How to Write a Good Thesis Introduction

1.1 Structure

Until now, much of your science writing has focused on writing reports in which you simply described what you did and what you found. Although this will help you write the central 'report' sections (Methodology and Results) of a research paper or thesis, it doesn't prepare you for writing an Introduction to a full-length research article; this is a new task that faces you once you move on to research writing.

In practice, you will find that you need to be certain about what you have done and what you have found in order to write the Introduction, and so the best time to write it will be after you have written, or at least drafted, the report sections. However, in this book, the structure of a research article is presented in the order in which it appears in a paper/thesis so that you can trace the connections between each part and see the sequence in which information is presented to the reader.

You may want to start your Introduction by describing the problem you are trying to solve, or the aim of your work, but as you will see when you examine published work, this is not how most research papers begin — and therefore it is not the best way for you to begin. In order to help you write the Introduction to your own research, the model you build must answer the following three questions:

- How do writers normally start the Introduction?
- What type of information should be in my Introduction, and in what order?
- How do writers normally end the Introduction?

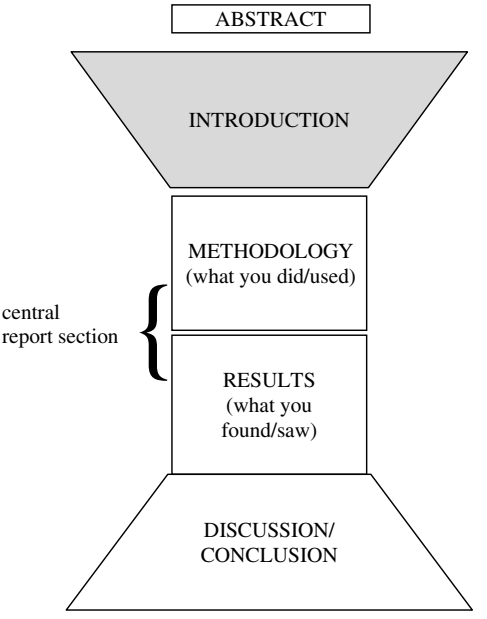

Fig. 1. The shape of a research article or thesis.

The first thing you may notice about Fig. 1 is that it is symmetrical. This is because many of the things you need to do in the Introduction are done — in reverse order — in the Discussion/Conclusion. For example, you need to write an opening sentence which enables you and your reader to 'get in' or start your paper/thesis and you also need to 'get out' at the end of the Discussion/Conclusion by finding an acceptable way to end the paper/thesis. In addition, you must look for a way to interface with the central report section at the end of the Introduction, and again — in reverse — when you move out of the central section to start the Discussion/Conclusion.

Something else you should notice about the shape of the diagram is that it narrows towards the central report section, and widens after it. This represents the way information is ordered in the Introduction and the Discussion/Conclusion: in the Introduction you start out by being fairly general and gradually narrow your focus, whereas the opposite is true in the Discussion/Conclusion.

Read the Introduction below. Don't worry if the subject matter is not familiar or if you have difficulty understanding individual words, especially technical terms like *polylactide.* Just try to get a general understanding at this stage and familiarise yourself with the type of language used.

The synthesis of flexible polymer blends from polylactide and rubber

Introduction

1 *Polylactide (PLA) has received much attention in recent years due to its biodegradable properties, which offer important economic benefits.* **2** *PLA is a polymer obtained from corn and is produced by the polymerisation of lactide.* **3** *It has many possible uses in the biomedical field*[1] *and has also been investigated as a potential engineering material.*[2,3] **4** *However, it has been found to be too weak under impact to be used commercially.*[4]

5 *One way to toughen polymers is to incorporate a layer of rubber particles*[5] *and there has been extensive research regarding the rubber modification of PLA.* **6** *For example, Penney et al. showed that PLA composites could be prepared using blending techniques*[6] *and more recently, Hillier established the toughness of such* composites.[7] **7** *However, although the effect of the rubber particles on the mechanical properties of copolymer systems was demonstrated over two years ago,*[8] *little attention has been paid to the selection of an appropriate rubber component.*

8 *The present paper presents a set of criteria for selecting such a component.* **9** *On the basis of these criteria it then describes the preparation of a set of polymer blends using PLA and a hydrocarbon rubber (PI).* **10** *This combination of two mechanistically distinct polymerisations formed a novel copolymer in which the incorporation of PI significantly increased flexibility.*

1.2 Grammar and Writing Skills

This section deals with four language areas which are important in the Introduction:

TENSE PAIRS
SIGNALLING LANGUAGE
PASSIVE/ACTIVE USE
PARAGRAPHING

1.2.1 Tense pairs

Present Simple/Present Continuous

In order to use tenses correctly in the Introduction, you first need to look at the difference between the way the Present Simple tense and the Present Continuous tense are used.

Look at these two sentences:

(a) I live in Beijing.	Present Simple
(b) I'm living in Beijing.	Present Continuous

(a) describes a permanent situation and (b) describes a temporary situation. Because of this, the Present Simple tense is used in science writing to state accepted facts and truths — but what qualifies as an accepted fact or truth is often, surprisingly, your decision. Sometimes the writer considers that research findings have the status of a fact; in that case, s/he can decide to state them in the Present Simple, usually followed by the appropriate research reference. Here is an example from the Introduction in Section 1.1:

> **5** *One way to toughen polymers is to incorporate a layer of rubber particles*[5] *and there has been extensive research regarding the rubber modification of PLA.*

Later on, in the Results section, you can even decide to state your own findings this way. Look at these two sentences which describe results:

*(a) We found that the pressure **increased** as the temperature **rose**, which **indicated** that temperature **played** a significant role in the process.*

*(b) We found that the pressure **increases** as the temperature **rises**, which **indicates** that temperature **plays** a significant role in the process.*

Which sentence is 'stronger'? In (a), using the Past Simple tense means that your findings are linked only to your own research, and you do not claim your deductions should be considered as accepted or established facts, or even that another researcher will necessarily get the same results. In (b), using the Present Simple tense means that you believe your findings and deductions are strong enough to be considered as facts or truths. The Present Simple communicates this reliability and your readers will respond to your work accordingly. There will be more about this later, in the unit on Results.

Past Simple/Present Perfect

Another tense pair you need in the Introduction is the Past Simple tense and the Present Perfect tense. You will need both, and you need to know when and why to switch from one to the other. Look at these sentences:

(a) Past Simple: I lived in Tokyo for five years…	but I don't live there anymore.
(b) Present Perfect: I have lived in Tokyo for five years…	and I still live there NOW.
(c) Past Simple: I broke my glasses…	but it doesn't matter/ I repaired them.
(d) Present Perfect: I have broken my glasses…	and so I can't see properly NOW.

You probably learned the difference between (a) and (b) years ago: that one of the differences between Past Simple and Present Perfect is the 'time' of the verb, *i.e.* when it happened. The difference between (c) and (d) is harder to understand and more important for you as a writer of science research.

In (c) and (d), 'time', *i.e.* when the verb happened, isn't really what separates the two sentences; it's possible that both (c) and (d) happened last month, this morning, or one nanosecond ago. What is important is that the event in (d) is considered more relevant to the situation now than the event in (c), which is why it is given in the Present Perfect. Why is this idea of relevance useful when you write an Introduction? Look at these sentences from the Introduction in Section 1.1:

> *For example, Penney et al.* ***showed*** *that PLA composites could be prepared using blending techniques*[6] *and more recently, Hillier* ***established*** *the toughness of such composites.*[7] *However, although the effect of the rubber particles on the mechanical properties of copolymer systems* ***was demonstrated*** *over two years ago,*[8] *little** *attention* ***has been paid*** *to the selection of an appropriate rubber component.*

* *Note*: **a little** means 'a small amount', but **little** means 'virtually none'.

Where does the tense change? Why do you think the writer changes from the Past Simple to the Present Perfect? Could it be because this research article is NOW paying attention to the selection of an appropriate rubber component?

Now look at what happens if the writer forgets to change tense and continues in the Past Simple:

> *However, although the effect of the rubber particles on the mechanical properties of copolymer systems* ***was demonstrated*** *over two years ago,*[8] *little attention* ***was paid*** *to the selection of an appropriate rubber component.*

Suddenly, the sentence means that little attention was paid THEN, *i.e.* two years ago. Perhaps attention has been paid to this problem since then; perhaps the problem has even been solved! Tense changes are always meaningful, and they always signal a change in the function of the information — so don't change tense randomly and make sure you remember to change tense when you should.

Now check what you have learned about tenses by looking carefully at the way the Past Simple and Present Perfect are used in the Introductions of your target articles. Look in particular at the way the Past Simple tense and the Present Perfect tense are used to refer to previous research.

1.2.2 Signalling language

Sentence connection

One of the most common errors in writing is failing to connect one sentence or idea to the next. Every time you end a sentence, your reader has no idea what the next sentence is going to do or say. As a result, the space between a full stop and the next capital letter is a dangerous space for you and your reader. Perhaps you stopped for ten minutes after a sentence, and during that time you thought about your work and your ideas developed. Perhaps you turned off your computer and went home. When you start typing again, if you don't share the link between those sentences with your reader, you create a gap in the text which will cause problems.

One of your tasks as a writer is to make sure that gap is closed, so that your reader is carried carefully from one piece of information to the next. Connecting sentences and concepts is good for you too, as it forces you to develop your ideas logically.

One way to connect sentences is to **overlap**, meaning to repeat something from the previous sentence:

*The pattern of inflammation during an asthma attack is different from that seen in stable asthma. In **stable asthma** the total number of inflammatory cells does not increase.*

*One way to toughen polymers is to incorporate a layer of rubber particles. As a result, there has been extensive research regarding the **rubber** modification of PLA.*

Another way is to use a **pronoun** (*it, they*) or **pro-form** (*this method, these systems*) to glue the sentences together:

> *Many researchers have suggested ways of reducing cost without affecting the quality of the image.* ***These methods*** *rely on data structures built during a preprocessing step.*
>
> *On the basis of these criteria it then describes the preparation of a set of polymer blends using PLA and a hydrocarbon rubber (PI).* ***This combination*** *of two mechanistically distinct polymerisations formed a novel copolymer in which the incorporation of PI significantly increased flexibility.*

The third way is not to finish the sentence at all, but to join it to the next sentence with a **semicolon** or a **relative clause** (a 'which' clause). Joining sentences with a semicolon works well when two sentences are very closely related and one of them is quite short:

> *The procedure for testing whether components are operationally safe usually takes many hours;* ***;*** *this means that tests are rarely repeated.*
>
> *It has received much attention over the past few decades due to its biodegradable properties,* ***which*** *offer important economic benefits.*

The fourth way is to use a signalling sentence connector to indicate the relationship between one sentence and the next, or one part of a sentence and the next. You know how useful sentence connectors are from your reading; when you see a word like *therefore* or *however,* you are able to process the next piece of information in the sentence correctly even if you don't understand every word. This is because the sentence connector signals the function of the information in the sentence. The opposite is also true: when the writer does not signal the function of the information with a connector, it is harder for the reader to process the information. Even if the grammar is perfect and every word is correct, the reader still may not be sure what the information is doing (Is it a result of the previous

sentence? An example? A cause?), and may interpret it differently from the way the writer intended.

You already use words like *therefore* and *however* and one aim of this subsection is to make sure that you are using them correctly. Another aim is to expand your vocabulary of signalling words, because you can't spend the rest of your writing life using only *therefore* and *however*! Here are some examples of signalling language arranged according to their function. It is not a long list because only those which are commonly used in science writing have been included.

CAUSE

The experiment was unsuccessful _____ the measuring instruments were inaccurate.
The experiment was unsuccessful _____ the inaccuracy of the measuring instruments.

due to (the fact that) on account of (the fact that) in view of (the fact that)	as because since

- Be careful when you use *since*; it is also often used to mean 'from that time', so if there's any possibility of confusion, choose a different connector.
- All these connectors can be used at the start of a sentence, even because (Because the measuring instruments were inaccurate, the experiment was unsuccessful).

RESULT

The measuring instruments were calibrated accurately, _____ the experiment was successful.

therefore consequently hence	as a result (of which) which is why so

- Don't start sentences with *so* to communicate a result; it's too informal.

- You can sometimes use *then,* for example in sentences like 'If x then y', but it won't work in every sentence, which is why it has not been included in this list.

CONTRAST/DIFFERENCE

British students are all vegetarians, _____ Norwegian students eat meat every day.

however	on the other hand
whereas	while
but	by contrast

- *on the contrary* and *conversely* don't fit into this category because they don't only communicate difference; they communicate the fact that 'exactly the opposite is true', so you can't use them in the sentence above (because *vegetarians* and *meat eaters* aren't opposites, they're just different). However, you could use them in the following sentence: *Some experiments used uncalibrated instruments and succeeded;* ***conversely****, other experiments used carefully calibrated instruments and failed.*
- Be careful when you use *while*; it is also often used to mean 'at that/the same time', so if there's any possibility of confusion, choose a different connector.

UNEXPECTEDNESS

(a) _____ it was difficult, a solution was eventually found.
(b) _____ the difficulty, a solution was eventually found.
(c) It was difficult; _____ a solution was eventually found.

(a) Although	(b) Despite	(c) nevertheless
(a) Even though	(b) In spite of	(c) however
(a) Though	(b) Regardless of	(c) yet
	(b) Notwithstanding	(c) nonetheless
		(c) even so

- There are other connectors with the same meaning, such as *still* and *anyway,* but they are more informal.

ADDITION

We used a batch processing system because it was more effective; _____ it was faster.

in addition	also
moreover	secondly (etc)
furthermore	in the second place (*etc.*)
apart from that/which	what is more,

- *besides* has more or less the same meaning as the items in the list above, but it's more powerful and is therefore better used in more persuasive contexts.

Now check what you have learned by looking at the way sentences are connected in the Introductions of your target articles.

1.2.3 Passive/Active

Students often ask whether they can use **we** in their research articles. In the Introduction you usually say what you will be doing or presenting in the research article. You can use **we** to refer to your research group or team, but do not use it to refer to people or humanity in general. If you are referring to people in general, it's better to use a construction with *It* (*It is known/thought that…*) rather than *We know/think that…* It is also common to use the passive instead of **we**, especially in the central 'report' section (*was measured, was added, etc.*).

In a thesis, you are writing as an individual and you don't have a research group or team. Since you cannot write your thesis using **I,** you will probably write in the passive. Use words like *here* and *in this study* to

let your reader know when you are referring to your own work. You can also use a 'dummy' subject to take the place of **I** or **we**:

> ***This article*** *describes an algorithm for clustering sequences into index classes.*
> ***The present paper*** *presents a set of criteria for selecting such a component.*

The problem with using the passive in formal writing is that the agent (the person who performed the action of the verb) is often not mentioned in the sentence. In other words, we say that something *was done* or *was identified etc.* but we don't say 'by me' or 'by other researchers', so the reader may not know who *did* it or who *identified* it. This can cause confusion and for that reason it is sometimes clearer to use a dummy subject (*This article/ the present paper*) in the Introduction rather than the 'agentless' passive *(x is presented).* Now look at the way the passive and dummy subject are used in the Introductions of your target articles.

PARAGRAPHING

Why is paragraphing important?

Paragraphs are an important visual aid to effective reading and writing. Two common errors in paragraphing are clusters of short or single-sentence paragraphs, and paragraphs that are too long. Both errors will confuse readers and are signs of poorly-organised writing.

To understand how paragraphing works, imagine that you have won a 24-hour trip to Paris. You have two options. The first option is to fly to Paris, get off the plane and walk around the city. If you take that option, a friend may ask you later if you saw the famous Louvre art gallery; you say: 'Well, no, I got lost and spent hours walking around the industrial area by mistake.' You show your mother the clothes you bought in Paris and she asks if you bought them in the famous Rue de la Paix shopping street, and you say, 'No, I bought them near my hotel. I didn't know where the big shopping area was.' You begin to realise that you wasted a lot of time and missed many important things.

The second option is to take a short helicopter ride over Paris before you leave the airport. It's a difficult decision because you are impatient; you only have 24 hours and you don't want to waste time, but you do it anyway. The helicopter flies over Paris for half an hour in a grid pattern, after which you begin your tour of Paris. You find a well-situated hotel, which you saw from the helicopter. You buy your clothes in the Rue de la Paix — which you saw from the helicopter. You visit the Louvre and you have lunch in one of the big parks near the centre … which you saw from the helicopter.

What is the connection between this and good paragraphing?

Let's bring that idea to the skills of reading and writing. If you read the last page of a murder mystery before you finish the book, the rest of the story is less exciting — but you may finish the book faster. This is because you don't waste time wondering who the murderer is; you know it's the husband, so whenever his name is mentioned you concentrate and read carefully, but you don't bother to read the details about the other suspects. This enables you to read faster by giving you the confidence to ignore things which you know are not relevant.

The more you know about what you are reading, the faster and more effectively you read. So how can you find out about a long article or chapter before reading it? The answer is to skim it quickly before you begin to read. Like the helicopter ride over Paris, skimming is done before reading, not instead of reading. Your aim when you skim through a text is **to find out quickly what it is about and where the various pieces of information are located** so that you can read it faster and more confidently.

How do I skim efficiently and quickly?

Most of the instructions in the box below tell you just to 'look at' or 'check' something. Skimming is a pre-reading technique and should be done very fast; if it takes more than a few minutes you're not skimming, you're reading.

1. READ THE TITLE
   and try to predict the type of information you expect to see
2. LOOK AT THE NAME OF THE AUTHOR
   What you know about the writer will help you predict and evaluate the content.

3. CHECK THE DATE
   and use it to help you assess the content.
4. READ THE ABSTRACT
   to find out what the researchers did and/or what they found
5. LOOK QUICKLY AT THE FIRST PARAGRAPH
   without trying to understand all the words.
6. LOOK QUICKLY AT THE FIRST SENTENCE OF EACH PARAGRAPH
   without trying to understand all the words
7. LOOK QUICKLY AT EACH FIGURE/TABLE AND READ ITS TITLE
   to try and find out what type of visual data is included
8. READ THE LAST PARAGRAPH
   especially if it has a subtitle like 'Summary' or 'Conclusion'