

## How to Write a Strong Discussion in Scientific Manuscripts

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A strong Discussion section provides a great deal of analytical depth. Your goal should be to critically analyze and interpret the findings of your study. You should place your findings in the context of published literature and describe how your study moves the field forward.

It is often easy to organize the key elements of a Discussion section into distinct paragraphs (or groups of paragraphs).

### » Paragraph 1: This paragraph provides a “big picture” perspective for readers to remind them of the importance of your study.

- Summarize the major gap in understanding that your work is attempting to fill. What was the overarching hypothesis? In the first few sentences of the Discussion, state the main problem that you were trying to address. Although this should relate to the information that you provided in the Introduction, this paragraph should not repeat statements that have already been made.
- Why is filling this gap important? How will answering this question move the field forward? After identifying the problem, state the main reason that this study was needed. Describe how answering this specific research question will make a significant contribution to your field.
- In the following example, we state **the problem (bold)** as well as the significance (underline), the ultimate “big picture” reason for performing the study.

Example: EGFR-overexpressing cancers are highly aggressive and have a higher tendency to metastasize. Currently, available drugs specifically target the EGFR and elicit high response rates. However, the majority of patients eventually develop progressive disease. **The mechanisms through which cancers escape EGFR-targeted therapies remain unclear.**

**Identification of specific molecules that mediate resistance to EGFR-directed treatments will facilitate the development of novel therapies and may improve responses to currently available therapies.**

### » Paragraph 2: This paragraph provides a critical analysis of your major finding(s).

- What was your overall approach for studying the gap? In one or two sentences, state the main models or strategies that you used to study this specific research question. This should recapitulate whether the work included animals, cell culture, human subjects, or other novel techniques. (Some investigators prefer to place this section at the end of the first paragraph. This decision may vary depending on the specific study.)
- What was the most important result of your study? The focus of this paragraph is to highlight the most important contribution that your study has made. Explicitly state this result. Additional findings (major and minor) can be described in subsequent paragraphs. Do not repeat detailed results that can be found in the Results section. In general, specific figure numbers do not need to be re-stated in the Discussion unless you feel that doing so would substantially enhance your argument or discussion point. A schematic of your proposed mechanism or model can often be helpful for clearly and concisely summarizing your major result(s).
- How does your result(s) fit with existing literature? This is an important part of the paragraph and may require multiple paragraphs depending on the number of key studies that exist on your topic. This paragraph should be well-rounded, meaning that contrary reports must also be discussed. In the case of a contrary report, you should state your interpretation of how and why the results of the two studies differed. For example, did the approaches differ or were there major differences in sample sizes that may have affected results? (Depending on how much information is available in the literature, a critical analysis of your major finding may require multiple paragraphs.)
- In the following example, we state **the approach (bold)** and the main result (underline).

Example: In this study, we measured secreted factors in the media of sensitive and resistant cell lines to identify differentially expressed cytokines that may mediate resistance. Through a combination of ELISAs and mass spectrometry-based assays, we identified cytokine A as being significantly up-regulated in resistant cells. Cytokine A is a major activator of the ABCD signaling cascade (literature citations). The ABCD cascade is a known target of EGFR signaling and is usually blocked in response to EGFR inhibition (literature citations). A previous study demonstrated that exogenous stimulation of ABCD signaling reduces the response to EGFR-targeted drugs (literature citations). This report is consistent with our finding that a major stimulus of ABCD signaling is overexpressed in resistant cells. Based on these data, we propose that hyperactive ABCD signaling is a major mechanism of resistance to EGFR-targeted therapies (Figure XX, schematic of proposed mechanism of resistance). This section will be greatly expanded in a real Discussion section to place your finding in the context of multiple published studies.

### » Paragraph 3: Discuss additional findings and how these fit with existing literature.

Most studies yield multiple results. After you discuss your main result in the paragraph above, discuss additional major or minor



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findings. Unexpected and intriguing findings may be especially important to convey to readers. In addition, if a finding is contrary to what has been suggested in the literature, acknowledge this, and offer explanations based on your study. Even if a result was not statistically significant, it can be helpful to discuss a potential trend that may be important to assess in a future study. If these additional findings relate to your main finding, discuss the associations.

» **Paragraph 4: Discuss the limitations of the study.**

Discuss potential limitations in study design. For example, how representative was your model? Did sample size affect your conclusions? Consider how these limitations affect the interpretation or quality of data. Do they affect the ability to generalize your findings?

» **Paragraph 5: Discuss future directions.**

○ *What major follow up studies are indicated based on your results?* Most studies yield new discoveries that prompt additional studies. Consider what new directions are supported by your findings. For example, do your experiments suggest that a specific molecule should be tested as a new drug target or that tissue-based studies or clinical investigations should be performed to translate your animal studies to patients? Making recommendations for follow-up studies is an important part of a Discussion.

» **Paragraph 6: Discuss your overall conclusion and the major impact of your study.**

- *What is the main take-home message of your study?*
- *What is the main contribution that your study makes to your field?*
- Relate this section to the first paragraph of the Discussion. In other words, how does your study fill “the gap” or address the problem that you presented in the Introduction and re-stated earlier in paragraph 1 of the Discussion?

In summary, a strong Discussion includes a concise summary of the problem you are investigating and a critical discussion of major and minor findings in the context of published literature. The limitations should also be acknowledged, and future directions should be discussed. A strong ending is important; discuss the significance, overall conclusion, and major impact of your study.

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