**Different Formats of Scientific Writing**

**Introduction**

A central theme in all of our science writing resources is the need to tailor your writing specifically to the needs of your audience. This is why writing a journal-style paper or lab report requires very different skills to those needed to write a fantastic essay or blog post.

For example, journal-style papers and lab reports typically follow a well-defined **I-M-R-A-D structure (Introduction – Methods – Results – and – Discussion)**, and are aimed at people within the same/similar field. As a result, these papers contain more specialist information than would be suitable for more general audiences.

Science essays typically require a similar level of detail but the emphasis is more on developing a logical argument, while blog posts and/or journalistic articles should be suitable for non-specialists, and might even need to be simplified to ensure the most newsworthy elements are presented clearly and succinctly.

In all cases, when you are writing about science, you should judge things from the perspective of your likely readers. In this guide we have put together tips and loose guidelines to help you write effective pieces in these three different formats.

**Writing Journal-Style Articles (and Lab Reports)**

The **I-M-R-A-D** structure provides a framework for you to use in organizing content, and – more so than for any other format – you can write science journal-style articles and lab reports by focusing on the different sections as if they are discrete, mini reports.

**Introduction**

The **Introduction** typically sets the scene by describing similar work in the field, as well as providing information to explain why your research question is important and/or interesting. Although this is often written in quite a formal way, you should still try to write in short, succinct sentences, and use the active voice wherever possible. It is also very important to find and cite sources correctly to provide sufficient content. Try to paraphrase this material by putting it in your own words, rather than quoting it directly to try to make it fit into the flow of your writing.

**Examples**

Write: ***“We assessed whether increasing temperature caused butterfly larvae to mature faster,”*** rather than: *“An assessment was made as to whether rising temperatures are linked to more rapid butterfly larvae maturation.”*

Write: ***“Mitchell (2008) showed that cooler winters tended to correlate with slower growth rates in Canadian species,”*** rather than: ***“Mitchell (2008) said: ‘When the winters were significantly colder, as shown by multivariate analyses, three species took significantly longer to pupate.’”***

**Methods**

The **Methods** section describes all the fine details that someone would need to conduct the same experiment that you performed and are now writing about; these details include the materials used, the time taken, the precise step-by-step recipe you followed, and even things like the software used for statistical calculations. Generally speaking, this would be unnecessary and even boring for non-specialists but it is a vital part of a journal-style article or lab report.

**Examples**

Write: ***“We kept 107 butterfly larvae in XF730 Michaelson incubators held at 6.5°C…,”*** rather than: ***“Butterfly larvae were kept at the same cool temperature.”***

Write: ***“We conducted all statistical analyses in the software program R, version 2.32 (R core project, 2008),”*** rather than: ***“We performed paired t-tests on the data.”***

**Results**

The **Results** section then focuses on what you discovered, but should not contain any explanation; try to write this section as though you are entirely impartial and are simply briefing someone else on what happened (do not include any supporting information to explain why you think it happened). It is very important to organize your data with tables and figures, and use written explanations to inform the reader of your results.

Tables should be as succinct as possible, including only vital information (often summarized) and figures should be easy to interpret and be visually engaging. When adding your written explanation to accompany these visual aids, try to refer your readers to these in such a way that they provide an additional descriptive element, rather than simply telling people to look at them. This can be especially helpful for readers who find it hard to see patterns in data.

**Examples**

Write: ***“Figure 1 shows that grizzly bears are hibernating for fewer days in areas where spring temperatures are rising fastest,”*** rather than: ***“Figure 1 shows the relationship between grizzly bear hibernation (number of days) and spring temperatures (°C).”***

Write: ***“The mean length of hibernation in the warmest area was 185 days, which was 12 days less than those in the coldest area,”*** rather than: ***“Bears living in the warmer areas hibernated for 12 days less, on average, which is probably because they were awoken sooner by the greater warmth.”***

**Discussion**

The **Discussion** section is similar to the Introduction in the sense that it should include sources that are relevant to your work (you should compare and contrast your results to those of similar researchers), but the main focus is to try to explain the results that you found, and then tell your readers why these results are important and/or interesting.

Simplicity is often the best policy, such that you do not try to explain every single result, but instead focus your attention on the important ones that might have the biggest influence on the scientific field (what have you *really* learned?).

**Examples**

Write: ***“Similar to Nolan (2010), our results showed that warmer temperatures were correlated to shorter hibernation duration,”*** rather than: ***“Our work provided results that were similar to those found by other researchers.”***

Write: ***“The most important finding was that bears in the warmest areas hibernated for almost two weeks less than those in colder areas, which suggests the temperature is driving their behavioural responses,”*** rather than: ***“There were lots of important findings, including the difference in hibernation duration, the variation in hibernation duration, and the number of bears in each location…”***

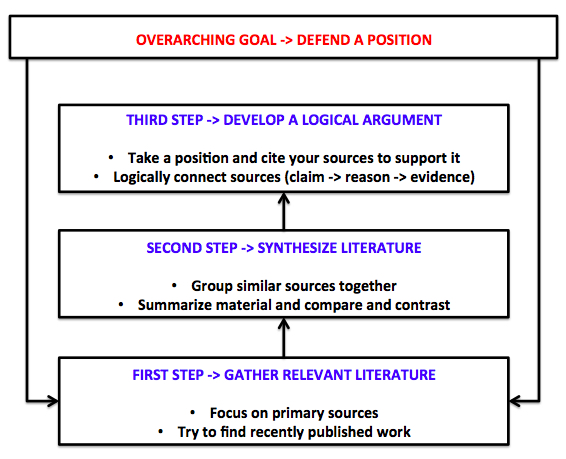
**Additional Tips: Tense Consistency**

Try not to confuse your readers by mixing tenses in the same sentences. It can often be easy to do this when writing about science in this format, because you are talking about your experiment (which has already happened), and then linking it to theory, which is still evolving (happening now, and continuing to happen in the future).

To help, try to refer to your experiment in the past tense and then mention its link to other work in the present or future tenses – but do this in different sentences. The Methods and Results sections should be written entirely in the past tense because these things have already happened (you have conducted your experiment and you have gathered your results).

**Writing Science Essays**

The main aim when writing science essays is to synthesize information (mostly from primary sources in the literature) to support the position that you are taking; by this, we mean that you should clearly set out what you are going to say and how you are going to say it, before summarizing reliable sources to provide reasons and evidence to justify your position (Figure 1).



**Figure 1. Science Essay Writing Framework**

**The Thesis Statement and Development Statements**

The opening to your essay should have a strong, clear, and specific ***thesis statement and one or more development statements.*** The ***thesis statement*** is the ***claim*** of the argument presented in the essay. Without this, the reader would not know what to expect the rest of the essay to develop.

The ***development statement(s)*** are also crucial as they tell a reader which points will be used to support the argument, and also which order they will be presented in. If some of these points are not listed – or presented in a different order to the one stated – the reader might fail to understand your intent, or even discount the steps used to support the argument. This logical progression is vital to make sure your readers follow the same line of thought as you did.

You can write a development statement at the start of each new paragraph to form something of a signpost for your readers.

***Handy hints***:

* *Although using a thesis statement and clear development statements to open your essay will mean you do so in an organized way, do not be afraid to split these up around other conversational sentences within your opening paragraph*
* *It is also fine to make personal, stylistic choices in the way that you present your development statements and link them to your thesis statement, to prevent your introduction from sounding too choppy and formulaic (e.g. you do not have to write: “I will support ‘a’ with ‘b’, ‘c’ and ‘d’.” You can instead write: “’b’, ‘c’ and ‘d’ all suggest that ‘a’ is true in most environments…”).*

**Examples**

Write: ***“Reintroducing wolves as additional predators into Yellowstone National Park has had a positive effect on plant biodiversity,”*** rather than: ***“Reintroducing wolves into Yellowstone National Park has benefited lots of plants.”***

Then, write: ***“Changes in the number of plant species and the relative dominance of each species demonstrates this, as does the biomass of experimental plots that were surveyed before and after the reintroduction,”*** rather than: ***“This essay will consider lots of different ways in which plant biodiversity has improved.”***

**The Main Body**

In the ***main body*** of the essay, each of the points presented in the introduction should be presented and discussed. Examples and references (citations) are generally included in these paragraphs, but it is important to note that each paragraph should contain only one main idea with examples or references that justify it. This main idea should be presented in a ***topic sentence*** at or near the beginning of the paragraph; these topic sentences act as signposts throughout the main body of the essay (and can be mini development statements).

Try to pay an appropriate amount of attention to each point as you develop the essay; if you are going to write more about one point than others, try to make it clear why you are doing this because otherwise your reader might wonder why other points have received less comprehensive treatment.

**The Summary**

The ***summary/conclusion*** of the essay is your final opportunity to synthesize your argument and finish with a convincing bang. Here, you should review your main argument and, depending on the length of your essay, your supporting points. (A short essay will not require this.) Most importantly, you need to show your readers how these ideas fit together and why they are important – you are giving them closure and tying up any loose ends. No new information should be added to the essay at this point.

**Additional Tips: Peer Review and Creating and Using Writing Outlines**

Before you start to put pen to paper (or fingers to keyboard), you should produce a writing outline. Although it can seem like wasted time, you will find that producing a detailed ‘roadmap’ will help you organize your writing much more efficiently. It will almost certainly save you time in the long run, and will also help you compartmentalize the different tasks associated with your essay, making them seem more manageable.

Once you have written your essay by using the outline, you can start to edit it and add in transitions to make each sentence flow smoothly into the next one. Although the content is the most important part, you should not underestimate the importance of transitional words and phrases in helping to develop a smooth, logical development.

Scientific communication often relies on a rigorous **peer review** process, in which scientists in similar fields read and then critique each other’s written work, before allowing the original author(s) to respond and alter their work to improve it.

Whether you are writing a journal-style article/lab report, an essay, or a blog post, it is always a valuable exercise to ask someone to review your work before submitting it; this is especially true for essays, because your aim is to produce a convincing, logical argument, but it can be hard to be objective about your own work and so what seems to make perfect sense to you might not be clear to someone else. Often, it is only when someone reads your work and provides you with feedback that you see some holes in your logical development.

With this in mind, we advise you to ask a peer tutor or friend to read your work before you submit it; if they follow your argument and seem convinced at the end, you have probably done a good job! Either way, their feedback as readers will be helpful for you as you revise and take your work to the next level.

**Writing Journalistic Articles and Blog Posts**

Writing journalistic articles and blog posts requires very different skills than the other two formats we have considered because your target audience is very different. Think about the last science-based news article you read in the newspaper or online and consider how much more accessible it was than a journal article. Specific detail is important in journal-style articles; however, informal, even quirky, writing without too many details (like those found in a science journal article’s methods section) is more likely to capture the imagination of the casual reader.

There are many different ways of attempting to structure a journalistic article or blog post. One such approach is to try to include ‘**The 5 W’s**’ (the who, what, where, when, why) in the first two paragraphs of an article/post. Journalists sometimes refer to this as ‘the lead’. In the interest of creating an engaging opening to your story, you should aim to do this in no more than 50 words.

**Example**

Write: **“Professor Gareth Bennett of Trinity College Dublin has found a way to make aircraft quieter while using less fuel, paving the way for a ‘greener’ future.**

**Professor Bennett yesterday signed an agreement with leading aircraft manufacturers, which will see these planes in action by 2018.”**

In the above example, readers have learned all about the important news in just 45 words. The story could now be developed with more specific information and quotations throughout the rest of the story by working down the ‘**inverted pyramid’** of information (Figure 2). The key here is to add to the story by including content of increasing depth and decreasing breadth as you work your way into the news.



**Figure 2**: The inverted pyramid of information. Try to work down it by adding more specific detail as you go.

Including quotations from relevant sources will make the story more interesting and add a personal touch as well as credibility, but make sure these quotations say something useful. Try to ensure they add something to the story (they don’t just repeat information already paraphrased beforehand) and make sure they are interesting and easy to understand; there is no point including a quote from someone whose opinion is irrelevant or inappropriate, or if it fails to ignite an interest in the story. Be careful that you are not using a quote out of context and that you include any background information readers might need to understand it properly.

**Examples**

Write: ***“Professor Bennett said: “I’ve been flying high ever since we signed the contract; this has been the culmination of some serious work as it has been my dream for the last decade to reduce the carbon footprint we leave as frequent flyers,”*** rather than: ***“Professor Bennett said: “These new planes will make less noise and use less fuel.”’***

Write: ***“London Heathrow Airport Traffic Controller, Stuart Richards, said ‘Noise pollution has been a growing concern for 20 years, so this truly is a ground-breaking development,’”*** rather than: ***“Toby Hamilton, who flies at least 20 times a year on business, said ‘I’m looking forward to getting on board as soon as the new planes are in operation.’”***

**Additional Tips: Visual and Audio Aids**

News is no longer confined to newspapers. In addition to being more readily available through digital formats, news stories are spread quickly through social media. In such a fast-paced news environment, visual and audio aids can make the difference between an article appearing internationally on hundreds of different websites or failing to get ore than a few views in the local newspaper.

Try to think of any relevant images that you can add to your article/blog post, or share via Twitter for example, to try to boost readership. Even better, video and/or audio clips that can be embedded in a webpage and shared via social media will likely create more interest as well (many people will watch a three-minute news round-up on their smartphones on the commute to work). Remember to credit any image, audio or video, just as you would cite a source used in an essay or lab report.

Try also to choose a quirky, snappy title for any images you use; people are more likely to read the caption and the article if the visual element takes their eye and the caption grabs their attention, than if it sends them to sleep before they’ve begun to read it.

**Example**

Write: ***“Trinity Engineer Flying High,”*** rather than: ***“Professor Bennett Makes Aeroplane Breakthrough.”***