



## A five-step process to outlining your research paper

Imagine that you have (nearly) completed your research project and wish to prepare a manuscript to submit to a peer-reviewed journal. You must describe your work in a clear and understandable way, while also differentiating it from the “competition” – the papers quite similar to yours that were published before it.

Below is a five-step process that we recommend when outlining your “plan of attack” in your manuscript. In each Step, formulate 2-3 bullet points (each 1-2 sentences, NOT entire paragraphs). Your goal here is to “lay the foundations” or “create the scaffolding” of your research story, not to bury the reader in huge amounts of detail. You should mix just enough specific details with big picture so that a reader can see everything about your science and/or methods that is new and necessary to advance the field.

You could present your responses in this five-step process to co-authors and your group leader to ensure that everyone is “on the same page” before people begin writing the complete manuscript.

### STEP 1

**What are the “knowledge gaps” or “performance gaps” addressed by your study? Why is it important to fill these gaps?**

Examples:

- We know that *A* is important in disease *B*, but we don’t know why. Finding out why could open the door to new treatments. (*knowledge gap and its importance*)
- We can use system *A* to detect *B*, but it is fairly insensitive, so it can lead to many false negatives. (*performance gap and its importance*)

### STEP 2

**How have these gaps been addressed in the literature so far? In other words, what is the closest that we have come to filling in these gaps, and why is this still not enough? In still other words, why did your study need to be done with the methods that you used?**

In this step, you are outlining the “state of the art”: what are the most recent advances related to these gaps, which your study extends or complements. You are not going to start at the

beginning of your field and summarize everything that has ever been done. Instead, you are going to start from the published studies whose science or methods overlap the most with yours.

Examples:

- *A* appears to be mutated in patients with disease *B*, but whether such mutations are a cause or effect of disease pathogenesis is unclear.
- Researchers have attempted to increase the sensitivity of system *A* by manipulating *X*, *Y* and *Z*, and while these approaches have been somewhat successful, they substantially increase cost and computational time.

### STEP 3

**What is the new knowledge or performance that your study delivers? What are the “products” or “deliverables” that your work provides? These bullet points should make obvious how your paper extends and complements the state of the art in Step 2.**

Examples:

- We performed studies in cell culture and small animal models of disease *B* that show that introducing mutations in *A* is sufficient to create pathogenesis similar to that in patients.
- We identified upstream regulators and downstream effectors of *A*, implicating several signaling pathways in disease *B*, which may serve as therapeutic targets.
- We focused on a combination of *Y* and *Q* to increase the sensitivity of system *A* by 30% while keeping the cost comparable to commercial devices and even reducing computational time by nearly 10%.

### STEP 4

**What’s your “visual storyline”? How will you illustrate your products or deliverables in Step 3? List likely titles of the figures and tables that will appear in your paper. At this stage, you do not need to create detailed captions describing all the panels within figures.**

Examples:

Figure 1. Mutations in *A* drive *B*-like pathogenesis in cell culture.

Figure 2. Mutations in *A* drive *B*-like pathogenesis in a mouse model.

Figure 3. Upstream regulators of *A* that may be involved in disease *B*.

Figure 4. Downstream effectors of *A* and signaling pathways that may be involved in disease *B*.

Figure 5. Proposed model for how *A* contributes to disease *B*.

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Figure 1. Schematic of system *A* and optimization of *Y* and *Q*.

Figure 2. Validation of *Y/Q*-optimized system *A* on phantoms and live animals.

Table 1. Benchmarking of *Y/Q*-optimized system *A* with conventional commercial systems.

## STEP 5

Propose a title for the paper. Try with a maximum of 20 words. The title should capture the unique “products” and “deliverables” of your work, and emphasize how your work differs from your “competition”, i.e. the next-most-similar studies in the field.

Examples:

Mutations in *A* induce signaling *X* and *Y* to drive pathogenesis in models of disease *B*

Sensitive, rapid detection with system *A* through optimization of *Y* and *Q*

Notice how the title comes last in this process. Until you have a clear sense of how your work extends and complements the state of the art, it’s hard to write an effective title! As you go through these Steps, do not hesitate to “backtrack” and revise previous ones. Nailing down the structure of a strong paper should be an iterative process: as you think more deeply about what differentiates your work from the “competition”, you should arrive at more concise and precise “take-home messages” to organize your title, abstract, introduction and discussion.

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For questions or help with your outlining, contact us at [info@creaducate.eu](mailto:info@creaducate.eu)

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