Lecture 5
Writing the Results Section of a Paper

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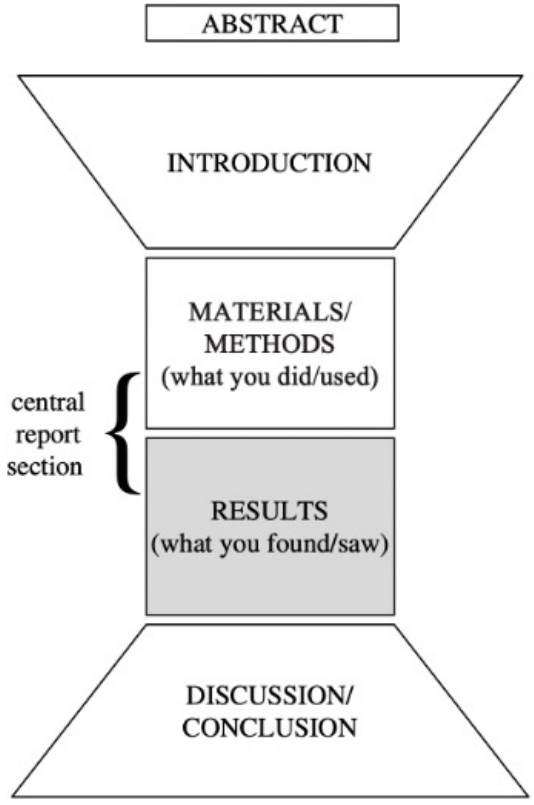
What is the results section for?

The authors report what they found or observed with the help of figures and tables in the results section.



(Glasman-Deal 2010, Science Research Writing for Non-Native Speakers of English)

What is the results section for?

In general, the authors report the findings objectively without interpretation or explanation in this section.

Tip 5 - Results: present findings without interpretation!

A model for the results section

The results section can often be divided into individual subsections, each dedicated to a particular finding or a group of related findings.

The results section often include

- introductory context for understanding the results, i.e., research problems, summary of methods etc.;
- Systematic descriptions of the results, highlighting for the readers findings that are most relevant to the topic under investigation;
- Inclusion of non-textual elements, such as, figures, charts, photos, maps, tables, etc. to further illustrate the findings.

Writing strategy: the LD structure

Lead/Development structure, as we have seen in the methods section, is an effective way to guide readers through technical and detailed test.

When writing results, give an overview or summary of the findings first and then flesh out the details.

> Simultaneous additions of N and P produced higher responses than single nutrient additions across all systems but, across systems, overall responses to P or to N added separately are broadly equivalent. N enrichment or P enrichment result in growth responses that are staitstically indistinguishable in freshwater and terrestrial systems when systems are analyzed separately. N enrichment in marine environments produces significantly greater growth responses than P enrichment, although as noted above, average marine RR_P is signfiic antly greater than zero, indicating a positive response to P enrichment.

(Elser et al 2007, Ecology Letters)

Writing strategy: the LD structure

The lead can be a brief mention of the method that lead to the result you are presenting. This helps the reader follow where the results come from and is particularly useful when methods are long or complex.

To examine the PtrCLE20 peptide localization, specific antibodies against PtrCLE20 peptide were raised as well as antibodies against phloem expressed PtrCLE41 peptide. Both antibodies were able to detect a single band, respectively, in total proteins isolated from *Populus* young stem without bark. It was noted that...

(Zhu et al 2020, Plant Biotechnology Journal)

Writing strategy: the LD structure

The lead can be a statement about the purpose of the results. This helps the readers understand what was done and why it was done.

> Next, we examined whether our Ribo-Seq experiments efficiently captured the translational signals of uORFs. We focused on the 35735 uORFs that were annotated in the modEN-CODE mRNA-Seq and CAGE-Seq data and also expressed in at least 1 of the 12 samples we examined.

(Zhang et al 2018, PLOS Biology)

Writing strategy: the LD structure

This example here directly goes into the details of the results.

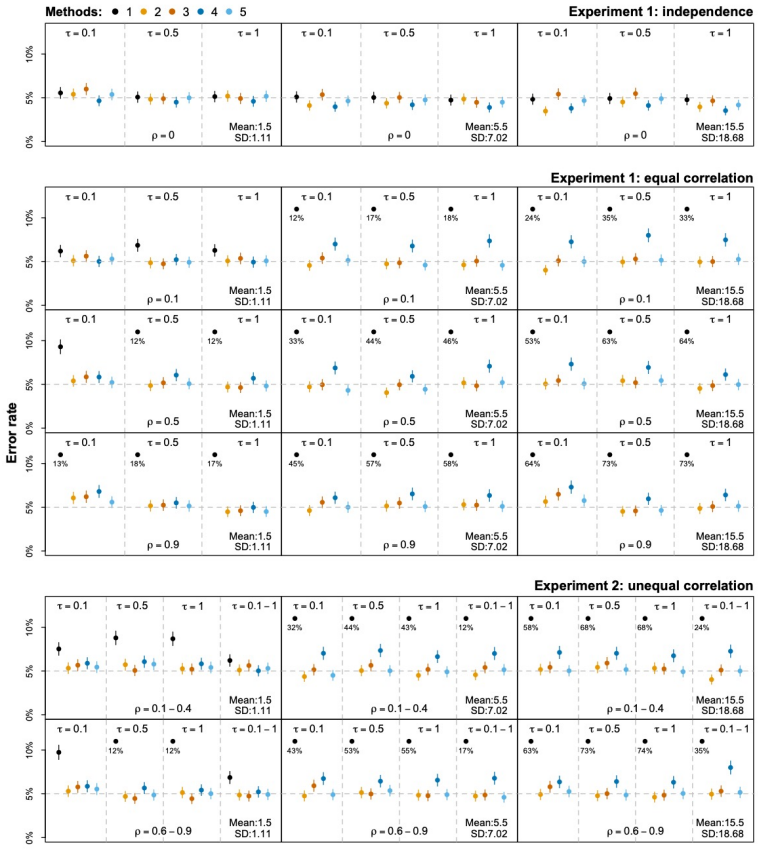
> The steady state pH of cultures continuously exposed to 380 and 700 ppm CO_2 was 7.29 and 7.20 respectively. This difference in pH is less than the predicted 0.2–0.4 unit change due to the buffering capacity of the growth medium. Total DIC concentration under 380 and 700 ppm CO_2 were 135.94 and 208.63 µmol L^{-1}, respectively.

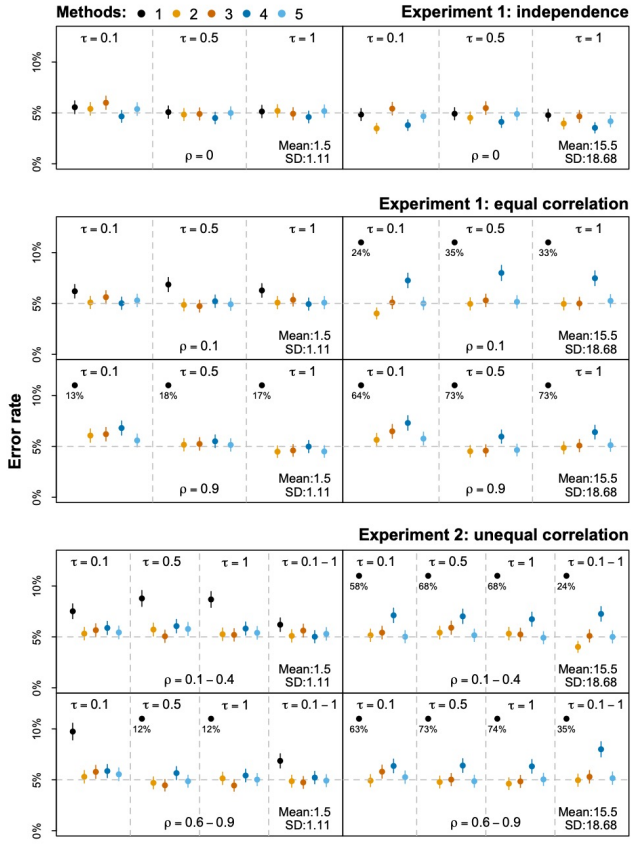
Adding a lead sentence could make this paragraph much easier to follow.

> Exposure to high atmospheric CO_2 led to increases in inorganic carbon concentrations. The steady state pH of cultures continuously exposed to 380 and 700 ppm CO_2 was 7.29 and 7.20 respectively. This difference in pH is less than the predicted 0.2–0.4 unit change due to the buffering capacity of the growth medium. Total DIC concentration under 380 and 700 ppm CO_2 were 135.94 and 208.63 µmol L^{-1}, respectively.

Choose what to present

Present relevant and representative data rather than endlessly repetitive data.

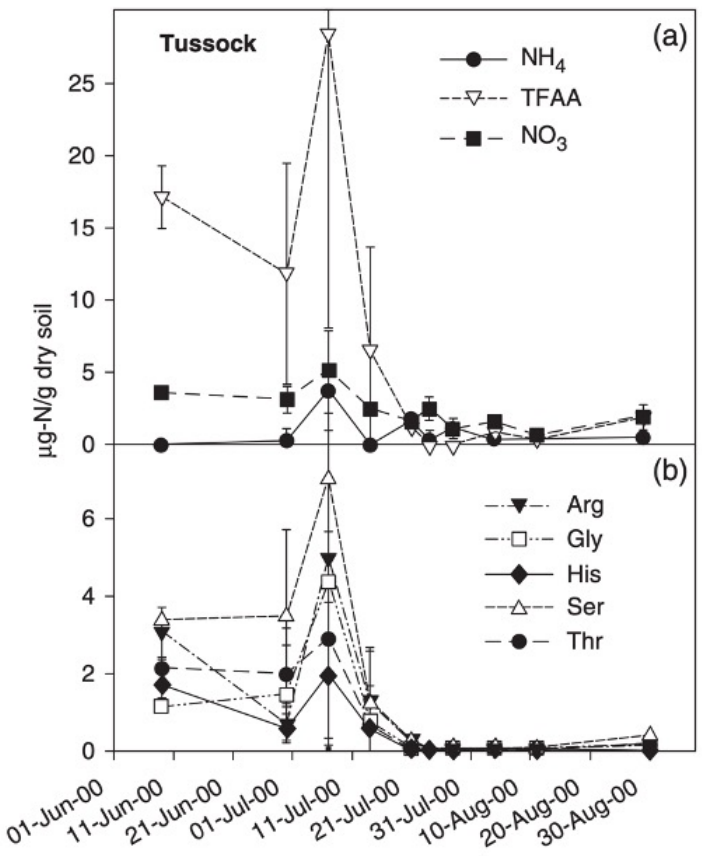




The full figure contains results from all simulation scenarios. Only a subset of scenarios was presented in the main text due to similarities among many simulation scenarios (Song et al 2020, Ecology).

Choose what to present

State the findings that matter to your story. No need to describe every datum or pattern you show in the figures or tables.



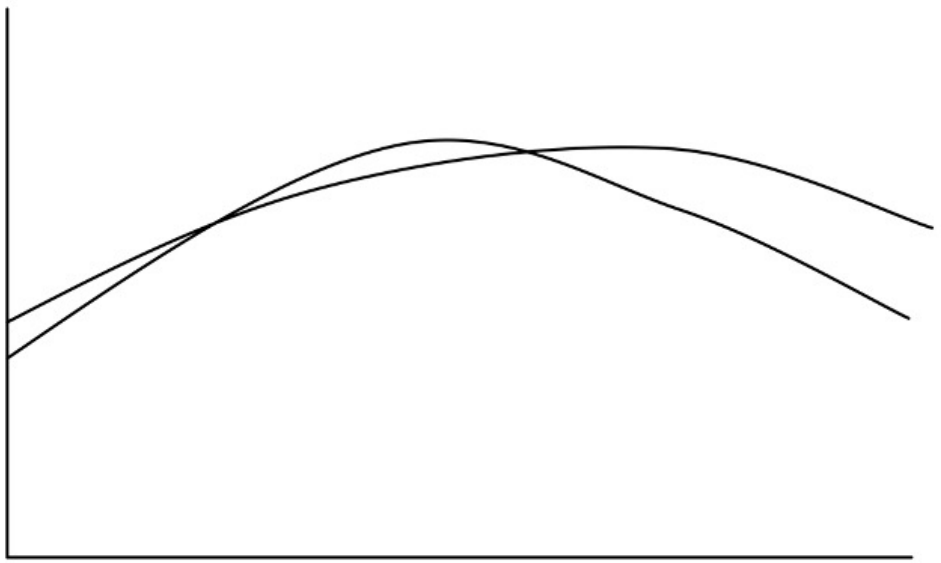
The five highest overall individual amino acids were serine, arginine, glycine, threonine, and histidine. They all closely tracked one another, and DIN, for the most part. At the beginning of June, immediately after snowmelt, amino acid concentrations in tussock soil were among the highest we measured that summer, in any soil, while NH_4^+ was below detection and NO_3^- was below 5 µg N/g soil. The highest TFAA concentration we observed during the growing season, 28 µg N/g soil, was on July 7, 2000, when there was a large peak in amno acids and smaller peaks in NH_4^+ and NO_3^-. After this, the declines in concentrations were rapid, and none went above 2 µg N/g soil after July 14.

(Weintraub et al 2005, Biogeochemistry)

Tell the story

Results do not speak for themselves. Readers' interpretation may not always be what you want to convey. You need to tell the readers what the data say.

The readers will focus on the similarities if you say "the two curves are very similar". They will focus on the differences if you say "the two curves are noticeably different".



(Glasman-Deal 2010, Science Research Writing for Non-Native Speakers of English)

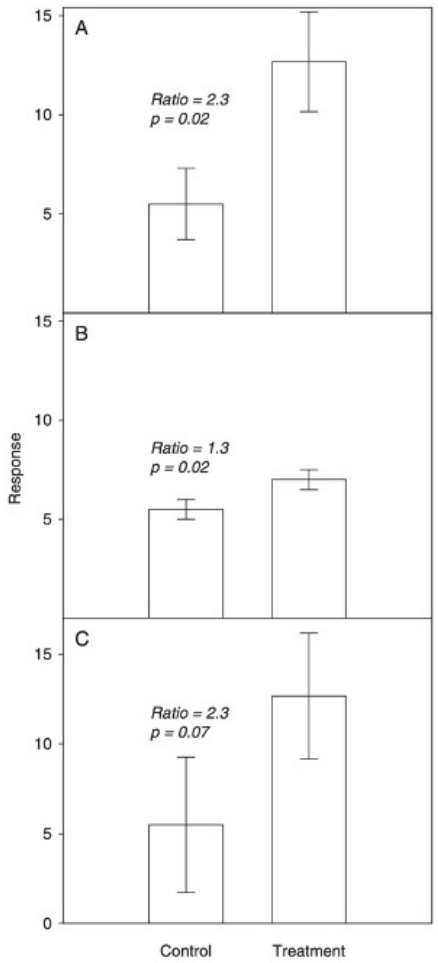
Tell the story

The language you use to describe the results has as much power as the tables and figures, perhaps even more. Compare the following two pieces of writing about the finding that a statistical method might inflate type I error rate from 5% to 8%.

> The highest type I error rate of multilevel meta-analysis models achieved across all scenarios was about 8.2%, which seems marginal in absolute terms, but relative to the nominal rate of 5% constitutes an increase of 64%
>
> Although one might be tempted to dismiss this inflation as minor, error rates were as much as 1.6 times the nominal rate of 0.05, which, in certain contexts, might be unacceptable.

Statistics and stories

A common mistake is putting too much focus on the statistics. Focus on the data, be concrete and show the whole story.



Focus only on statistics:

A: The treatment significantly increased the response ($\mathrm{P} = 0.02$).
B: The treatment significantly increased the response ($\mathrm{P} = 0.02$).
C: There was no significant treatment effect ($\mathrm{P} \geqslant 0.05$).

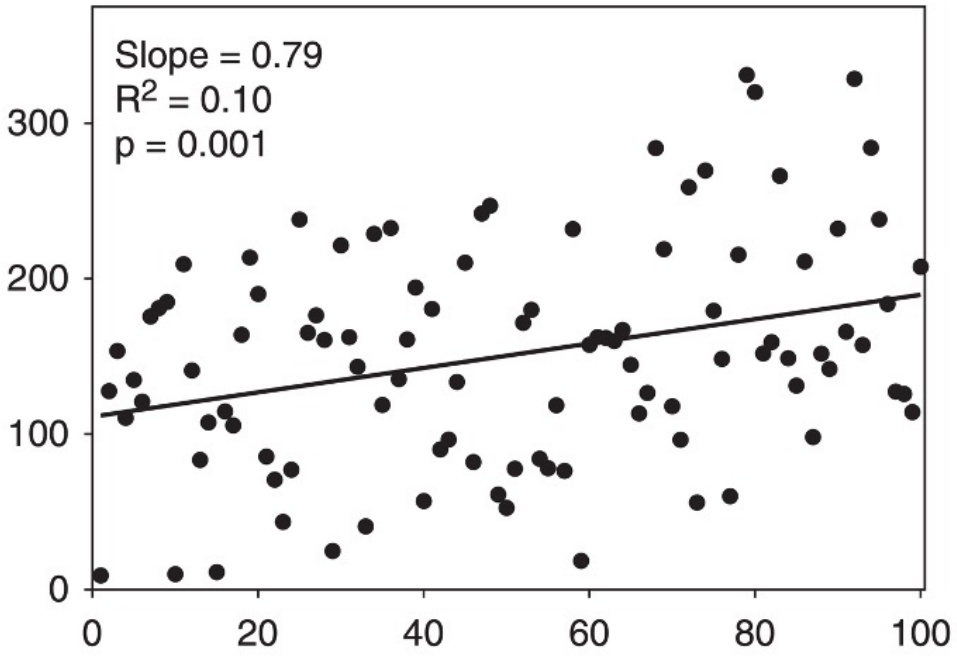
Tell the whole story:

A: The treatment increased the response by a factor of 2.3 ($\mathrm{P} = 0.02$).
B: The treatment increased the response by 30%, but this increase was statistically significant ($\mathrm{P} = 0.02$).
C: The response in the treatment was 2.3 times higher than in the control, but the difference was only statistically significant at $\mathrm{P} = 0.07$.

Statistics and stories

Is this a strong relationship? Through the lens of statistics, you may describe it as a strong relationship because $P = 0.001$.

If you look at the data, you see "the relationship between x and y is weak ($R^2 = 0.1$) but statistically significant ($P = 0.001$).



(Schimel 2012, Writing Science: How to Write Papers that Get Cited and Proposals that Get Funded)

Writing style: tense

Because results section details what you found at the time of your experiments/analyses, and your new findings have not become established knowledge yet, **past tense** is often used in the results section in primary research papers;

If results can be regarded as established knowledge, for example, results from a synthesis, present tense can be used, but this is rare.

Writing style: avoid redundancy

Avoid being verbose in citing figures and tables. You do not need to explain in words what the figure is. That's what figure caption is for.

> Figure 5 lets you compare the amount of CO_2 emitted from the Northern and Southern Hemispheres. CO_2 emissions from the Northern Hemisphere were twice those of Southern Hemisphere – 40.5 Pg C y^{-1} *cf* 18.0 Pg C y^{-1}.

The example can be revised to be more concise.

> CO_2 emissions from the Northern Hemisphere were twice those of Southern Hemisphere – 40.5 Pg C y^{-1} *cf* 18.0 Pg C y^{-1} (Figure 5).

Writing style: presenting numbers

Sentences do not start with an Arabic number. If it is necessary to start a sentence with a number, write it out in letters.

In general, there should be a space between a number and its unit except unit symbols for degree, minute, and second for plane angle.

Symbols representing variables are italic while symbols for unit are not.

Twenty liters of water were collected from the stream.

Total DIC concentration was 208.63 μmol/L.

The mean effect size, θ, was estimated using the weighted average.

This study was performed at Research Station A (101°12'E, 37°30'N).