WRITING IN SCIENCE (Language and Learning Online)

Writing in Science

It is important for you to develop your skills in oral and written communication in Science for three main reasons:

1. The audience for scientific writing today is made up of both scientists and non-scientists.
2. Employers expect graduates to be able to communicate effectively with both professional and non-professional audiences on science-related matters.
3. Scientific work is a cooperative venture in which current work depends on the previous work of others in the scientific community, and it is vital that the work which goes into research and writing is honestly and properly acknowledged.

Dishonest behaviours such as cheating, collusion and plagiarism are serious breaches of acceptable behaviour, and severe penalties including exclusion from Monash may be applied to students who are caught committing these offences.

The aims of this tutorial are:

- to help you with the writing of Science assignments
- to encourage you to adhere to the highest standards of academic honesty in all your work at Monash
- to provide you with information on plagiarism and how to avoid it.

Before you read any other sections of this document, have a good look at the section on Plagiarism <www.monash.edu.au/lls/llonline/writing/general/plagiarism/index.xml>.

What makes a good Science communicator?

Scientists write, among other things, to inform the public, to persuade government and industry to fund research, and to communicate results, innovations and discoveries to fellow academics, industry, and public audiences. Whatever the form of communication used – oral presentation, report, academic paper, website or news item – the good Science writer:

- thinks objectively and thoroughly
- researches carefully
- keeps good records and notes
- writes clearly, concisely and accurately
- considers the background of the audience
- uses the appropriate format for the type of writing involved
- presents the material neatly
- takes care to acknowledge all sources of information.

Features of academic writing

As a tertiary student you need to be very clear about which audience you are writing for. While you may sometimes be expected to write for external audiences such as a business client or a member of the public, most often you will be writing essays and reports for your tutors and lecturers. To write in a formal academic style, you need to develop skills in using some typical features of academic writing.
As you read the articles recommended for your particular subject look for examples of:

- tentative statements
- academic wording

and try to use them in your academic writing.

In your reading you should note:

- whether the style is personal or impersonal
  <www.monash.edu.au/lls/llonline/writing/science/1.5.xml>
- how figures, tables and graphs are used and presented
- how other research is cited and referred to
- which tenses are used <www.monash.edu.au/lls/llonline/writing/science/7.1.xml>.

**Tentative statements**

Research in Science is cumulative which means that research conducted today may depend to a large extent on the work of numerous other researchers over a long period. The results of experiments are rarely conclusive and findings may later be shown to be inaccurate or based on false assumptions. For these reasons it is a good idea to be fairly tentative in your writing in the results and discussion sections.

Make tentative statements rather than direct, categorical ones. For example, rather than writing ‘This experiment proves…’ it is preferable to use expressions such as:

- tends to…
- appears to…
- suggests that…
- would seem to…

In order to express tentative statements you can use **limiting words**, **modal verbs**, and **softening or hedging verbs**.

**Limiting words**

<table>
<thead>
<tr>
<th>Examples of limiting words</th>
</tr>
</thead>
<tbody>
<tr>
<td>possible or possibly</td>
</tr>
<tr>
<td>probable or probably</td>
</tr>
<tr>
<td>likely</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limiting words in sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is <strong>possible</strong> that the use of a different model…</td>
</tr>
<tr>
<td>It is <strong>likely</strong> that vinculin localises in low amounts at the basement membrane…</td>
</tr>
</tbody>
</table>

**Modal verbs**

These change the strength of the main verb and indicate that there is room for doubt.
Examples of modal verbs

- may or may be
- might, might be or might have been
- could be
- could have been
- would
- would have been.

Modal verbs in a sentence

- The data appear to support the hypothesis, but further sampling would need to be undertaken to increase the reliability of the final result.

Note that this sentence also includes the softener 'appear'.

'Softening' or 'hedging' verbs

Examples of softening or hedging verbs

These include verbs such as:

- appears
- suggests
- indicates.

Softening or hedging verbs in sentences

The results shown in Figure 1 suggest that stratified sampling by gender...

The evidence seems to indicate that the flow rate of NaOH does not significantly affect...

This result appears to demonstrate that the presence of flower galls at permanently-flooded sites can be accounted for by...

The section on Tenses in Science <www.monash.edu.au/lis/llonline/writing/science/7.1.xml> also gives you examples of how the choice of verb tenses in scientific writing can convey particular academic meanings.

Academic wording

Use full forms instead of contractions

Because scientific essays and reports are types of formal writing it is important not to use the informal short forms (contractions) you would use in your emails and letters to friends. For example, you should use:

- do not instead of don’t
- cannot instead of can’t
- will not instead of won’t.
Use nominalised phrasing

One important feature of formal scientific writing is the use of nominalisation, or the use of nouns rather than verbs. In the following pairs of sentences, the first sentence makes use of verbs and the second sentence relies on noun forms to a greater extent.

Examples

| a. Use of verbs: The gel was set in the oven and the excess water was removed. The lanthanum oxide binding gel was then taken from the moulding and stored in MQ water. |
| b. Use of nominalisation: After setting in the oven, removal of excess water, and disassembly from the moulding, the lanthanum oxide gel was stored in MQ water. |

| a. Use of verbs: In dialysis, nitrogenous wastes are removed from the body and electrolyte imbalances are corrected. |
| b. Use of nominalisation: Dialysis involves the removal of nitrogenous wastes from the body and the correction of electrolyte imbalances. |

| a. Use of verbs: When people catch too many fish, the coral pests increase and eventually overrun the coral colonies. |
| b. Use of nominalisation: Overfishing results in increases in pest numbers and the overrunning of coral colonies. |

Avoid writing subjectively

Students sometimes write using a ‘chatty’, informal or subjective style such as in the following example:

Subjective style

These results seem to be really quite good. The model fits very well with the data points as can be interpreted by the $R^2$ values of 0.32 shown in Table 1 above. But the method used to obtain the best values for $a$, $b$, and $c$ was a little silly and time-consuming as it required putting lots of values into a changeable Excel spreadsheet over and over to try and get the lowest $R^2$ value, even though this is probably the only way to do it accurately. Also, this model can be used to extrapolate the PCB concentrations of fish of ages not measured in the study, but that's about it.

Although the scientific points made by this student may be correct, the form of expression is not appropriate for a formal scientific report. There are a number of ways in which this passage could be made more objective, but first it is important to think about whether to use a personal or impersonal style.

Personal or impersonal style?

Should you use a personal or impersonal style? Until quite recently, text books on scientific writing advised students to use an impersonal style of writing rather than a personal style.

An impersonal style uses:

- the passive voice
- the third person rather than the first person (it rather than I or we)
- things rather than people as subjects of sentences.
However, overuse of the passive voice may mean that your writing is less precise, and it may lead to writing which is more difficult to read because it is less natural than the active voice.

Times are changing, and in some disciplines and sub-disciplines of Science it is now quite acceptable to use the active voice, personal pronouns such as I and we, and to use people as subjects of sentences.

**Examples of active and passive sentences**

**Active:** I observed the angle to be…

**Passive:** The angle was observed to be…

**Active:** The authors suggest…

**Passive:** It is suggested…

**Active:** We used a standard graphical representation to…

**Passive:** A standard graphical representation was used to…

**Examples of the first and third person pronouns**

**First person:** I found…

**Third person:** It was found that…

**First person:** I assumed that…

**Third person:** It was assumed that…

**Examples of persons or things as subjects**

**Person as subject:** I noticed…

**Thing as subject:** Analysis of the raw data indicated…

**Person as subject:** In this report I show…

**Thing as subject:** This report presents…

**Write objectively**

Look at the following paragraph and compare it with the paragraph Writing subjectively <www.monash.edu.au/lhs/lionline/writing/science/1.4.xml> . What changes have been made? Which style is closer to the style used in journals in your discipline?

**Writing more objectively**
These results appear to be reasonable as the model fits very well with the data points, as can be interpreted by the $R^2$ values of 0.32 shown in Table 1 above. However, the method used to obtain the best values for $a$, $b$, and $c$ was rather time-consuming as it required putting many values into an Excel spreadsheet many times to obtain the lowest $R^2$ value. While this is probably the only way to obtain accurate results, a further limitation is that this model can be used only to extrapolate the PCB concentrations of fish within age ranges measured in the study.

Have you noticed that the style of writing in scientific journals differs from one disciplinary area to another?

In this general overview it is not possible to give advice appropriate to all disciplines and sub-disciplines in Science, so it is important to seek advice from your lecturer and tutors, and to take note of the styles used in the study guides and the academic journals in your discipline.

**Acknowledging your sources**

Science is a cooperative enterprise where new concepts, theories and hypotheses are built on the foundations of existing ideas. The context of your scientific report or essay is therefore the scientific work that has been done before. There are several reasons why you must reference as a Science student:

- to acknowledge the source of an idea or fact
- to permit the reader to trace the source of an idea or fact to its origin
- to avoid plagiarism.

It is important to develop your skills in:


**Referencing**

Correct referencing is important for a number of reasons:

- to support your arguments
- to add credibility to the information you present
- to enable the reader to trace the source you used
- to avoid possible accusations of plagiarism
- to enhance your assignment and contribute to the mark you receive.

**Citing research**

When writing a scientific report or essay you will often need to refer to the information, evidence or research of other writers. Citations indicate where you have used such sources of information and must be used carefully if you want to avoid being suspected of plagiarism.

Citations can be of two basic types:
• information-prominent
• author-prominent.

Information-prominent citations

A research fact or information is the subject of the sentence. The author’s name and date of publication are placed in brackets at the end of the sentence. Information-prominent citations are often used in the introduction to a new topic or section.

**Example**

The mouse was selected for the experiment as it has been shown to provide the most appropriate model of the basic mechanisms of nuclear transfer (Wakayama and Yanagimachi, 1999).

Author-prominent citation

The author name or names form the subject of the sentence. The date only is put in brackets after the author's name. This type of citation is used when focussing on the research or viewpoint of the other writer. These citations usually appear after information-prominent ones.

**Example**

Bache et al (1972) conducted an observational study to establish the concentration of PCB residues in Cayuga Lake.


**The Harvard referencing system**

The most common referencing system used in Science is the Author-Date or Harvard system (find out about in-text references [www.monash.edu.au/lss/llonline/writing/science/3.2.xml](http://www.monash.edu.au/lss/llonline/writing/science/3.2.xml) and reference lists [www.monash.edu.au/lss/llonline/writing/science/3.3.xml](http://www.monash.edu.au/lss/llonline/writing/science/3.3.xml) in the next two pages). However, many other systems are used by scholars, and you may be asked to use another system by your lecturers. Therefore, read your unit guide carefully.

**NB: If you are a Psychology student, you are required to use APA referencing guidelines. Please refer to the Psychology information under the Faculty of Medicine.**

**In-text citations**

An in-text reference comprises author surname/s, and the publication date of the source (in brackets), within the body of the essay or report. It is inserted directly after the information being sourced from the scientific literature. For example:

_A study conducted by Bright and Western (1984) suggested a significant relationship between..._

Alternatively, when emphasising a particular author's ideas, author name/s can become the subject of the sentence with the date only following in brackets, for example:
Bright and Western (1984) have argued that...

Examples of Harvard in-text referencing

Biological stoichiometry is the study of the balance of energy and multiple chemical elements in living systems (Reiners 1986, Sterner 1995). It has its roots in the work of Lotka (1925), one of the first to consider how thermodynamic laws of physical-chemical systems structure the living world. Lotka’s thinking echoes in concepts that are now cornerstones of ecology: optimal foraging (Belovsky 1978), resource ratio competition theory (Tilman 1982a, b), the Redfield ratio in oceanic biogeochemical cycling (Redfield 1958), and nutrient use efficiency (Vitousek 1982, Elser et al. 1998).

The second feature of multi-species toxicity tests is particularly significant given a worldwide trend towards the use of probabilistic risk assessment by regulatory bodies. One of the most widely accepted approaches to ecological risk assessment was developed by the USEPA (1992) and refined by Solomon et al. (1996) to include a probabilistic component. The trend towards use of ecological risk assessments is apparent in Australia with the recent introduction of risk-based regulatory guidelines for water quality management (ANZECC, 2000).

Reference lists

The Reference List provides full publication details about all (and only) references cited in your essay or report. These references appear at the end of the text in alphabetical order according to author surnames. Make sure you correctly identify which is the surname or family name, and which is only a first name.

Examples of Harvard style reference lists


Summarising and paraphrasing

As a student writer it is expected that you will build up your texts by referring to the ideas and research findings of other writers and experts. In Science, this is normally done through a process of summarising and paraphrasing (rewording). Quoting, that is, the use of the exact words of another writer within inverted commas (“...”) is very rarely used in Science.

Note: You must always provide a reference when summarising, paraphrasing or quoting, because you are reporting ideas and words that are not your own.

The following site provides advice on paraphrasing Purdue University Online Paraphrase Advice <owl.english.purdue.edu/handouts/print/research/r_paraphr.html>.

Quoting

Direct quotations are rarely used in scientific writing except for definitions, or when an idea or principle is exceptional, or cannot be expressed any better.
The writing process

Good writing is challenging and requires practice, and even people whose profession is writing sometimes find it difficult. You will find the writing task simpler if you are well-prepared, keep good records, and approach the task in an organised way.

The following sections outline strategies to help you with various writing tasks. For information about other forms of scientific writing, refer to Other writing in Science resources <www.monash.edu.au/lls/llonline/writing/science/other-resources.xml>.

You should also look at

- Planning and writing the assignment <www.monash.edu.au/lls/llonline/writing/science/process/1.xml>
- Presentation and formatting <www.monash.edu.au/lls/llonline/writing/science/process/2.xml>

Appointments

Remember that you can make an appointment to see a Language and Learning Support adviser if you need personal assistance with your writing. For contact details go to the Science faculty page on Language and Learning Support for undergraduate students <www.sci.monash.edu.au/lls/undergraduate.html>.

Different types of scientific writing

At undergraduate level, depending on the units you choose to study, you may be required to produce a wide range of different types of writing including laboratory reports, essays, posters, reports, and literature reviews. You may also be required to make oral presentations supported by clear, well-written visuals.

The requirements for writing at university may be quite different from the requirements for writing which you have been expected to follow previously. The requirements are set out in the unit guide for each unit and on the unit websites. It is therefore very important for you to refer to the unit guide for specific instructions for each assignment you are required to complete.


Planning and writing the assignment

There are four broad stages in the writing of an assignment:

- planning and task analysis <www.monash.edu.au/lls/llonline/writing/science/process/1.1.xml>
- writing the assignment <www.monash.edu.au/lls/llonline/writing/science/process/1.2.xml>
Planning and task analysis

<table>
<thead>
<tr>
<th>Task</th>
<th>Sub-tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan how you will carry out the task</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• When is the assignment due? Write the date in your diary.</td>
</tr>
<tr>
<td></td>
<td>• When will you complete the first draft and final draft? Write these dates in your diary.</td>
</tr>
<tr>
<td>Analyse the assignment task</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Break the question or task into its parts. Ask yourself: how many parts or actions are involved?</td>
</tr>
<tr>
<td></td>
<td>• Underline the question words (eg. discuss/describe/explain/compare etc.) and make sure you understand their specific meanings.</td>
</tr>
<tr>
<td></td>
<td>• Analyse your audience. Think of your potential readers as intelligent non-experts on the topic. What information do you think they need to know?</td>
</tr>
<tr>
<td></td>
<td>• Identify the materials you need to carry out the task - theory, factual information, statistics, case studies, interviews, etc.</td>
</tr>
<tr>
<td></td>
<td>• Organise your thoughts by brainstorming ideas, and grouping them. Which ideas are more relevant to the topic and which can be cut out? What links are there between ideas? See: QuickRef 25: Brainstorming and mind mapping for assignments &lt;www.monash.edu.au/lts/ltonline/quickrefs/25-brainstorming.xml&gt;</td>
</tr>
<tr>
<td></td>
<td>• Make a rough plan of the main headings</td>
</tr>
<tr>
<td>Gather information for the task</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Start researching the literature early to get an idea of the dimensions of the topic.</td>
</tr>
<tr>
<td></td>
<td>• Review the material covered in lectures, workshops and problems relevant to the task.</td>
</tr>
<tr>
<td></td>
<td>• Collect any other information or data required.</td>
</tr>
<tr>
<td></td>
<td>• Read the material you have collected and make careful notes.</td>
</tr>
<tr>
<td></td>
<td>• Keep records of literature reviewed.</td>
</tr>
<tr>
<td></td>
<td>• Make changes to your plan as you read the literature.</td>
</tr>
</tbody>
</table>

Seek advice from your tutor or lecturer or Language and Learning adviser if necessary. For contact details go to Language and Learning Support for undergraduate students <www.sci.monash.edu.au/lts/undergraduate.html>.

Writing the assignment

<table>
<thead>
<tr>
<th>Task</th>
<th>Sub-tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make an outline draft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• List the ideas you will use under the relevant heading.</td>
</tr>
<tr>
<td></td>
<td>• Make a list of all references.</td>
</tr>
<tr>
<td></td>
<td>• Go over the outline and make sure you have addressed all points of the question.</td>
</tr>
</tbody>
</table>
### Write your first draft
- Expand each idea into a paragraph.
- Arrange the paragraphs into a logical sequence.
- Write simply and clearly, using short grammatical sentences.
- Use your own words as much as possible *(See Acknowledging your sources)*.
- Link the paragraphs.
- Redraft if necessary.

### Write using scientific style
- Use correct scientific terms wherever possible.
- Write formal generic terms in italics (eg *Eucalyptus regnans*). When the name of the genus has been established it is permissible to use the abbreviated format (eg *E. regnans*). Informal names (eg eucalypts) are written in normal text.
- Describe accurately and precisely. Use the passive voice (eg 'The data are plotted in Table 1' rather than 'I plotted the data in Table 1').
- Thoroughly explain tables and figures. Make sure you refer to any figure or table used in your text. Make sure you number and label all figures and tables appropriately (eg 'Table 1: Mollusc varieties found in Northern Queensland'; 'Figure 2: Distribution of *Eucalyptus regnans* in Victoria').
- Use acronyms correctly. Write the words in full the first time and add the acronym in brackets eg. 'El Nino and the Southern Oscillation (ENSO)'. Thereafter, simply use the acronym (eg ENSO).
- Reference all materials, tables and figures you have used appropriately.

### Prepare the final draft
- Re-read, and rewrite if necessary.
- Write the introduction and conclusion last.
- Leave the draft at least 48 hours before final proof-reading.
- Complete the cover sheet.
- Submit the assignment on time.

### Checking your work
These are the last stages before you submit the report. Read what you have written – aloud if possible. If anything is unclear to you it will be unclear to the reader.

<table>
<thead>
<tr>
<th>Checking your work</th>
<th>Complete?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td><strong>Complete?</strong></td>
</tr>
<tr>
<td>1. Is the title clear and informative?</td>
<td>▼</td>
</tr>
<tr>
<td>2. Is your work placed in context?</td>
<td>▼</td>
</tr>
<tr>
<td>3. Is the topic or problem stated clearly?</td>
<td>▼</td>
</tr>
<tr>
<td>4. Is the theoretical framework outlined?</td>
<td>▼</td>
</tr>
<tr>
<td>5. Are any research hypotheses stated clearly?</td>
<td>▼</td>
</tr>
<tr>
<td>Structure</td>
<td>Complete?</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>1. Does the structure follow the requirements of the subject?</td>
<td>▼</td>
</tr>
<tr>
<td>2. Does the introduction outline the importance of the work and provide the necessary background information?</td>
<td>▼</td>
</tr>
<tr>
<td>3. Does the method section explain what was done and how it was done?</td>
<td>▼</td>
</tr>
<tr>
<td>4. Does the result section explain what was found?</td>
<td>▼</td>
</tr>
<tr>
<td>5. Does the discussion section interpret and explain the results?</td>
<td>▼</td>
</tr>
<tr>
<td>6. Does the conclusion summarise the method and results, discuss the implications of the results and suggest improvements in future research?</td>
<td>▼</td>
</tr>
<tr>
<td>7. Does the reference list include only the references you have actually used?</td>
<td>▼</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Format</th>
<th>Complete?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the format appropriate for the discipline and the task?</td>
<td>▼</td>
</tr>
<tr>
<td>2. Are the headings uniform and spaced consistently?</td>
<td>▼</td>
</tr>
<tr>
<td>3. Are the figures, tables and diagrams clearly labelled and appropriately placed?</td>
<td>▼</td>
</tr>
<tr>
<td>4. Have you referred to all the figures, diagrams and graphs you have included?</td>
<td>▼</td>
</tr>
<tr>
<td>5. Have you acknowledged the source of all figures, diagrams and graphs you have obtained from other writers?</td>
<td>▼</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Style</th>
<th>Complete?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the writing clear, concise and objective?</td>
<td>▼</td>
</tr>
<tr>
<td>2. Is the writing fluent?</td>
<td>▼</td>
</tr>
<tr>
<td>3. Are the style of sentences and the vocabulary appropriate to the discipline and the topic?</td>
<td>▼</td>
</tr>
</tbody>
</table>
4. Have you checked that you have not used emotive language such as ‘This is a really exciting result.’?

5. Have you demonstrated your understanding of the sources you have used?

6. Have you made sure that you have not used colloquial language such as ‘We got these answers.’?

Grammar, spelling and punctuation

<table>
<thead>
<tr>
<th>Grammar, spelling and punctuation</th>
<th>Complete?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the grammar of all the sentences correct?</td>
<td></td>
</tr>
<tr>
<td>2. Are the tenses used appropriately?</td>
<td></td>
</tr>
<tr>
<td>3. Are all the words spelled correctly?</td>
<td></td>
</tr>
<tr>
<td>4. Are punctuation marks used correctly?</td>
<td></td>
</tr>
</tbody>
</table>

**Learning from feedback**

Lecturers and tutors spend a good deal of time marking your assignments and commenting on them, but some students do not take advantage of this feedback. The written comments on your work will often give you specific advice on how to improve your work and your marks.

When you receive the marked assignment:

- read the tutor’s comments carefully
- think about how you can improve your work
- seek advice from your tutor if necessary!

**Presentation and formatting**

When preparing your report or essay for submission, think about the person who will be marking it. If you want good marks, ensure that your work looks professional and neat. Refer to your unit guide for instructions on how to present and format your document. The following suggestions are provided as a guide.

**Presentation**

- Word-process your report or essay, rather than writing it by hand.
- Use the spellcheck function.
- Think about sentence and paragraph construction.
- Use headings and sub-headings to make your text reader-friendly. Ensure headings refer to the content rather than stage of the paper.
- Correctly reference any material you use from other authors (see Referencing <www.monash.edu.au/lls/llonline/writing/science/3.xml> ).

Seek advice from your tutor or Language and Learning Services where necessary.

Formatting your document

Check your unit guide for specific instructions. If no specific instructions on formatting are given, the following guidelines may be helpful.

<table>
<thead>
<tr>
<th>Formatting your document</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section</strong></td>
</tr>
<tr>
<td>Font</td>
</tr>
<tr>
<td>Margins</td>
</tr>
<tr>
<td>Title</td>
</tr>
<tr>
<td>Author details</td>
</tr>
<tr>
<td>Main text</td>
</tr>
</tbody>
</table>
| Section titles | • The main titles should be in 14 point font size, bold, upper and lower case. The titles should be numbered 1, 2, 3, ... .
• Secondary titles should be in 12 point font size, bold, and numbered with a second number (eg 1.1, 1.2, 1.3, ... ). Leave a blank line before and after each title. |
| Tables and figures | Include tables and figures in the body of the paper, number them, and refer to them as Table 1, Figure 2, etc. All figures and tables should have short explanatory captions (titles). |

Using figures, tables and graphs

Figures, tables and graphs are often used in scientific reports. They are valuable because they can be used to present complex results in a readable way, but it is important that they are used carefully.

Labelling and using tables and diagrams

Tables and graphs should be:

- numbered sequentially
- labelled clearly and
- positioned as close to the relevant text as possible.

Placement of tables and diagrams

- Put graphs, tables, figures and diagrams in the Results section and complex raw data in the Appendix.
Refer to figures and tables

- Make specific reference to each figure and table. Do not assume that the reader will make the necessary connection between the text and the figure or table. Write something about each figure and table.
- Refer to each figure or table in the text by its figure or table number.
- Remember to guide the reader in interpreting the information in the table or figure. What does the table show? What specific point are you making?

Labelling

- Label tables above the table and figures below the figure.
- A table or figure from an outside source should be labelled like any other outside information and its source should be provided.
- Number all tables and figures, even if you use only one of each.

Figures and tables in appendices

- Number figures and tables in appendices according to the appendix in which they appear. For example in Appendix A you would have:
  - Figure A1
  - Table A1
  - and so on.

Example
The results are shown in Table 3 below, and the graph of V against M is found in Appendix A3.

Titles of tables

- Keep titles brief but informative. You can include explanatory notes, if needed, as footnotes under the table or figure.

Example
Table 1. Reagent tests of known nutrients for specific food substances
(Table here)

- Note: Numbers in parentheses indicate the range of response for each reagent.

Referring to tables and figures

When referring to tables and figures, you can use:

- clauses beginning with as

Example
As shown in Table 1 below, lipids were found in hamburgers, hot dogs, potato chips, pizza and doughnuts.

- passive voice
Example
Mean weights for samples are shown in Table 1.

- brackets

You may refer to Tables or figures by using brackets with or without the verb see

<table>
<thead>
<tr>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average female wasps were twice as numerous as male wasps (Table 1).</td>
</tr>
<tr>
<td>Each sample tested positive for the three nutrients (see Table 2).</td>
</tr>
<tr>
<td>Plant growth did not differ across irrigation treatments (Figure 1).</td>
</tr>
</tbody>
</table>

- This pattern can also be used at the end of a sentence.

Example
X and Y remained constant, as shown in Table 1.

If it is appropriate in your discipline you may choose to use the active voice to express the same notion.

See the section on personal or impersonal style.

Example
Table 1 shows mean weights for samples.

The lab report

The laboratory report is an important form of writing for scientists as it provides a record of experiments completed. Depending on the type of task or investigation you carry out, the sections of the written piece may vary, but a lab report or project report will usually have a title page, abstract, introduction and methods, results, discussion sections, a conclusion and references test section.

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title page + ID details</td>
<td>• displays your name and student ID number</td>
</tr>
<tr>
<td></td>
<td>• the title gives a precise description of what is in the report (this may be supplied by the lecturer).</td>
</tr>
<tr>
<td>Section</td>
<td>Overview</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Abstract  | • placed at the beginning of the report  
• provides a summary of the entire paper (about 5% of the whole text) including:  
  o the problem and its importance  
  o what was done (the experiment)  
  o how it was done (the method)  
  o what resulted (the most important results)  
  o what this research contributes to the field (significance)  
  
  NB: The abstract does not include figures or tables. |
| Introduction | • gives the background or scope of study  
• includes background information so that the reader  
  1. understands the question behind the research  
  2. how it relates to other work in the field, and  
  3. why it is worth investigating. |
| Methods    | • describes the methods and procedures used  
• clearly explains the methodology so that it could be replicated (repeated) by another researcher. |
| Results    | • presents the results of the experiment  
• uses an equation editor with correct mathematical symbols if the results involve numbers and equations  
• includes clearly labelled figures, tables and graphs where appropriate. |
| Discussion | • analyses and interprets the results, showing how these relate to the scope of study  
• states conclusions about how the results confirm, verify, or support the hypothesis, or refute, negate, or contradict it.  
  
  NB: The word “prove” is not used except in very specific contexts (eg in mathematics). |
| Conclusion | • summarises the conclusions of the study. |
| References | • lists all references cited in the text. |

For an outline of the organisation of a typical laboratory report and samples of each section of the report, check the site on [laboratory report](http://www.writing.eng.vt.edu/workbooks/laboratory.html).

**The annotated bibliography**

In some units in the Faculty of Science you may be asked to write an annotated bibliography. Refer to your unit guide for specific instructions. The following information is provided as a general guide.

Your annotated bibliography should provide the reader with:

- an informative title
- a short introduction - introducing the topic and explaining the relevance of the selected articles to the topic
- full details of each article covered, including author and publication details according to the referencing guidelines required for the unit
- a brief summary of the aims of the research reported in each article
- a brief summary of the conclusions of each article
- an evaluation of the article's relevance to the topic.

### A checklist for the annotated bibliography

<table>
<thead>
<tr>
<th>Item</th>
<th>Complete?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you provided a title which informs the reader exactly what the annotated bibliography is about?</td>
<td>☐</td>
</tr>
<tr>
<td>Have you given a short introduction and explained why you have selected the articles?</td>
<td>☐</td>
</tr>
<tr>
<td>Have you provided full publication details of each article?</td>
<td>☐</td>
</tr>
<tr>
<td>Have you summarised the aims of each research report?</td>
<td>☐</td>
</tr>
<tr>
<td>Have you summarised the conclusion of each research report?</td>
<td>☐</td>
</tr>
<tr>
<td>Have you evaluated each article in terms of its relevance to the topic?</td>
<td>☐</td>
</tr>
<tr>
<td>Have you checked your spelling and grammar?</td>
<td>☐</td>
</tr>
</tbody>
</table>

### The literature review

In a scientific essay, project or report you will be expected to show that you are aware of the relevant research on the topic and a literature review will form an important part of your assignment. In some units you may be expected to write a stand-alone literature review as the whole assignment.

**Literature reviews are important to scientists because**

- scientific knowledge is not static
- scientific knowledge changes as scientists conduct their research, replicate the research of other scientists, and report their findings
- it is important to understand how knowledge in a particular discipline is changing
- it is very important to be aware of the controversies in the discipline.

A literature review will give the reader

- a clear statement of the topic or problem
- a clear presentation of the range of research on the topic
- an evaluation of the research
- an indication of what further research is necessary.

It is not enough to summarise the research literature. You need to show you understand the relevance and significance of the different publications, and how they relate to each other.
How to write the literature review

To write the literature review, follow these steps:

1. Analyse the topic
   - What exactly are you being asked to do?
2. Locate appropriate published research on the topic
   - Be very careful about using material you have located on the Internet
3. Read and understand the research you have located
4. Summarise the research
5. Analyse the research
   - What methods have been used?
   - What findings have been reported?
   - What common strands are there?
   - What differences are there?
   - What are the strengths and weaknesses of the research?
   - How convincing is the research?
   - What further research may be needed?
6. Decide on an organisation for your analysis. For example:
   - General to specific
   - Chronological (oldest to most recent)
   - Methodological
   - Other
7. Write your first draft

A standalone literature review

A standalone literature review will usually have a title page, introduction, body, conclusion and references section.

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title page + ID</td>
<td>• Your name and student ID number</td>
</tr>
<tr>
<td>details</td>
<td>• The title gives a precise description of the assignment</td>
</tr>
<tr>
<td></td>
<td>(The title may be supplied by the subject lecturer)</td>
</tr>
<tr>
<td>Introduction</td>
<td>Give the background to the topic</td>
</tr>
<tr>
<td></td>
<td>• Why is it important?</td>
</tr>
<tr>
<td></td>
<td>• Why is it interesting?</td>
</tr>
<tr>
<td></td>
<td>• How does it relate to other work in the field?</td>
</tr>
<tr>
<td></td>
<td>• What is the scope of the review?</td>
</tr>
<tr>
<td></td>
<td>• How is key terminology defined?</td>
</tr>
<tr>
<td></td>
<td>• How is the review organised?</td>
</tr>
</tbody>
</table>
**Body**

- Present the reviews according to the organisation you have chosen.
- Outline the research using summaries and paraphrases expressed in your own words.
- Evaluate the research (See Analyse the research) <www.monash.edu.au/lhs/lionline/writing/science/lit-review/1.xml> . Note: Think carefully about the ways you cite information from the work of others (See Referencing, <www.monash.edu.au/lhs/lionline/writing/Science/1.1.xml> )
- Note: Think carefully about the verbs you use when you cite the work of others.

**Conclusion**

- Summarise what you have written.
- Identify any issues you have identified.
- Indicate any further research which may be needed.

**References**

- Provide a full list of all research you have referred to.
- Ensure that you have provided full details.

---

**A checklist for the literature review**

<table>
<thead>
<tr>
<th>Check list</th>
<th>Select one</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you analysed the topic carefully?</td>
<td></td>
</tr>
<tr>
<td>Have you identified the key aspects of the topic?</td>
<td></td>
</tr>
<tr>
<td>Have you defined the key terms?</td>
<td></td>
</tr>
<tr>
<td>Have you explained the organisation of the review?</td>
<td></td>
</tr>
<tr>
<td>Have you used primary research from peer-reviewed journals?</td>
<td></td>
</tr>
<tr>
<td>Have you summarised the research in your own words?</td>
<td></td>
</tr>
<tr>
<td>Have you evaluated the research?</td>
<td></td>
</tr>
<tr>
<td>Have you summed up your work?</td>
<td></td>
</tr>
<tr>
<td>Have you identified areas for further research?</td>
<td></td>
</tr>
</tbody>
</table>

If you are still unsure about any of these questions, check your unit guide and/or seek advice from your tutor or Language and Learning adviser.
The Science essay

For an essay you will be expected to read widely about the topic, select the best references and then write a careful critical analysis. Your essay should introduce the topic, discuss it, and lead to a logical conclusion. The essay should have a title page, introduction, body with appropriate section headings, conclusion and list of references.

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
</table>
| Title Page + ID details      | • displays your name and student ID number  
• states what the essay is about. Sometimes the title may be provided by your lecturer. |
| Introduction                 | • places the question in its scientific context  
• gives the minimum necessary background for the topic  
• states the argument or proposition  
• sets out the interpretation of the topic  
• defines important technical terms  
• outlines how you intend to approach the topic |
| Body - various sections      | • provides appropriate section headings  
• makes clear the logical development of the subject matter  
• states what led you to your point of view  
• uses relevant information to support the argument  
• uses figures and tables to support the text  
• references all sources of information including tables and figures  
• numbers and labels all tables and figures used. |
| Conclusion                   | • provides a brief restatement of the purpose of the essay  
• summarises the main points made in the body of the essay  
• states your conclusions clearly and concisely  
• sets out your reasons for your conclusions  
• indicates suggestions for future research if appropriate |
| List of References           | • lists all references cited in the text. |

The Science report

Formal reports are a common feature of scientific work and it is important to pay particular attention to the structure, style, and presentation of your reports.

The following section presents general guidelines, but you should consult your unit guide for specific information about the requirements for your unit.

The scientific report will usually have the following sections. Those which are optional are given in brackets (..).

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Title page and ID</td>
<td>• provides your name and student ID number</td>
</tr>
<tr>
<td>details</td>
<td>• if the title is not given, ensure that your title is informative.</td>
</tr>
<tr>
<td>(Abstract)</td>
<td>gives a very brief indication of:</td>
</tr>
<tr>
<td></td>
<td>• the aim of the report</td>
</tr>
<tr>
<td></td>
<td>• what you did</td>
</tr>
<tr>
<td></td>
<td>• what you found</td>
</tr>
<tr>
<td></td>
<td>• what you concluded.</td>
</tr>
<tr>
<td>Introduction</td>
<td>provides the context for the report</td>
</tr>
<tr>
<td></td>
<td>• states why the topic is important or useful</td>
</tr>
<tr>
<td></td>
<td>• explains any abbreviations or special terms.</td>
</tr>
<tr>
<td>Method</td>
<td>sets out what you did in sequence</td>
</tr>
<tr>
<td></td>
<td>• explains how you did it</td>
</tr>
<tr>
<td></td>
<td>• indicates what materials, techniques or equipment you used</td>
</tr>
<tr>
<td></td>
<td>• provides sufficient information for the reader to replicate the study.</td>
</tr>
<tr>
<td>Results</td>
<td>presents what you found</td>
</tr>
<tr>
<td></td>
<td>• includes clearly titled and labelled graphs, tables and figures as</td>
</tr>
<tr>
<td></td>
<td>appropriate</td>
</tr>
<tr>
<td></td>
<td>• do not simply cut and paste an Excel file into your document</td>
</tr>
<tr>
<td></td>
<td>• detailed calculations may be provided in the appendix.</td>
</tr>
<tr>
<td>Discussion</td>
<td>• explains what the results mean</td>
</tr>
<tr>
<td></td>
<td>• indicates whether the results were consistent or inconsistent with</td>
</tr>
<tr>
<td></td>
<td>your expectations</td>
</tr>
<tr>
<td></td>
<td>o explains what possible sources of error there are</td>
</tr>
<tr>
<td></td>
<td>o indicates how the experiment could be improved in future.</td>
</tr>
<tr>
<td>Conclusion</td>
<td>• briefly restates the main results</td>
</tr>
<tr>
<td></td>
<td>• briefly explains the significance of the findings.</td>
</tr>
<tr>
<td>References</td>
<td>• provides a list of sources of information which you have used,</td>
</tr>
<tr>
<td></td>
<td>following the referencing conventions required for the unit (see</td>
</tr>
<tr>
<td>(Appendices)</td>
<td>• provides supporting information such as calculations.</td>
</tr>
</tbody>
</table>

For an outline of the organisation of a typical laboratory report and samples of each section of the report, check the site on laboratory reports <www.writing.eng.vt.edu/workbooks/laboratory.html>.
English has a complex system of tenses, and this can be problematic when writing Science reports.

**Which tenses should you use?**

The tenses used in scientific writing can vary from one disciplinary area to another. As a result it is not possible to give a single simple rule to follow. Think about the tenses you come across while you are reading and researching in your subject area, and notice how they are used in the research reports you read. You should follow the recommendations of your lecturer or tutor in each unit, and your study guide may also provide useful hints.

There are a number of factors to take into account when deciding which tense to use. The section of your report and your view of the research you are reporting upon may influence the verb tense you use.

With thanks to Dr David Rowland, Learning Assistance Unit, University of Queensland.

**Introduction**

Your introduction will need to include background information which is generally accepted as fact in a discipline. This is usually presented in the simple present tense.

<table>
<thead>
<tr>
<th>Example 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemophilia A, also known as Factor VIII deficiency, is a serious inherited disorder characterised by bleeding in soft tissue, muscles and weight-bearing joints (Gitschier, 1989).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in stream health due to anthropogenic effects necessitate regular sampling and monitoring (Mulholland et al, 2005).</td>
</tr>
</tbody>
</table>

In the introduction you also will need to explain why the research you are writing about is important or necessary. This is usually done by using a form of the present tense.

<table>
<thead>
<tr>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genomics provides crucial information for rational drug design.</td>
</tr>
</tbody>
</table>

**The choice of tense indicates your view**

You will need to refer to existing research relevant to your work, and you can indicate your opinion of the research you are writing about by a careful selection of tense.

For example, when you use the present tense you are indicating to the reader that you believe that the research findings are still true and relevant, even though the original research may have been conducted some time ago.

<table>
<thead>
<tr>
<th>Example 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemophilia A, also known as Factor VIII deficiency, is a serious inherited disorder characterised by bleeding in soft tissue, muscles and weight-bearing joints (Gitschier, 1989).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in stream health due to anthropogenic effects necessitate regular sampling and monitoring (Mulholland et al, 2005).</td>
</tr>
</tbody>
</table>
Many of the lakes and wetlands in the region are located in craters or valleys blocked by early Pliocene lava flows (Ollier and Joyce, 1964).

Example 2

Potassium is necessary for the maturation of berries and canes and is absorbed in large quantities by vines (Nagarajah and McCarthy, 1996).

**Past tenses to report research**

If you use a past tense in your introduction when you refer to previous research, you are indicating to the reader that that there may be a gap in the existing research, or that the research may no longer be true or relevant.

Example

A great deal of research has been conducted on the basic techniques of nuclear transfer, but few experiments have been carried out to discover the most appropriate age of the cytoplasm to support nuclear transfer most effectively.

This suggests that you believe that more experiments are necessary. This gap is further emphasised by the phrase but few experiments.

Look at the two sentences below. The first sentence, in the present tense, suggests that you are not sure that the assumption is correct. The second sentence is in a form of the past tense called the past perfect tense. If you are using this form you are suggesting that this was true up to now, but there may be a problem with the assumption.

Present tense

Clark and Thompson (2006) assume that there is a clear linkage between first flowering date and mean air temperature.

Past perfect tense

Clark and Thompson (2006) have assumed that there is a clear linkage between first flowering date and mean air temperature.

**Methods**

**Past tense to describe what was done**

In your methods section it is customary to use a form of the simple past tense to describe what you did in your study. Look at the examples below.

Examples

Total phosphorous (TP) and total nitrogen (TN) were measured in the laboratory using standard procedures.
The standard protocol was followed for the preparation of the media from stock solutions.

**Active and passive voice**

The two examples above are in the past tense but in the passive voice. Have a look at the examples below in the past passive and past active voice.

<table>
<thead>
<tr>
<th>Example 1</th>
</tr>
</thead>
</table>
| **Past passive**  
Three 2 litre samples were taken at a depth of between 0.1 and 0.5 m at the down-wind end of each wetland. |
| **Past active**  
Each of the three groups took 2 litre samples at a depth of between 0.1 and 0.5 m at the down-wind end of each wetland. |

<table>
<thead>
<tr>
<th>Example 2</th>
</tr>
</thead>
</table>
| **Past passive**  
Specified amounts of solution were added to each tube as indicated in Table 1. |
| **Past active**  
We added specified amounts of solution to each tube as indicated in Table 1. |

<table>
<thead>
<tr>
<th>Example 3</th>
</tr>
</thead>
</table>
| **Past passive**  
A control study of unaffected individuals was also conducted. |
| **Past active**  
Research colleagues at the South African campus also conducted a control study of unaffected individuals. |

From your reading, which voice do you think is used most often in your scientific discipline?

The section on **What makes a good Science communicator?**  

**Present tense for diagrams and figures**

If you use figures or diagrams to help explain what you did, refer to the figure or diagram using the present tense.

<table>
<thead>
<tr>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1 above shows the success of cloning in various animal species.</td>
</tr>
<tr>
<td>Figure 2 below shows methylation in mouse 2-cell embryos.</td>
</tr>
</tbody>
</table>
Results

Past tense for results obtained

In the results section, use the past tense to set out the results you obtained.

Examples

Overall, more than 70% of the insects collected were non-phytophagous.

Results indicated that prolonged exposure to ultra-violet radiation had a positive correlation with the development of melanomas.

Following activation of NT oocytes with strontium, the cell cycle was resumed in both groups.

Present tense to refer to figures, tables and graphs

As in the previous sections use the present tense when you refer to figures, tables and graphs.

Examples

Figure 1 shows the comparative variation in the morphology of donor chromatin in both age groups of oocytes.

Table 1 below shows the stream flows calculated for each stream using Equation 1.

Figure 3 below shows the results of the second simulation indicating the decreasing power rates of all tests.

Discussion

Present tense to explain significance of results

In your discussion section you will usually try to explain the significance of the results. The present tense is usually used for this purpose.

Example

Removal of vegetation for agricultural purposes appears to negatively affect the water quality of streams.

Past tense to summarise findings, with present tense to interpret results

However, writers may use the past tense to summarise the findings, in combination with the present tense to explain or interpret what the results mean.

Look at the next two examples.
Example 1

As the maxima and minima did not correspond to high and low tides, it is possible that the patterns observed may not be the result of mixing of waters with different concentrations.

Example 2

Leaf carbon and phenolic content did not differ across sites, indicating that the response of secondary plant chemicals such as phenolics to water is complex.

Note that in example 1 the phrases it is possible that and may not be are used to indicate that other explanations are possible. This is an example of the use of limiting words to discuss findings in an academically tentative way.

Example 2, on the other hand, is less tentative. If you make a statement such as this, you are confident that your results and conclusion are correct.

Check the section above on making tentative statements <www.monash.edu.au/lls/llonline/writing/science/1.2.xml>.

Conclusion

A combination of tenses to highlight past research and future directions

In the final section of your report you need to summarise the main findings and the major implications of the study, point out any limitations, and offer suggestions for future research. In order to achieve these multiple aims you may use a combination of tenses.

Example

Although the study found evidence of tillage and irrigation within the study area, from the data collected it was not possible to determine if the effects of agriculture upstream cause (or caused) higher levels of total nitrogen downstream. Further studies are therefore necessary to determine the effects of agriculture on the health of Stringybark Creek.

The Science poster

For some Science units you may be asked to produce a poster. It is very important to remember that a poster is not simply an essay presented in a large format. A good poster is a combination of text, illustrations, and space which is attractive, informative and easy to read.

For guidelines on the preparation of posters and some samples check the site on Design of scientific posters <writing.engr.psu.edu/posters.html>.

Tips and tricks for Creating Effective Poster Presentations :: An Effective Poster <www.ncsu.edu/project/posters/>.
Visuals to accompany oral presentations

Well-prepared visuals can make a big difference to your oral presentations. For hints, samples, and a link to a PowerPoint template to help you make your own visuals check the site on Rethinking the design of presentation slides <www.writing.eng.vt.edu/slides.html>.

Writing good sentences

The sentence is the basic building block of any scientific writing. If you want to communicate clearly you must be able to construct grammatically correct, complete sentences.

What makes a good sentence in academic writing? Tick all the correct features in the list below.

1. Most important of all, a sentence must make sense.

Parts of a sentence

Look at the following section from an unedited student practical report on finding and describing 'fossil' trackways in concrete pavements.

Continuous trackway (Homo Sapiens)
A set of eight, shod human footprints (Fig 4) across four concrete paving panels was found in the semi-circular pathway in Hopetoun Gardens, Glenhuntly Road, Elsternwick. Variable speed is indicated in the prints (Fig 5), indicating the human took four steps onto the wet concrete, and stopped briefly (prints 5 and 6) to survey the situation, before taking two large steps to leave the freshly concreted panels. The deeper impression of print 6 (clearly evident in Fig 6) indicates the hominid pushed off from the right foot, showing a footedness common to the species.

1. How many sentences are there in this paragraph?

1 Incorrect!
Try again.

1 Incorrect!
Try again.

1 Correct!
The fullstops mark the end of each sentence.

2. What is the main verb in the first sentence?
3. What is the subject of the first sentence?

Incorrect!
Was found is the verb. You can't say Eight human footprints was found ...

Correct!
Was found is the verb, so the subject of the sentence is the noun phrase that answers the question What was found?

5. What is the subject of the last sentence?

Correct!
The main verb is indicates. This answers the question What indicates?
Correct!
The main verb is indicates. This answers the question What indicates?

Incorrect!
The main verb is indicates. Hominid is the subject of the verb pushed but not of the sentence.

Sentence-level errors

Common sentence-level errors include:

- omission of punctuation
- incorrect punctuation
- omission of main verb
- incorrect use of verbs
- incorrect word order
- including too much information.

What's wrong with these sentences?

From the Carboniferous to the Permian it seems that only Western Australia was submerged underwater although this does not suggest that other parts of Australia were not also covered.

Correct!
The commas were missing. This is the corrected version.

From the Carboniferous to the Permian, it seems that only Western Australia was submerged underwater although this does not suggest that other parts of Australia were not also covered.

Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!

From the Carboniferous, to the Permian, it seems that only Western Australia was submerged underwater, although this does not suggest - that other parts of Australia were not also covered.

Incorrect!
Try again!
Correct!
The punctuation was incorrect. Check the differences in the corrected version.

From the
From the Carboniferous to the Permian, it seems that only Western Australia was submerged, although this does not suggest that other parts of Australia were not also covered.

Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!

From the Carboniferous to the Permian, it seems that only Western Australia was submerged, although this does not suggest that other parts of Australia were not also covered.

The main verbs were missing. From the Carboniferous to the Permian, it seems that only Western Australia was submerged, although this does not suggest that other parts of Australia were not also covered.

Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!
Incorrect!
Try again!

From the Carboniferous to the Permian, it seems that only Western Australia is submerged underwater, although this does not suggest that other parts of Australia was not also covered.

The verbs were in the wrong tense or did not agree with the grammatical subject. From the Carboniferous to the Permian, it seems that only Western Australia was submerged, although this does not suggest that other parts of Australia were not also covered.
From the Carboniferous to the Permian, although this does not suggest that other parts of Australia were not also covered, it seems that only Western Australia was submerged underwater.

The word order made the sentence confusing and you don’t need *submerged* if you have *underwater*. From the Carboniferous to the Permian, it seems that only Western Australia was submerged, although this does not suggest that other parts of Australia were not also covered.

There was too much information in one sentence. Some of the information could be included in a separate sentence. The presence of rugose corals and crinoid fossils found suggests that it was a continental shelf environment and still relatively warm, as corals cannot grow in cold waters.
Look at the following extract from an Earth Sciences assignment. The extract has been edited for the purposes of this exercise to remove all punctuation and capital letters.

from the carboniferous to the permian it seems that only western australia was submerged underwater although this does not suggest that other parts of australia were not also covered the presence of rugose corals and crinoid fossils found in wa suggests that it was a continental shelf environment and still relatively warm as corals cannot grow in cold waters the absence of marine organisms throughout the rest of australia and especially victoria during this period suggests that the sea level was receding again or that no sedimentary deposition was occurring Can you correct this paragraph? There are 9 errors of capitalization, and 4 commas and 3 full stops have been omitted.

Can you correct this paragraph? There are 9 errors of capitalization; and 4 commas and 3 full stops have been omitted. Type your text into the box below and then check your answer.

Would you like a real challenge? Now look at the following unedited extract from an essay on stromatolites.

Walter (1973) states that there are many types of stromatolites, but they are all the same and are only different because of the way that they have responded to the environment that they are growing in, like branching ones are branching because they are torn apart at the tops, and elongate ones are elongate because of the direction of the currents which change direction twice a day when the moon affects the tides which are high in the areas that stromatolites grow in today, like the ones at Shark Bay and other places that have high salinities and are protected from predators like snails and diatoms so that we can still go there and visit them to look at their shapes, while others are fine flat layers and that means that they grow in sheltered environments like shallow lakes because any currents would rip them apart to make branching stromatolites like the ones mentioned above.

How could you improve this paragraph? If you were marking this assignment, what mark out of ten would you give it?

1. Read it out loud to yourself. How many sentences does it REALLY include?

Incorrect.
Try again.

Incorrect.
Try again.

Correct!
2. What is the subject of the first sentence?

[2-1] Correct!

[2-2] Incorrect.
Try again.

Try again.

3. What is the main verb in the third sentence?

[3-1] Incorrect.
Try again.

[3-2] Correct!

[3-3] Incorrect.
Try again.

4. What common errors do you think this writer has made?

[4-1] Incorrect.
Try again.

[4-2] Incorrect.
Try again.

[4-3] Incorrect.
Try again.

[4-4] Incorrect.
Try again.

[4-5] Correct!
You could leave out "but they are all the same" if you go on to say they're different. There are also some problems with the punctuation.
Paragraphing

Good scientific writing in English is very carefully organised, and particular attention is given to paragraph structure. A well-written paragraph is not simply a collection of sentences about a particular topic. The first sentence of a paragraph is usually particularly important, and all sentences in a paragraph are carefully linked together using a variety of linguistic devices.

In this section you'll find out:

- how the **topic sentence** establishes the main idea
- how to link sentences within a paragraph with **repetition**
- other ways to **connect ideas**
- how to make **connections between paragraphs**

In the following exercises, we will be using this passage from a scientific report.

<table>
<thead>
<tr>
<th>Sample passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polychlorinated biphenyls (PCBs) comprise a group of 209 individual compounds which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the environment due to their ability to resist chemical and physical breakdown. They also accumulate up the food chain, with those organisms higher up the food chain typically demonstrating higher levels where contamination has occurred. PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects. Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans. Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.</td>
</tr>
</tbody>
</table>

The topic sentence

Look at the first paragraph. Think about what the writer is doing in the first sentence.
Polychlorinated biphenyls (PCBs) comprise a group of 209 individual compounds which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the environment due to their ability to resist chemical and physical breakdown. They also accumulate up the food chain, with those organisms higher up the food chain typically demonstrating higher levels where contamination has occurred.

She is informing the reader what the paragraph will be about. The first sentence of a paragraph usually establishes the topic to be discussed in the lines which follow, and it is known as the topic sentence. A paragraph without a topic sentence may cause frustration for the reader who has to work hard to understand the purpose of the writing. The topic sentence is usually the first sentence in a paragraph but may sometimes be the second sentence – or the last.

Find the topic sentences in paragraphs 2, 3 and 4.

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

The topic sentences are the:

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future.
Find the topic sentences

Look at the following sentences from a paragraph about the therapeutic uses of garlic. Unfortunately the sentences are not in the correct order.

---

**Paragraph 1**
Garlic has been shown to reduce the risk of cardiovascular disease (Aboul-Enein and Aboul-Enein, 2005), and possess anti-microbial (Sivam, 2001) and antioxidant properties (Imai et al., 1994). This essay will explore research into garlic's potential roles in reducing cancer risk and in treating cancer. Garlic (Allium sativum L.) has been used for centuries for medicinal purposes. Its use for healing purposes can be traced back as far as 1550BC when documentations of its therapeutic use first appear in Egypt (Hassan, 2003; Rivlin, 2001). In modern times belief in the beneficial effects of garlic on health has led to it being used for a number of conditions.

---

Given what you now know about well-written paragraphs can you reorder the sentences to produce a good paragraph?

Look at the following extract from an essay on cystic fibrosis.

---

Cystic fibrosis (CF) is one of the most common genetic disorders. CF is inherited as an autosomal recessive trait and a defective gene causes the body to produce an abnormal amount of very thick, sticky mucus which clogs the lungs and pancreas, interfering with breathing and digestion. This mucus builds up in the breathing passages in the lungs and the pancreas and respiratory complications develop from the blockage of the bronchial passages. Eventually, the cilia which are responsible for clearing the mucus are destroyed. In addition, the mucus traps bacteria which cause infections and permanent damage to the lungs, and may also block the ducts of the pancreas which contains enzymes necessary for the digestion of food.

---

Can you identify the topic sentence?

---

Correct!
The first sentence is the topic sentence.

---

Linking by repetition

A paragraph is a group of sentences on a single topic. The topic sentence marks the main idea, but how do you show that ideas within a sentence relate to each other.

One way a writer can link sentences in a paragraph is by simply repeating a key word, but it is important not to use this device too often.
You'll notice that the term PCBs is repeated in other sentences in the first paragraph.

### Paragraph 1

Polychlorinated biphenyls (PCBs) comprise a group of 209 individual compounds which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the environment due to their ability to resist chemical and physical breakdown. They also accumulate up the food chain, with those organisms higher up the food chain typically demonstrating higher levels where contamination has occurred.

Look for examples of repetition of PCBs in these paragraphs.

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

How many instances of PCBs can you find in the last paragraph?

Incorrect. Try again.

Correct! You will find Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

Incorrect. Try again.

**Using pronouns to link**

Writers often make links between sentences in a paragraph by using pronouns such as *it* or *they*, or demonstrative pronouns such as *this* or *that*.

Can you find examples of the use of pronouns or demonstratives to make links between sentences?
Look in paragraphs 2, 3 and 4 for examples of the use of pronouns or demonstratives to make links between sentences.

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

How many examples can you find in paragraph 2?

[1] Incorrect.
Try again.

[2] Correct! You'll find they and these chemicals in Paragraph 2 of the passage. PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Try again.

Using synonyms to link

Another technique used by writers is to use words with similar meanings (synonyms) in the paragraph. This is a way of making links between sentences without using too much repetition

You'll find a number of synonyms for polychlorinated biphenyls in this paragraph: PCBs, a group of 209 individual compounds, organochloride chemicals.

Polychlorinated biphenyls (PCBs) comprise a group of 209 individual compounds which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the environment due to their ability to resist chemical and physical breakdown. They also accumulate up the food chain, with those organisms higher up the food chain typically demonstrating higher levels where contamination has occurred.

What synonyms for polychlorinated biphenyls can you find in paragraphs 2, 3 and 4 of the passage?
PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

Use the dropdown options to indicate which paragraph you found these words.

1. PCBs, PCBs, such potentially dangerous chemicals

2. PCBs, these chemicals

3. the chemicals, PCBs, PCBs

Words which belong together

To make connections between sentences words do not have to be exact synonyms. Sometimes a writer will use words which belong together. For example the word book suggests other words in the mind of the reader, like paperback, page, library, title or author. Careful use of meaning connections can give the reader the sense that the paragraph is well-organised without being repetitive.

Look at the first paragraph again. Note that the topic sentence begins with polychlorinated biphenyls and there are a number of synonyms or near synonyms in the paragraph. These are (PCBs) PCBs, organochloride chemicals, and DDT.
We also have a number of words which belong together with PCBs, including **compounds, the environment, ability to resist chemical and physical breakdown, food chain, organisms higher up the food chain, higher levels, contamination.**

<table>
<thead>
<tr>
<th>Paragraph 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polychlorinated biphenyls (PCBs) comprise a group of 209 individual <strong>compounds</strong> which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the <strong>environment</strong> due to their <strong>ability to resist chemical and physical breakdown</strong>. They also accumulate up the <strong>food chain</strong>, with those <strong>organisms higher up the food chain</strong> typically demonstrating <strong>higher levels</strong> where contamination has occurred.</td>
</tr>
</tbody>
</table>

**Making connections with verbs**

Meaning connections can be used with verbs as well as nouns. Look at the verb phrase **persist in the environment**. You'll notice that it creates associations with **polychlorinated biphenyls**. Can you see any other phrases which convey similar meanings?

<table>
<thead>
<tr>
<th>Paragraph 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polychlorinated biphenyls (PCBs) comprise a group of 209 individual <strong>compounds</strong> which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the <strong>environment</strong> due to their <strong>ability to resist chemical and physical breakdown</strong>. They also accumulate up the <strong>food chain</strong>, with those <strong>organisms higher up the food chain</strong> typically demonstrating <strong>higher levels</strong> where contamination has occurred.</td>
</tr>
</tbody>
</table>

Did you find these: **resist chemical and physical breakdown, accumulate up the food chain**?

Now look for phrases in paragraphs 2, 3 and 4 which create associations with **polychlorinated biphenyls**.

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.
Tick the phrases which create associations with polychlorinated biphenyls in the paragraphs above. There may be more than one correct answer. Click the check answers button when you have finished.

Correct! All of the options given are ways of referring to polychlorinated biphenyls.

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects. Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans. Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

Connecting ideas – examples

How can you help your ideas hang together within a paragraph?

Click the highlighted words to reveal different ways key terms are connected in this paragraph.

Cystic fibrosis

Cystic fibrosis (CF) is one of the most common genetic disorders. CF is inherited as an autosomal recessive trait and a defective gene causes the body to produce an abnormal amount of very thick, sticky mucus which clogs lungs and pancreas, interfering with breathing and digestion. This mucus builds up in the breathing passages in the lungs and the pancreas and respiratory complications develop from the blockage of the bronchial passages. Eventually, the cilia which are responsible for clearing the mucus are destroyed. In addition, the mucus traps bacteria which cause infections and permanent damage to the lungs, and may also block the ducts of the pancreas which contains enzymes necessary for the digestion of food.
Cystic fibrosis (CF) is one of the most common genetic disorders. CF is inherited as an autosomal recessive trait and a defective gene causes the body to produce an abnormal amount of very thick, sticky mucus which clogs the lungs and pancreas, interfering with breathing and digestion. This mucus builds up in the breathing passages in the lungs and the pancreas and respiratory complications develop from the blockage of the bronchial passages. Eventually, the cilia which are responsible for clearing the mucus are destroyed. In addition, the mucus traps bacteria which cause infections and permanent damage to the lungs, and may also block the ducts of the pancreas which contains enzymes necessary for the digestion of food.

Paragraph exercises
Click the highlighted words below to see how key terms are referred to in this paragraph on telescopes.

- [1] Telescopes
- [2] planets
- [3] stars
- [4] connectors

Telescopes
Many ground- and space-based telescopes are currently being proposed to detect terrestrial planets around stars other than the sun. However, the earliest of these is not expected to be operational within the next decade, and as the development of such telescopes is subject to changing political and budgetary constraints, there is no certainty that such advances will be achieved. It is therefore important to investigate methods for the detection of terrestrial planets of known extra-solar planet systems using existing telescope technology.

Telescopes

Many ground- and space-based telescopes are currently being proposed to detect terrestrial planets around stars other than the sun. However, the earliest of these is not expected to be operational within the next decade, and as the development of such telescopes is subject to changing political and budgetary constraints, there is no certainty that such advances will be achieved. It is therefore important to investigate methods for the detection of terrestrial planets of known extra-solar planet systems using existing telescope technology.

Telescopes

Many ground- and space-based telescopes are currently being proposed to detect terrestrial planets around stars other than the sun. However, the earliest of these is not expected to be operational within the next decade, and as the development of such telescopes is subject to changing political and budgetary constraints, there is no certainty that such advances will be achieved. It is therefore important to investigate methods for the detection of terrestrial planets of known extra-solar planet systems using existing telescope technology.

Look at these paragraphs on a range of topics and see if you can identify the terms which help hold ideas together.

1. The extra-solar planet systems
   <www.monash.edu.au/lls/llonline/writing/science/paragraphs/1.8.xml#extrasolar>
2. The mammalian auditory system
   <www.monash.edu.au/lls/llonline/writing/science/paragraphs/1.8.xml#mammalian>
4. Cardiovascular disease
   <www.monash.edu.au/lls/llonline/writing/science/paragraphs/1.8.xml#cardio>

Look at the highlighted words in each passage. For each there is one linked term which has not been marked. Type it into the space provided and click the check answer button.
1. **The extra-solar planet systems**
   The formation of extra-solar planet systems can be achieved **in two ways**. In the first, a terrestrial mass planet can form in the inner disk, while a gas giant forms beyond the snow line. During the inward migration of the gas giant the terrestrial planet is captured in a mean motion resonance where it remains until migration ceases. **In the second**, a gas giant migrates through a disk of planetismsals. This results in mean motion resonances with the gas giant sweeping through the disk of planetismsals, causing material to be either scattered out of the system or captured into these resonances. Any captured material will coagulate into a terrestrial planet, provided the density is sufficiently high.

   In the first
   Correct!

2. **The mammalian auditory system**
   The mammalian auditory system can be divided into **three major parts**: the outer ear, the middle ear and the inner ear. The outer ear has two parts: the external ear and the ear canal which is separated from the middle ear by the ear drum. The middle ear contains the smallest human muscle and **bones** in a tiny air cavity to create a mechanical connection to the inner ear. The inner ear is no bigger than the size of a chickpea and is one of the hardest bones in the human body.

   Type in the linked term from the passage above which hasn't been marked in bold.

   The mammalian auditory system
   Correct!

3. **Hepatitis**
   Although Hepatitis A and Hepatitis B are well-known to science, it was only in 1989 when a third major type of hepatitis was identified. The Hepatitis C virus (HCV) is a major health problem around the world, and it is the most common cause of chronic liver disease (Marr, 1998). There are approximately 175 million HCV carriers around the world and it accounts for 20% of all cases of acute hepatitis, 70% of all cases of chronic hepatitis, 40% of all cases of end-stage cirrhosis, 60% of all cases of hepato-cellular carcinoma and 30% of all liver transplants (Sherlock and Dooley, 2002).

   There are several synonyms for hepatitis in the paragraph above, like Hepatitis A, Hepatitis B and Hepatitis C.
Type one **pronoun** used for the same term in the box below, and click the **check answer** button.

**it**

Correct!

*It* is the pronoun used to stand for *Hepatitis C* in this passage.

Although Hepatitis A and Hepatitis B are well-known to science, it was only in 1989 when a **third major type of hepatitis** was identified. The **Hepatitis C virus (HCV)** is a major health problem around the world, and it is the most common cause of chronic liver disease (Marr, 1998). There are approximately 175 million **HCV** carriers around the world and it accounts for 20% of all cases of acute hepatitis, 70% of all cases of chronic hepatitis, 40% of all cases of end-stage cirrhosis, 60% of all cases of hepato-cellular carcinoma and 30% of all liver transplants (Sherlock and Dooley, 2002).

4. **Hepatitis**

Look at the same paragraph again. What associated term has not been marked in **bold** in the paragraph above?

**acute hepatitis**

Correct!

Acute hepatitis is another associated term. In the paragraph below, the the associated terms are marked in bold. **Hepatitis**

Although Hepatitis A and Hepatitis B are well-known to science, it was only in 1989 when a **third major type of hepatitis** was identified. The Hepatitis C virus (HCV) is a major health problem around the world, and it is the most common cause of chronic liver disease (Marr, 1998). There are approximately 175 million **HCV** carriers around the world and it accounts for 20% of all cases of acute hepatitis, 70% of all cases of chronic hepatitis, 40% of all cases of end-stage cirrhosis, 60% of all cases of hepato-cellular carcinoma and 30% of all liver transplants (Sherlock and Dooley, 2002).

5. **Cardiovascular disease**

Cardiovascular disease (CVD) is one of the leading causes of death in industrialised nations, and pathological and age-related structural changes to the large arteries in the vascular system are thought to be major factors in cardiac deaths. Changes in the structure of the large arteries such as the aorta due to normal processes of ageing or as a result of pathological conditions such as atherosclerosis lead to **decreased flexibility** of the artery. This stiffness leads to increased blood pressure in high risk populations, and some researchers have provided evidence that **large artery stiffness** is a possible contributor to the development of CVD (McGrath, Liang et al. 1998; Weber, Auer et al 2004).

a. What is the third term that could have been highlighted in the paragraph above?

**This stiffness**

Correct!
This stiffness refers to decreased flexibility of the artery or large artery stiffness.

Cardiovascular disease

Cardiovascular disease (CVD) is one of the leading causes of death in industrialised nations, and pathological and age-related structural changes to the large arteries in the vascular system are thought to be major factors in cardiac deaths. Changes in the structure of the large arteries such as the aorta due to normal processes of ageing or as a result of pathological conditions such as atherosclerosis lead to decreased flexibility of the artery. This stiffness leads to increased blood pressure in high risk populations, and some researchers have provided evidence that large artery stiffness is a possible contributor to the development of CVD (McGrath, Liang et al. 1998; Weber, Auer et al 2004).

6. Salinity

Australian wetlands are the ecosystems most likely to be at threat from salinity in dryland and irrigated regions. These wetlands form the lowest topographic points in the landscape, increasing the likelihood of receiving saline groundwater discharge and – like streams and rivers – they also act as receptacles for surface water flows which bring with them pollutants such as salinity and nutrients from the surrounding catchment.

Look at the words marked in bold in the paragraph above. Can you find another associated word?

salinity
Correct!

Salinity is associated with saline groundwater and pollutants. Salinity

Australian wetlands are the ecosystems most likely to be at threat from salinity in dryland and irrigated regions. These wetlands form the lowest topographic points in the landscape, increasing the likelihood of receiving saline groundwater discharge and – like streams and rivers – they also act as receptacles for surface water flows which bring with them pollutants such as salinity and nutrients from the surrounding catchment.

Connections between paragraphs

You have been looking at some ways in which ideas are connected in a paragraph. When you are writing a report or an essay, it is important to ensure that similar connections are made between all the paragraphs. If you do not make these links, your lecturer or tutor may feel that your writing is disorganised.

Look at the following paragraphs from the introduction to a report on concentrations of polychlorinated biphenyls in fish, and try the following exercises.

Polychlorinated biphenyls (PCBs) comprise a group of 209 individual compounds which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the environment due to their ability to resist chemical and physical breakdown. They also accumulate up the food chain, with those organisms higher up the food chain typically demonstrating higher levels where contamination has occurred.

PCBs are fat soluble and accumulate in fat where they persist for many years after exposure has ceased. Negative health effects of exposure to these chemicals have been observed in both
humans and other animals, and include carcinogenic, immunotoxic, reproductive and developmental effects.

Prior to the banning of the chemicals by the American Federal Government in the late 1970s, PCBs were discharged into waterways around the USA. As more health risks have been associated with PCBs, scientists have become increasingly concerned with the concentrations seen in fish, which have the potential to accumulate up the food chain to humans.

Modelling the concentrations and ages of sample fish will allow scientists to predict the effects PCBs will have in the future. The most accurate model for the degradation of PCBs is required to ensure the accuracy of any predictions, and is of the utmost importance when dealing with such potentially dangerous chemicals.

Look at the first two words of this passage: polychlorinated biphenyls. You will notice that polychlorinated biphenyls are referred to in different ways throughout the passage. Try these two questions.

1. The only pronouns in paragraph 1 which refer to polychlorinated biphenyls are they, and their.

   Incorrect.
   Try again.
   Correct! Which is also a pronoun which refers to polychlorinated biphenyls. Polychlorinated biphenyls (PCBs) comprise a group of 209 individual compounds which were produced commercially in large quantities up to the late 1970s (Muller, 1997). They were used in products as diverse as electrical equipment, lubricants, paints, plasticisers, carbonless copy paper and slide mounting for microscope slides. PCBs are among a broader group of organochloride chemicals, similar to the notorious DDT, which persist in the environment due to their ability to resist chemical and physical breakdown. They also accumulate up the food chain, with those organisms higher up the food chain typically demonstrating higher levels where contamination has occurred.

2. Where would you find these the synonyms for polychlorinated biphenyls through the passage?

   a. PCBs, compounds, PCBs, organochloride chemicals, DDT  
   
   b. the chemicals, PCBs, PCBs  

Other writing in Science resources

Books

The Monash library has many books which can help you with writing for Science. In the Hargrave-Andrew library you can look for call numbers around 808.0665. Here are some examples of useful books.


Websites

The following websites provide more detailed information about scientific writing:

- [The Craft of Scientific Writing](http://www.writing.eng.vt.edu/csw.html)
- [Scitext Cambridge principles of Science writing](http://www.scitext.com/writing.php)

Science resources

- **Communicating Science: a handbook**  

  Written for professional scientists who wish to improve their communication skills, the Handbook is also relevant for Science students taking practical communication courses.

- **Communicating in Science: writing a scientific paper and speaking at scientific meetings**  

  Writing scientific papers and giving talks at meetings and conferences are essential parts of research scientists' work, and this short book will help workers in all scientific disciplines to present their results effectively.

- **Writing for Science: a practical handbook for Science, engineering and technology students**  
  Heather Silyn-Roberts, 1996.
Good written skills are in high demand by employing organisations. Science and engineering faculties require a large component of written assessment. This well-written and practical book aims to make the writing process more productive for students.

- **Writing lab reports**  

  Especially for non-native speakers of English, but an excellent short guide to scientific lab report writing. Written by one of the experts in the field, it covers every section of the lab report, with very clear examples and good exercises (no answer key).

- **Writing up research - experimental research report writing for students of English**  

  Especially for non-native speakers of English - detailed and comprehensive, with many exercises and illustrations. There are three chapters on the "staging" of the introduction alone. Would be relevant to a range of technical/scientific subjects which require experimental report writing. **Also for postgraduates.**