How to Write a Research Paper:  
Introduction and Discussion
What’s the Purpose of an Introduction?
What’s the Purpose of an Introduction?

Familiarize and orient
How Does an Introduction Fulfill this Purpose?
How Does an Introduction to a Fulfill this Purpose?

Provides the **context** of your work

   Creates your research space, defines gap in knowledge

States your **focus**

   i.e., hypothesis, question

Provides **justification** for your work

   Why the question is important
   Why your work can answer it
The context, focus, and justification in the introduction....

... set the direction you’ll take in the discussion.
Macrostructure of a Research Article

Overall organization of the research paper (Hill et al; 1982).

Figure by MIT OCW.
Don’t hide your main points or save them for the end... *Put your main points up front in the Abstract, Introduction, Results, and Discussion.*
What are Some Common Pitfalls in Introductions?

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What are Some Common Pitfalls of an Introduction Section?

Including **unnecessary background** or being repetitive.

**Exaggerating** (or understating) the importance of your work.

Using **lackluster** openers and **weak** follow-through in the body of your introduction.

Including **new results** in the introduction section.

**Improper tense** (Introduction is largely PRESENT tense).
An Example from The New England Journal of Medicine:


- Morbidity and mortality among patients with chronic obstructive pulmonary disease are related in large part to acute exacerbations, which occur one to three times per year. Our understanding of the cause and pathogenesis of these exacerbations is incomplete, and the role of bacterial pathogens is controversial.

- In studies performed decades ago, investigators followed patients with chronic obstructive pulmonary disease longitudinally, with periodic collection of sputum samples for culture, to determine whether there was an association between the isolation of bacterial pathogens in sputum and the occurrence of exacerbations. In these studies, the rate of isolation of potential bacterial pathogens from sputum samples during stable disease was identical to the rate during acute exacerbations. This finding led to the conclusion that bacterial pathogens do not cause exacerbations and that their presence in sputum is due to chronic colonization.

- An increased understanding of the genetic heterogeneity among strains of a bacterial species exposes a major limitations of the older cohort studies. At the time of these studies, it was not possible to differentiate among strains of a pathogenic bacterial species. Therefore, all strains isolated from sputum over the course of the study were regarded as identical if they belonged to the same species. This approach did not allow for the detection of changes in strains over time. More recent studies have shown that the immune response to bacterial pathogens after exacerbations of chronic obstructive pulmonary disease is characterized by considerable strain specificity, suggesting the importance of differentiation among strains of bacterial pathogens isolated over time from patients with chronic obstructive pulmonary disease.

- We hypothesized that the acquisition of a new strain of pathogenic bacterial species in a patient with chronic obstructive pulmonary disease who has no preexisting immunity to the strain leads to an exacerbation. To test this hypothesis, we conducted a study in which we obtained sputum samples monthly and during exacerbations in a cohort of patients with chronic obstructive pulmonary disease. Bacterial strains isolated from sputum obtained during periods of stable disease and during exacerbations were subjected to molecular typing. This report represents the results from the first 56 months of this study.
Discussion and Conclusion

The squid technique:
The author is doubtful about his or her facts or reasoning and retreats behind a cloud of ink.
What’s the Purpose of a Discussion Section?

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What’s the Purpose of a Discussion Section?

**Summarize findings** presented in the results section.

**Cite supporting literature.**

**Explain discrepancies** between your findings and previous reports.

**Point out shortcomings** of your work.

Define unsettled points.

Discuss theoretical and practical implications of your work.

End with a short summary or conclusion about the work’s importance.

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Source: International Committee of Medical Journal Editors (ICMJE), “Uniform Requirements for Manuscripts Submitted to Biomedical Journals (Updated October 2001).”
Remember This?

- The Introduction and Discussion are like **bookends** around your Methods and Results.

- They **integrate** your original findings with the literature and current knowledge.

- **Context, Justification, and Focus** addressed in the Introduction are echoed in the Discussion section:
  - **Focus** = Summary of findings
  - **Context** = How do findings fit in?
  - **Justification** = Implications of your work (and next steps).

Figure by MIT OCW.
What Makes a Discussion Section Tough to Write?

The discussion section is **harder to define** than other sections of a research paper.

It requires **perspective, knowledge, and thought**.

You may have begun **writing before the conclusions were formulated**.

Your data may be weak or **inconclusive**.

Figure removed for copyright reasons.
What are the Pitfalls of a Discussion Section?

**Long, wordy** arguments that **lack of focus** and meander.

**Failure to follow through** with arguments begun in the introduction.

Failure to **focus on current results**.

**Speculating** too much or not enough.

**Improper tense** - Discussions are written in the present tense.

**Hedging** excessively.
Excessive Hedging
from Successful Scientific Writing, 2nd ed.

“The cause of the degenerative changes is unknown but possibly one cause may be infection by a presumed parasite.”

Rule of thumb: One hedge word per sentence!
## Common Hedging Words

*from Successful Scientific Writing, 2nd. Ed.*

<table>
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<th>nouns</th>
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</table>
Introduction Checklist

- Summarize pertinent literature and use it to define a gap in knowledge (context).

- Make the gap in knowledge the focus of your work expressed as a specific question or hypothesis.

- Justify this investigation - what might it add to the literature, why is this important or novel?
Discussion Checklist

☐ Summarize findings presented in results.
☐ Cite supporting literature.
☐ Explain discrepancies.
☐ Point out shortcomings of your work.
☐ Define unsettled points.
☐ Discuss theoretical and practical implications.
☐ End with a short summary or conclusion.
Good Luck