Research Article Advice

The Importance of Sub-sections

- An effective way to help readers follow the logic of your argument, improve “flow”
- Definitely used in Methods, Results
- Usually helpful in Discussion, too (underused!)
- Rarely used in Introduction
  - but work from big picture to small

Results

- ***Purpose: present data in a relatively unbiased way, but with some guiding framework***
- Focus on relatively certain conclusions here; more speculative interpretation belongs in the discussion section.
  - Technical vs. scientific conclusions
- Organize sub-sections by functional content, not by lab day.
- Per sub-section, a writing strategy
  - Overview sentence introducing that experiment ("in order to…")
  - Walkthrough of relevant figure
  - Primary conclusion reached from that experiment
  - Intro/concluding sentences can also transition between data.

Methods vs. Results

- **Methods**: “DNA was extracted from XL1-Blue cells by a miniprep procedure. Cells from 1.5 mL of each liquid culture were spun down and resuspended…”
- **Results**: “Amplified DNA was isolated in order to evaluate the success of the mutagenesis reaction, and ultimately produce mutant protein. Two individual colonies carrying X#Z DNA were grown in liquid culture, then lysed to obtain DNA. Both candidates, along with S101L DNA from a colleague, were tested by sequencing and restriction digest…”

Discussion

- ***Purpose: interpret and contextualize the data***
- *Reiterate major findings first!* Then, do some/all of:
  - Connect your findings to other research, published or peer
  - Describe any ambiguities and sources of error, then suggest future experiments to resolve uncertainties
  - Explain where the work may lead, and suggest specific experiments for extending your findings
  - Describe any conceptual or technical limitations
  - Explain the significance of your findings to basic science and to engineering applications
- *Should have a clear organization and narrative flow*
- *Should interpret data holistically*

Results vs. Discussion

- **Results**: “We observed dark bands at 50 kD – the predicted size of inverse pericam. However, the lysates from induced D131G cells appeared to have a slightly retarded mobility with respect to those from wild-type and induced S101L cells. ”
- **Discussion**: “To test our hypothesis that inverse pericam was produced in induced cells, lysates were run on a SDS-PAGE and results indicated that the mutant proteins were produced (Fig. 4). However, we observed that the D131G mutant inverse pericam protein had a slightly retarded mobility. Since we did not observe any additional mutations in the sequencing results, we do not believe that this result indicates an erroneous D131G protein. Instead, the protein product may not have been purified completely, and a few contaminants may have been present.”

More Discussion Examples

- These differences in binding affinity… are not statistically significant. Further trials are required to confirm our results… and should include testing more calcium concentrations.
- Although both of our values were slightly greater than Nagai et al's, we analyzed 13 colleagues' data and observed that four others have reported similar data.
- Calcium binding affinity was decreased for the D131G mutant. This result was expected, since substituting glycine for the negatively-charged aspartate should reduce ionic interactions with the positively-charged calcium ion (Fig. 1B). Binding affinity did not change drastically, perhaps because there are several other aspartates in the fourth binding loop that could compensate for the loss at residue 131.

Other sections, briefly

- **Abstract**: A micro-report, from motivation to results
- **Introduction**: Motivate and contextualize the work
  - *Not* just a laundry list of background facts
- **Methods**: Allow someone to repeat your work
  - Develop your intuition for what is essential vs. extraneous
- **Citations**: Support your claims
  - Generally used in introduction and discussion
  - Should be relevant and thorough
- **Figures + Tables**

Contextual Material

- Introduction and Discussion are like bookends
- Discussion should “close the loop”
  - Were research goals proposed in the introduction met?
  - Revisit motivation and significance of the work.
  - Describe progress and future vision in terms of scientific knowledge or engineering applications enabled.
  - Might repeat some of the literature cited in the introduction, as well as some additional literature.

Order of assembly

- Start with Figures and Results – you can't write context if you don't know what it's context *for*
- Then work on Discussion and Introduction (with References – cyclic process to some extent)
- Finally, write the Abstract