate these findings to other researchers, they try to publish their article in a relevant journal.
3. The journal editor decides whether the article is of relevance, high enough quality and interest to the journal's readers. If yes, then the editor sends the article for review, usually by other scientists who are experts in that field. If not, the editor politely rejects the article.
4. The reviewers comment on the quality of the science and the writing.

5. The reviewers make recommendations to the editor about whether the article should be rejected, published, or revised. The editor sends the comments to the authors of the article. The authors can respond to the comments and may edit their article or conduct further experiments based on the reviewers' comments.

Databases

Searching databases to find literature

Use the library webpage to find good databases for ecologists, such as Scopus or Biological Abstracts. Use these databases to search for keywords and find new literature. Search for the relevant journal articles you've already found to see if they are cited by newer papers with a different perspective on the topic. If one author seems to publish regularly on your topic, you can search for their name and find all their articles.

University database training courses:

- Find Articles: Where to start
- Find Articles: How to use databases
- How to master Google Scholar
- E-books: Searching and using online books

Finding books and articles

Books and book chapters

Some are available online through the library's e-book subscriptions. Otherwise, search the Catalogue, go to the library and borrow the book, or photocopy the chapter including the references. If the library doesn't have the book, consider using the Interlibrary loan requesting service.

Journal articles

1. When searching with a database (eg, Scopus)

For each article, you can click on 'find full text' and follow it through to the abstract, and then a PDF of the article.

2. Directly from the journal through the library's subscription

Search for the title of the journal in the Catalogue, or through the list of e-journals. Follow the links to get to the journal's homepage, then find the right year, volume etc. to find the article's abstract, and then download a PDF.

3. Paper copy from the library.

Some older journals are not available online. Check the Catalogue to see if they have a subscription to the journal and find the call number. Visit the library, find the journal by its call number, and locate the correct year, volume and pages. Photocopy the article.

4. Interlibrary loan requesting service.

If the library doesn't subscribe to the journal or have a copy of the book you want, you can request a copy of any article from anywhere in the world via Interlibrary loan (this can take a couple of weeks). See the Interloan request service.

Managing your resources

To keep your references under control and easily searchable, use reference management software. For example RefWorks or EndNote. Libraries and Learning Services offers guides for using these tools. This software can automatically format and generate your reference list in your finished essay or report.

Exam essays

Preparation

Studying your lecture notes

Look over your lecture notes. Avoid passively reading lecture slides or notes. Instead, use **active learning** techniques. Reorganise information on a topic into flowcharts, mind maps or tables. Explain a diagram in sentences or convert a block of text into a diagram. Imagine you are the lecturer, how would you explain the concepts and terms to a student? Create flashcards and use them to test yourself.

See Exams: Preparing and Revising

Work out what is important

- Most lecturers provide **learning outcomes** for the course or indicate what they expect you to know for the exam.
- During a lecture, the lecturer will often emphasise topics or examples that will be in the exam. If you notice this, write a reminder on your lecture notes to include that topic.
- For each lecture, make a list of the major concepts and include an appropriate example. Show initiative and find new examples not given in lectures.
- Learn a diagram that illustrates a concept and sketch it in the exam. Having a picture to write about can be a good way to start your essay.
- Imagine you are the lecturer. Given the material you've covered in class, what would you put in the exam?

Find out the exam format

Ask your lecturer how many questions there will be on the exam. Will there be essay questions, short answer questions, multiple choice questions and/or diagrams to label? Will there be the option to choose between different questions? How many marks will each section be worth? Lecturers often cover this material in their final lecture or a tutorial.

Using past exam papers

- Get copies of past exam papers by searching Readings and Exams.
- Is the course still taught by the same lecturers? Changes in staffing will affect lecture material and exam questions.
- Is there a pattern to the type of questions asked? This may give you a clue about which material to concentrate on during your study.
- Turn lecture outcomes into questions to check your understanding of lecture content.
- Review your lecture notes, and then practise answering essay questions under exam conditions. Give yourself the same amount of time you would have in the exam, write by hand on paper, and remove distractions eg, music, TV and email. You can expect to write approximately 1500 words in an hour. Afterwards, have a break and then look over your lecture notes. How could you improve your answer?

During the exam

Reading time

Use reading time to identify the questions you are most confident answering. Start with those first and then move on to the harder questions.

Timing – how long to spend on a question

Look at the marks offered for each question and spend your time accordingly, even if you could write more. If you find yourself running out of time, use bullet points. It is better to write something than nothing.

Structure

1. Analyse the question

Look at the question carefully and underline the key words. Make sure you answer the question and supply relevant information. What is the focus of the question?

2. Plan your answer

Write a quick plan for the main points you want to cover in your answer. This could be some bullet points, a mind map or sketch. Planning before you start writing will help you structure your answer better and make it easier for the marker to understand.

3. Write

Break your answer up into paragraphs. Remember – one paragraph equals one idea supported by evidence and examples. Include a few sentences introducing and concluding your answer. Use scientific terms – your marker will be looking out for specific words.

4. Check

Write on every second line of your answer book and leave space in case you want to change anything. If you have time at the end read over your exam. Is your essay clear?

Handwriting, grammar, spelling and punctuation

Write clearly and legibly. Cross out mistakes with a single line. Try to maintain good spelling and punctuation, but remember your marker is not expecting perfection. Use the general rules for scientific writing, for example, species names, to show your marker that you are a master of the topic.

Good luck!

Scientific writing tips

This section offers some guidelines on how to use language to write a clear and concise scientific report. Remember these are guidelines only; scientific writing is a form of creative art, and there are exceptions to the rules.

Scientific writing is formal, but there is still room to express your personality and style. Aim for a concise and elegant style with well-constructed sentences and paragraphs that flow well between topics.

Avoid:

- **Wordy sentences.**
- So much **jargon** that even an expert can't understand what you're trying to say.
- **Colloquialisms** (eg, slang and sayings).
- Overusing the word *very* – it is often unnecessary.
- **Contractions** (eg, write *is not* instead of *isn't*).
- **Vague statements.**
    - Instead of: "*The destruction of habitats is bad*".
    - Be more specific: "*The destruction of habitat is detrimental to many species, because … "*.

Wordy sentences

Brackets have been placed around the clutter in this paragraph. The original paragraph has **100 words**, whilst the concise version has **59 words**!

Wordy

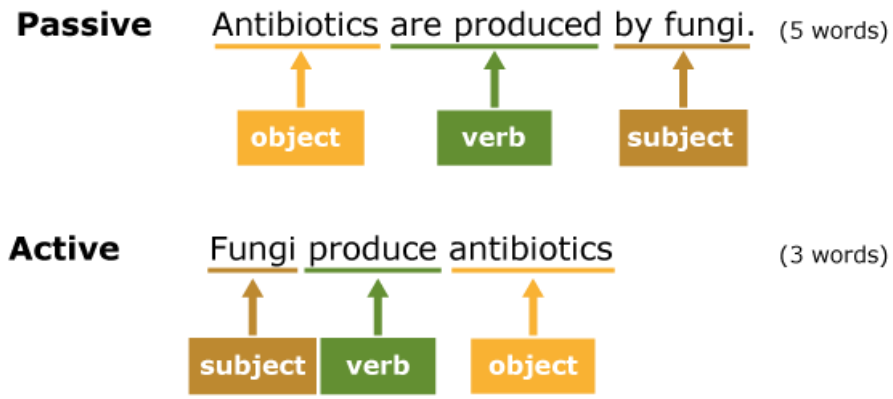
Remove any words, (phrases or sentences) that don't add meaning to your (written work). Strip your writing down to its (most bare) essentials by removing (all the) repetitive information (and text), and replacing (all those) pompous words and phrases with (much) simpler ones (that convey the same meaning). Too much clutter (and extraneous text) distracts the reader (from your writing) and makes your writing (less clear) unclear (and difficult to understand). When you're editing be ruthless (and merciless). Put brackets (or parentheses) around any words (or phrases) that could be removed (very easily) without changing (what you meant to say).

Concise

Remove any words, that don't add meaning to your writing. Strip your writing down to its essentials by removing repetitive information, and replacing pompous words and phrases with simpler ones. Too much clutter distracts the reader and makes your writing unclear. When you're editing be ruthless. Put brackets around any words that could be removed without changing the meaning.

Active vs passive voice

Most ecology writing generally uses active first-person voice to create a modern and concise style rather than the more old-fashioned passive voice. For example:



However, the passive voice has its place and you will find that your writing is a mixture of active and passive sentence structures.

Use the passive voice:

1. When the doer of the action is unknown, irrelevant or obvious.
2. When you want to emphasise the action rather than the doer (eg, methods section).
3. To maintain the logical flow of information.

For further information about when and why to use the active or passive voice see:

Active vs passive voice [Duke Graduate School]
Writing tips: The value of the passive voice [BioMedical Editor]

Appropriate vocabulary

For essays and reports, you are usually required to write in a formal, academic style. This doesn't mean write in a style that is dry, boring and difficult to understand, but rather use elegant vocabulary that is appropriate for both the audience and genre. Compare the two examples below.

Informal	Formal
In **land** ecosystems, dung beetles (Scarabaeidae: Scarabaeinae) play a central role **in getting stuff that would've been** locked up in **dead things** (Petersen and Luxton 1982). Dung beetles **are kind of important** in the first stage of **rotting** as they **bust up** and **munch on natural stuff**, **tearing apart big chunks** of **poo**, and **spreading it left to right** and **up and down** (Bustamante-Sanchez et al. 2004).	In **terrestrial** ecosystems, dung beetles (Scarabaeidae: Scarabaeinae) play a central role in **the recycling of nutrients** that would **otherwise be** locked in **dead organic matter** (Petersen and Luxton 1982). Dung beetles **are particularly important** in the first stage of **decomposition** as they **fragment** and **consume organic matter**, **dispersing large quantities** of **dung**, both **horizontally** and **vertically** (Bustamante-Sanchez et al. 2004).

Stavert, J. R., Gaskett, A. C, Scott, D.J. & Beggs, J.R. (2014). Dung beetles in an avian-dominated island ecosystem: feeding and trophic ecology. *Oecologia, 176,* 259-271.

Tense

When you read a scientific paper you may notice that the verb tense changes throughout the text. Below are some guidelines for when to use the past or the present tense.

Tense	When to use	Example
Past	Completed procedures	The DNA was extracted from soil samples.
	Results	High concentrations of glucose inhibited enzyme activity. Smith et al. (2010) found that high concentrations of glucose inhibited enzyme activity.
Present	Well-known theories	Animal cells contain membrane-bound organelles.
	Reference to tables and figures	Figure 1 shows the effect of temperature on growth.
	Morphological, geological and geographical features.	The area consists of rich, volcanic soils.

Adapted from: Silyn-Roberts, H. (2002). *Writing for Science* (2nd ed.) Auckland, New Zealand: Pearson Education New Zealand Ltd. (p. 142-143).

Nominalisation

Nominalisation is the process of turning verbs into nouns. Verbs are action words and drive your writing along. Turning too many verbs into nouns can make your writing clunky and cumbersome.

Look out for too many words ending in: -tion, -ment, -ance, -ence, -ity, -ness, -ment, or -ism.

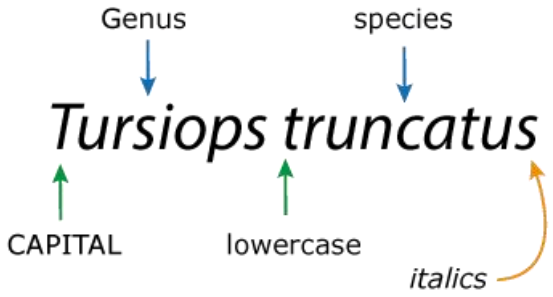
See if you can re-write any of your sentences using the verb form rather than the noun.

Nominalisation	Verb
Calculation	Calculate
Performance	Perform
Analysis	Analyse
Selection	Select
Comparison	Compare
Enhancement	Enhance
Colonisation	Colonise
Decomposition	Decompose
Measurement	Measure

Sword, H. (2012). *Stylish Academic Writing*. Cumberland, RI, USA: Harvard University Press. Retrieved from http://www.ebrary.com (p. 61).

Scientific names

The scientific name of an organism consists of a genus and a species.



If writing the name by hand, underline the genus and species (instead of italics). Higher taxonomic levels (eg, order, class, family etc) are not italicised, but their first letter is capitalised (eg, Delphinidae).

Common names

Common names do not require capitals (eg, kauri, flying fish) unless named after a person (eg, Thompson's gazelle) or a place (eg, Norfolk pine, North Island saddleback). Note that only the place or person's name is capitalised, not the organism.

Subspecies

When there are **subspecies**, there will be three parts to a scientific name eg, *Philesturnus carunculatus rufusater*). For plants, subspecies are written using the abbreviation subsp., which is not italicised, eg, *Avicennia marina* subsp. a*ustralasica* (mangrove or manawa). Varieties are written similarly, eg, *Kunzea ericoides* var. *microflora* (prostrate kanuka).

First mention

On first mention (eg, first time in the abstract, and first time in the introduction), provide the genus and species and then the common name (if it exists), eg, *Tursiops truncatus,* the bottlenosed dolphin.

Subsequent mentions

- Use either the scientific name or the common name, but be consistent.
- **The genus can be abbreviated** to its initial followed by a full stop (eg, *Tursiops truncatus* becomes *T. truncatus*).
- For animals, a subspecies can have an abbreviated genus and species, but not subspecies name (eg, *Philesturnus carunculatus rufusater* becomes *P. c. rufusater*).
- For plants with subspecies, only the genus is abbreviated (eg, *A. marina* subsp. *australasica*).
- If you have **more than one species from the same genus**, you can use the abbreviated genus for all species after writing it out in full for the first species you mention.

- If you have **more than one species from different genera**, but with the same initial, you'll have to write the genus out in full every time to avoid confusing your reader with which genus is which!

Numbers

Write numbers less than 10 as a word (eg, one, two, three, etc.)

Except:

- Tables or figures (eg, Figure 1 …)
- Measurements (eg, 3 km)
- Statistical values (eg, p = 0.001)
- Sentences beginning with numbers (eg, *Two kilometres further west ... ; Seventy samples were used ...)*

Formulae

Much of the non-text scientific symbology (eg, Δ, º, √, and ±) can be inserted in Word (Insert > Symbol). Newer versions of Word also have an equation editor (Insert > Equation*).*

Common errors

UK or US English

Pick one or the other and be consistent.

US  We analyzed the behavior of the hyena. ✓

or

UK  We analysed the behaviour of the hyaena. ✓

NOT BOTH ~~We analysed the behaviour or the hyena.~~ ✘

List of US and UK spelling alternatives

Data are plural

The word *data* is (generally) plural, because it refers to multiple pieces of information.

For example:

Correct These data (points) show …

Incorrect This data (points) shows …

Contractions

Do not use contractions in academic writing. For example, **don't**, **can't**, **it's**, etc.

Remember: It's – contraction of *it is* and **Its –** possessive (ie, belongs to)

Composed of and comprised

Comprise isn't followed by *of*.

Correct It is **composed of** three parts.

Correct It **comprises** three parts.

Incorrect It comprises of three parts.

Affect vs effect

Affect (v): to influence, to modify, to change.

Effect (n): a result, a consequence, an outcome.

Effect (v): to bring about; to cause to happen

Examples The increased use of pesticides *affects (v)* agricultural productivity.

The use of polychlorinated benzenes has an *effect (n)* on the cancer rate.

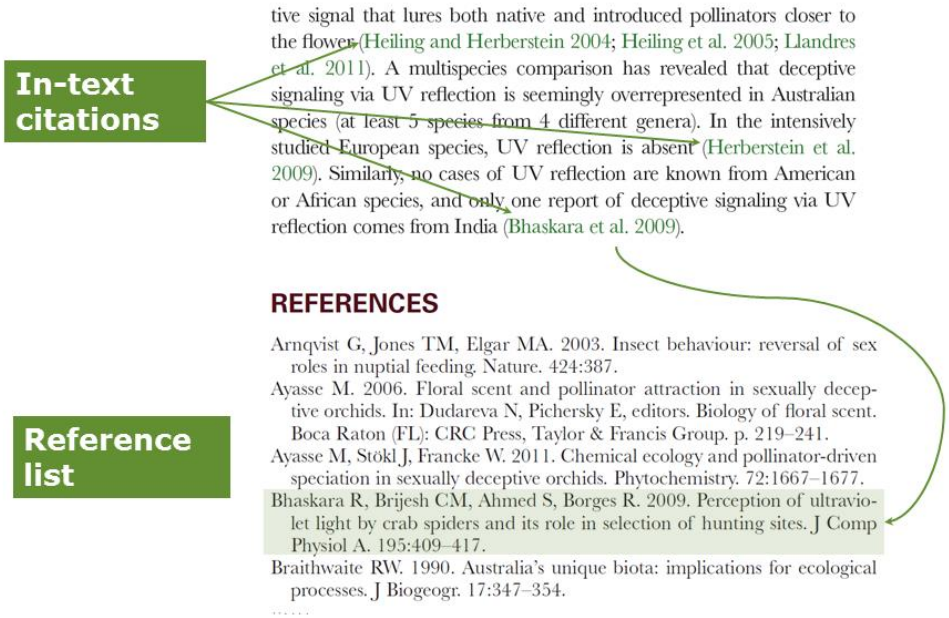
The new procedure *effected (v)* a 50% increase in yield.

(from Robinson, Stoller, Costanza-Robinson, & Jones, 2008)

References and citations

References contain details of information sources used in your assignment, including the authors, title and date, etc. They are presented as an alphabetical list at the end of your assignment.

Citations appear within the text to show the reader which reference relates to that information. The citation guides the reader to the reference, and the reference tells the reader where to find the original source of the information.



Avoiding plagiarism

Plagiarism is when a person submits someone else's work as their own, or uses ideas or information from a resource without referencing where it came from. Plagiarism includes copying and pasting sentences from a website or a journal article into your assignment, or including ideas or information from a journal article without adding a citation.

The Academic Integrity Course advises you on how to avoid plagiarism, rewrite information in your own words and acknowledge sources of information.

Plagiarism is embarrassing for the student, depressing for the lecturer, and has serious consequences for the student's studies and career. Even much later in life, serious plagiarism during university studies has a way of catching up with offenders.

Academic Integrity at the University of Auckland

General rules for citing

- Give the author's last name only without their first name or initials, then the year of publication, eg, (Foelix, 1988) or (Brown, 2000).
- You must personally read a source before you can cite it in the text.
- If you want to use a citation you saw in another paper, you must find that original source and read it before you can cite it.
- Do not cite lecture notes, lecture guides, or field/lab manuals. If you want to include any of this material, you must find the original source read it and then cite it.
- Direct quotes (ie, writing out a sentence word-for-word with quotation marks) are rarely used in ecology. Instead, rewrite the idea or information with your own words. This shows the reader that you understand.
- See Quick©ite for examples of how to insert citations in text.

Citing the best source

Cite a source that strongly supports your point, rather than one that just mentions the idea briefly.

For example, how could you cite to support this sentence?

"The colour vision system of flies involves two types of photoreceptors, allowing perception of four colour categories."

You could cite the original study that discovered flies have two photoreceptor types (Hardie & Kirschfeld 1983) or a paper that reviews all the literature on fly vision (Lunau 2014). Don't cite a study that mentions the idea but focusses on a slightly different hypothesis, eg, Kelly & Gaskett (2014), which tests how flower colours are seen by flies, but provides no new data on fly vision.

General rules for referencing

Your references can only list the literature that you have **actually cited** in your text.

- If there are more than two authors, name all of them. Do not use *et al.* in your Reference list.
- List references **alphabetically** based on the first author's surname. If you have multiple papers from the same author, list them chronologically under the author's name. If you have more than one paper by the same author from the same year, label them *a*, *b, c* etc. as you did in the citations and list them in the order they appeared in the main text.
- In some journals, reference lists provide abbreviated rather than full journal names, eg, *Proceedings of the National Academy of Science USA* is often abbreviated to *Proc. Nat. Acad. Sci. USA.* Choose either method and be consistent.
- Standard abbreviations for journals [University of Illinois Library]

Don't forget to ...

- Italicise genus and species names in article titles.
- For article titles, use *sentence style capitalisation* not *title style capitalisation* (eg, Orchid pollination by sexual deception: pollinator perspectives. **Not:** Orchid Pollination by Sexual Deception: Pollinator Perspectives).
- For journal titles, use *title style capitalisation* (eg, *The Biological Journal of the Linnean Society*).
- Ensure you use a consistent format for all the references in the list. RefWorks or EndNote can do this automatically.

How to reference – examples

Visit QuickCite for more examples.

The following examples use **APA referencing**.

Referencing a journal article

Authors. (Publication date). Title of article. *Title of Journal*, *volume number* (issue number, if available), page numbers.

Hegland, S. J., Nielsen, A., Lázaro, A., Bjerknes, A.-L. & Totland, Ø. (2009). How does climate warming affect plant-pollinator interactions? *Ecology Letters, 12,* 184-195.

Referencing a book

Author. (Year of publication). *Title of book*. Place of publication: Publisher.

Foelix, R. (1988). *The Biology of Spiders*. (2nd ed.). New York: Oxford University Press.

Referencing a book chapter

Author(s) of chapter. (Year of publication). Title of chapter. In Editor(s) (Ed[s].), *Title of book* (pages for chapter in book). Place of publication: Publisher.

Burns, B.R., Barker, G., Harris, R., & Innes, J. (2000). Conifers and cows: forest survival in a New Zealand dairy landscape. In J. L. Craig, N. Mitchell & D. A. Saunders (Eds.), *Nature Conservation 5: Nature Conservation in Production Environments: Managing the Matrix* (pp. 81-89). Chipping Norton: Surrey Beatty and Sons.

Referencing a thesis

Author (Publication date). *Title of thesis* (Thesis type). University, Location.

Stavert, J.R. (2014). *The feeding ecology of endemic New Zealand dung beetles.* (MSc thesis, Biosecurity and Conservation). University of Auckland, New Zealand.

Referencing a government report

Author. (Year of publication). *Title of report* [Report No. (or additional information about report)]. Place of publication: Government Department Name.

Neale, M.W. (2010). *State of the Environment Monitoring: River Water Quality Annual Report 2008* [Technical Report 2010/016]. Auckland Regional Council.

Referencing a website (avoid if possible)

Author(s). (Publication date). *Title of Web page*. Organisation. Retrieved day, month, year from URL.

Ford, K., Glenny, D. & James, T. (2009). *NZGrass Key - Key to the grasses of New Zealand.* Landcare Research, New Zealand. Retrieved 4 October 2014 from www.landcareresearch.co.nz/research/biosystematics/plants/grasskey/index.

Personal observations and Personal comments are not referenced.

Reference management software

EndNote or RefWorks can be used to insert citations and compile an accurate reference list in any format required. The Library offers guides and workshops for using these software programmes.

Should I use a reference management tool?

Help with writing and study skills

Many people learn scientific writing skills by reading widely, adopting the styles of other scientists and asking colleagues for advice. You can fast-track this process by using the University of Auckland's many development opportunities.

- The DELNA screening will help you identify your level of English reading and writing skills, and direct you to useful support.
- Student Learning Services offer online resources, workshops and advisory sessions on academic reading and writing, and general study skills like note-taking, time management and exam preparation.
- The Academic Integrity Course provides information on avoiding plagiarism.
- Computer training and assistance is available through Libraries and Learning Services and the IC helpdesks. See also IT Essentials.
- Assistance with English language is available at English Language Enrichment (ELE), and study options in Academic English Studies are available through the School of Cultures, Languages and Linguistics.
- The University also has general support for International Students, Māori Students and Pacific Students, including the Tuākana programme, and general personal support services for all students eg, counselling, mediation, and health and spiritual support.
- The Learning Disabilities Programme helps students successfully manage their learning disability within the academic setting.

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We thank all the original contributors for their work, and students and staff who have provided suggestions along the way.

Appendix

List of common task words used in essay questions

Analyse – To analyse, identify and explain the main parts or ideas of a subject and examine or interpret the connections between them.

Compare and Contrast – Examine the qualities and characteristics of a subject and emphasising the similarities (compare) and differences (contrast).

Define – When you define something you show, describe, or state clearly what it is and what it is like, you can also say what its limits are.

Describe – Give an account of characteristics, properties or qualities of a subject.

Discuss – Consider your subject from different points of view. Examine, analyse and present considerations for and against the problem or statement. In science essays, discuss often means give a comprehensive, objective evaluation or account of a subject*.

Evaluate – To evaluate, decide on your subject's significance, value, or quality after carefully studying its good and bad features.

Explain – Give reasons for a particular event or situation. State the 'how' and 'why', account for causes, results and implications. Use examples to support your explanation.

Interpret – To interpret, you should translate, solve, give examples, or comment upon the subject and evaluate it in terms of your judgement or reaction.

Justify – To justify, you should provide the reasons and grounds for the conclusions you draw from the statement. Present your evidence in a form that will convince your reader.

Outline – To outline, you give a general overview of ideas, principles, or theories.

Prove – To prove a statement, experiment or theory, you must confirm or test it. Evaluate the material and present experimental evidence and/or logical reasoning.

Relate –To relate two things, you should state or claim the connection or link between them.

Review – To critically examine, analyse and comment on the major points of a subject.

*Silyn-Roberts, H. (2002) Writing for Science (2nd ed.) Auckland, New Zealand: Pearson Education New Zealand Ltd. (pp 6-9).

Functions of common transition words

1. Continuity with what has gone before:

and, in addition, moreover, furthermore, also, indeed, besides, secondly, next, similarly, again, equally important, beyond that

2. An example or illustration of a point:

for example, for instance, as an illustration

3. Add emphasis to a point which reinforces a previous point:

in fact, in other words, that is, indeed, as a matter of fact

4. A conclusion or a result of what you have just been discussing:

thus, hence, therefore, consequently, as a result

5. Contrast with what has just been said:

but, however, nevertheless, by contrast, on the other hand, conversely

6. A qualification or reservation about what has been discussed:

no doubt, of course, to be sure

7. A summary statement is coming up:

in short, all in all, in brief, in conclusion, to conclude, given all this

8. Pronoun and adjectival links to something which has gone before:

this, that, the above-mentioned, such

9. Establishing time relationships:

after, afterwards, then, later, before, while, at the same time, immediately, thereupon, next, meanwhile, subsequently, previously, simultaneously

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