Introduction

What is an Introduction

An Introduction must provide the reader with all the information he/she will need to understand the rest of the paper. The author must summarize the problem to be addressed, give background on the subject, discuss previous research done on the topic, and explain in no uncertain terms exactly what this paper will address, why, and how.

An Introduction is usually 300 to 500 words, but may be more, depending on the journal and the topic. Some Introductions (especially for psychology papers) are several pages long. They usually follow this general format:

Idea 1: The broad topic: problem and background. The author should take an entire paragraph to state the problem to be investigated, and to give background on that problem. At then end of the first paragraph, the reader should know the broad topic that this paper will address. Later paragraphs will fill in the specifics.

For example: "Over the past decade, there has been heightened interest in the availability of mineral resources and in how quickly the world's expanding population is depleting these reserves. As worldwide consumption and usage of materials increases (Wagner LA 2002), the question arises as to whether adequate supplies of metals such as copper, silver, and zinc exist to satisfy the rising demand. The Stocks and Flows Project (STAF) at Yale University's Center for Industrial Ecology seeks to track the current and historical reservoirs of technologically significant materials, together with the flows into and out of these reservoirs, through substance flow analysis (SFA) and life cycle assessment (LCA) as defined in Table 1. With these

tools of industrial ecology, the environmental impacts and policy implications of world metal production and usage can be examined on national, regional, and global scales."

This paragraph gives the reader:

1. The broad topic: World-wide depletion of mineral resources
2. The problem: Do we have enough copper, silver, and zinc?
3. The background: STAF is tracking this problem using SFA and LCA

Idea 2: Narrower topic: background and problem. Next, the author should zero in on the specific problem his/her paper will address. This should be done as bluntly as possible, i.e.: "This study examines . . ." or "This paper focuses on . . ."

For example: "This paper characterizes the anthropogenic life cycle of silver for 1998 in the Commonwealth of Independent States (CIS) of Central Asia, one of nine world regions designated by the STAF group."

In the next several paragraphs, the author should discuss this narrowed topic and must include the following:

_ **Clear Statement of Hypothesis**. This is the "If-Then" statement that underlies the author's whole study. **If** rampart craters on Mars form because of groundwater **then** we should see a correlation between groundwater and rampart crater distributions.

Most authors forget this. The author need not write "We hypothesized that…". The hypothesis can be something as simple as an If-Then statement of what they were looking for.

For example: "Previous studies have suggested that the lobate ejecta blankets that characterize rampart craters form because of groundwater or ice in the subsurface. If this is true, then areas with more groundwater or ice should have more rampart impact craters and areas with no groundwater or ice should have no ramparts."

_ **Previous Research**. The author should summarize the results and findings of other studies in this area. What research has been done on this topic? How will this study differ? What other studies on similar topics might influence this study?

The author should provide enough discussion on previous research for the reader to understand the bigger picture, but not too much. This is not a review paper - the author should only discuss those papers that truly are relevant to his/her study. Depending on the topic, the discussion of previous research might run for two paragraphs or two pages.

_ **Explanation of Concepts**. In different journals, this means different things. For example, in a journal that specializes in gene therapy research, an author need not explain basic theories.

The *Journal of Young Investigators* caters to an audience of undergraduate science majors. Authors are expected to explain all concepts that an average undergraduate science major would not be familiar with. For example, the author need not explain how impact craters form, but should explain how multi-ringed impact basins form.

Idea 3: Motivation for Research. The final paragraph of the Introduction should be a summary of "Why should we care?" Why is the research important? Why is this problem important? How will answering this problem advance research in this area, in industry, in policy, or in people's lives?

Introduction Standards for Review

At JYI, we use the following criteria to judge Introductions. Different journals use different standards, but these cover the basics:

Background Information:

___ Enough Information: a non-specialist undergrad could understand this paper

___ Relevant Information: all of the information *needs* to be there

Previous Studies Described:

___ Enough Information: an interested reader could use this as a starting point

___ Relevant Information: all the previous studies are actually relevant to this one

Statement of Problem:

___ Clearly Stated: there is no doubt in the reader's mind of what this paper will study

Motivation for Research:

___ Clearly Stated: there is no doubt in the reader's mind of why this was done

Significance of Research:

___ Clearly Stated: there is no doubt in the reader's mind of why we care

Hypothesis:

___ Clearly Stated: the reader understands the logic behind the author's study

Structure:

___ The Introduction Follows the General Structure: "Broad Topic - Narrow Topic - Hypothesis - Purpose of This Study - Implications/Impact"

Introduction Section Overall:

___ Succinct: not verbose

___ Clear: easy to read and understand

___ Balanced: all the major topics are covered

___ Focused: no superfluous information is included

Common Mistakes in an Introduction

1. Too Much Information. Authors sometimes include far too much information in their Introductions. Only information related to the subject should be included.

For example, this is far too much information: "Benjamin P. Danielson (1954) first described the morphology of multi-ring impact basins on the Moon. He characterized them as large impact basins with multiple terraced levels, central rings, central peaks, and abundant secondary craters. Since then, multi-ring impact basins have been identified on Earth, Mercury, Venus, Mars, and many of the outer satellites."

This whole section could be reduced to: "Danielson (1954) defined multi-ring impact basins as having multiple terraced levels, central rings, central peaks, and abundant secondary craters."

2. Not Enough Information. Another common mistake authors make is to assume that their audience knows more than they do. Authors often do not explain concepts, do not provide enough background information, or do not discuss enough previous studies.

Reading a paper where the author assumes you know thing you don't is incredibly frustrating and pointless. Don't make your readers struggle to understand your paper – make yourself clear.

This is a difficult balance to strike, between superfluous explanations and not enough information. Think carefully about your audience and discuss with your advisor what should be included and what left out. The reviewers will help with this too, providing an outsider perspective.

3. Unclear What Study Is. Often, authors will build a thorough Introduction, but it is unclear what the rest of their paper will cover. The author needs to **bluntly** state what this paper will cover, how, and why. Phrases like "This study examines…" or "In this study…" are valuable.

4. Lists. A common temptation in Introductions is to list material, either in paragraph or bullet format. Sometimes this is unavoidable. Usually it is not. Try to avoid lists and describe your study in prose instead.

5. Confusing Structure. Authors often throw all sorts of information into an Introduction without thinking thru the organization. The result is a confusing read.

Remember to follow the structure outlined above: Big problem – my portion of that big problem – hypothesis (logic underlying my study) – description of my study – why the reader should care about this study.

6. First-Person Anecdotes. Undergraduates sometimes confuse a scientific manuscript with *My Wild Adventures in the Lab*. They might try to open an Introduction with an amusing story to "draw the reader in", thinking that this is an essay for an English class. First-person reporting does not belong in a research manuscript. The author shouldn't even say "I found…" but "It was found…". It's a passive voice, but a standard one for reporting research.