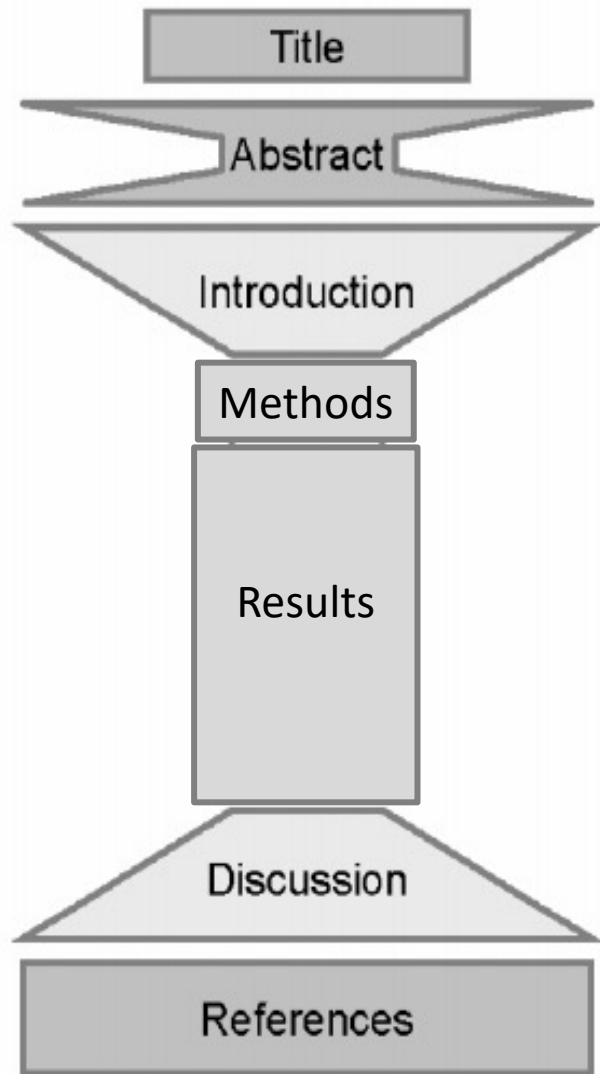


# Logistics for Research article

- Due date: **Monday, November 20 at 10 pm**
- Review Comm Lab workshop slides!
- Completed individually
- Only one submission
- Formatting guidelines
  - Prepare text in word document
  - Prepare figures in powerpoint file
- Written in complete sentences and paragraphs



# How will you communicate *your* science?



- Title & Abstract (10%)
  - First page
- Introduction (10%)
  - ~2-3 pages
- Methods (20%)
  - ~2-3 pages
- Results w/ Figures & Captions (50%)
  - ~4-5 pages
- Discussion (10%)
  - ~2-3 pages
- References
  - Last page(s)

# How will you report your methods?

- You already (mostly) completed this part!



- Be sure to review the feedback from the M2D6 homework
- Include the details regarding the confirmation digest / electrophoresis, protein purity / concentration, DSF experiment
- Be mindful of the following: sub-sections, level of detail, and word choices

# Methods: sub-sections

- Use sub-sections to group procedures
  - Include descriptive titles
  - Use logical, rather than chronological order
- Separate sub-sections with titles
  - Brief, but specific
- Include an introductory sentence
  - State the purpose or goal of particular method / group of procedures

# Methods: level of detail



# Methods: word choices

- the tube vs. the cell lysate
  - Give more informative, specific information
- combined or mixed vs. digested
  - Be precise about the procedure used
- cleaned vs. purified or isolated
  - Use the more scientific terminology
- in order to vs. to
  - Eliminate unnecessary wordiness
- avoid jargon and define all abbreviations

# Be mindful of sentence structure

“cell lysate was prepared by adding ... and proteins were separated using SDS polyacrylamide gel electrophoresis (130 V for 45 min) in TGS buffer  
... .”

1. PUT THE SUBJECT FIRST
2. BE SURE THE SUBJECT AND THE VERB MATCH

# Review of Introduction section...

- Impact statement
  - **Why is your research important / useful? Provide context for your project.**
- Specific background
  - Introduce topics (pathways, specific technologies, etc)
  - Narrow focus to the specific question addressed in your study
- Knowledge gap / statement of problem
  - State what is unknown
  - **Include your research question!**
  - What do you propose will be the outcome of your study?
- A brief preview of your findings
  - Here we show...



# How will you introduce your data?

## Introduction [\[edit\]](#)

The introduction will start on the second page. As you write your introduction, recall the idea of an hourglass structure. The information you use to set up the investigative question in your introduction should be supported by appropriate citations. **Any details you found in another researcher's work should be cited.**

The introduction provides a framework for the story you are about to tell, and thus serves two main purposes. For one, you must provide sufficient background information for a reader to understand the forthcoming results. Just as importantly, you must motivate the audience to keep reading! How? Reveal the significance of the work through connections to both prior scientific accomplishments and interesting future applications. The best introductions tell a coherent story rather than present a dense but unconnected list of facts.

Most introductions are "funnel"-shaped in terms of content:

- **Opening paragraph: most general, "big picture" paragraph.** Here you should introduce the reader to the broader context of your experiment.
  - Why is your research important?
  - What is the motivation of your research?
- **Middle paragraphs: "zooming in" somewhat.** Once the reader has a frame for thinking about your research, you can present background information in more depth and motivation with more specificity. Here where you fill-in the details that are needed to understand the specifics of your research.
  - Is there a concept that is particularly important in your research?
  - Is there a pathway or protein that is particularly important in your research?
  - Is there a technique or experimental approach that is particularly important in your research?
- **Closing paragraph: most specific, a description of your particular investigation.** Now that the reader understands the context and current status of the field related to your research, you should highlight the knowledge gap. Once the knowledge gap is identified you should make your research question clear to the reader. Lastly, the introduction concludes with a brief preview of key findings and their implications (2-3 sentences total).
  - What is the knowledge gap that your research attempts to fill?
  - What is your research question?
  - What are the key findings from your research?

Please pay close attention to the feedback you received from the Instructors on your homework assignments as you prepare your introduction (as well as the rest of the report).

The introduction will account for 10% of the final grade for this assignment.

# Review of Results section...

- Figures and captions
  - **Organize figures logically!**
  - Use figure subpanels (label with letters to better connect to the text in the caption)
  - Limit text on the image, move extra details / explanation to the caption
  - Use appropriately sized images
  - Include descriptive title that states the take-home message
  - Include introductory sentence at start of caption
- Results
  - **State the goal / intent / purpose of experiment in the first bullet**
  - What you did: experiments and expectations, describe controls
  - What you found: quantitatively describe your result, referring to the figure ("Figure 1a shows...")
  - What does this motivate you to do next: transition to next experiment

# How will you report your data?

## Results [\[edit\]](#)

The purpose of the Results section is to present your data in a relatively unbiased way, but with some guiding framework. You should organize the results using titled subsections that help support your high-level narrative. Subsections are organized by figures, such that each figure is described in a corresponding subsection in the results text. To ensure it is clear which figure and subsection go together, the title for the figure and title for the subsection should be similar. Also, the figure should be cited in the text whenever the data are specifically referenced.

To write the Results section, use the data (represented in figures and tables) as a guide. A helpful approach is to start by listing each data figure. The next step is to organize the data figures into a cohesive story such that the conclusion of each result leads to the next. To ensure the data are adequately explained in the results text, be sure to use the prompts below when writing the subsection for each figure.

- Begin with an overview that motivates and introduces the present experiment (2-3 sentences).
  - What was the goal of the experiment?
  - What was the method used to generate the data shown?
  - Because there is a methods section, technical details related to the experiment should not be included!
- Provide a written description of the data shown (length depends on complexity of the data).
  - What controls were included and why?
  - Were the results from the controls as expected?
  - What variables were tested and why?
  - What were the results for each of the experimental conditions tested?
  - Were the results from the experimental conditions as expected?
  - When describing the results, be specific! Use numbers. Compare samples using either percent differences or fold-changes.
- Connect the present experiment to the next figure (1-2 sentences).
  - How do the results of this experiment motivate the subsequent experiment?

Note that verbs in the results section are in the past tense and passive form. Only established scientific knowledge is written about in the present tense: "the world is round" is an example. You cannot presume that your own data are part of the body of established scientific knowledge. Thus, when you describe your own results, use the past tense: "a band of 1.3 kb was seen," for example. There are exceptions to this general rule, such as "Table 3 shows the sizes of the DNA fragments in our preparation" or "In a 1991 paper, Ebright and coworkers used PCR to mutagenize DNA," which are both acceptable statements.

The results section will account for 50% of the final grade for this assignment.

What figures will you include in the Research article?

1.

2.

3.

4.

5.

# Review of Discussion section...

- Start with 'here we showed...'
  - **Restate major results and broad implications**
  - Follow same order as in Figures/Results
- Describe your conclusions from your data
  - If necessary, describe caveats of experiment and suggest improvements
- Identify unknowns and speculate (within reason)
  - Don't make huge generalizations or overreach
- Propose future experiments, identify new questions that arise
- **Come back to the big picture / impact statement topic introduced in background**

# How will you interpret your data?

## Discussion [\[edit\]](#)

The purpose of the Discussion section is to interpret and contextualize your data. You should begin by reiterating the purpose of your research and your major findings. Then you might do any or all of the following: connect your findings to other research (published or that of your peers); describe any ambiguities and sources of error in the data, and suggest future experiments to resolve uncertainties; explain where you expect your work may lead, and suggest specific experiments for extending your findings; describe any conceptual or technical limitations of the research. Finally, you should explain the significance of your findings to basic science research and/or to engineering applications. As with previous sections, the discussion should have a clear organization and narrative flow, whether or not you use subsections.

You should cite the broader scientific literature thoroughly to inform your analysis in the discussion. You should also propose specific future experiments and otherwise show that you deeply understand the meaning and significance of your results; for example, if you have a hypothesis about why a particular transcript increased in response, consider what follow-up experiments you might try. You may also want to consider how the experiments can be improved; for example, what additional controls might be useful to include. In addition to drawing conclusions from your own data, you are expected to spend some time considering your classmates' data.

Most discussions "mirror" the introduction in terms of content:

- **Opening paragraph: most specific, a description of your particular investigation.** Here you should summarize your key findings and interpret the data such that the implications are clear. Then use the results to clearly answer your research question.
  - What did you discover in your research?
  - How do your results fill the knowledge gap identified in your introduction?
- **Middle paragraphs: "zooming out" somewhat.** Once the reader understands the results of your research, the data need to be contextualized. This means you should be honest about any limitations or unexpected results.
  - Were there any unexpected results? Is there a technical reason (i.e. an error in the setup or data collection)?
  - What follow-up experiment might you perform to clarify any unexpected results?
  - What are the limitations of your experimental approach? Is there another method that might better answer your research question? Is there another variable that should be tested to better answer your research question?
  - What next step experiment might you perform to further confirm your results?
- **Closing paragraph: most general, "big picture" paragraph.** Now that the reader understands your results, you should convey how your results move the field forward.
  - What is the broader implication of your research on the field?
  - How does your research advance what was already known?
  - How might your research improve a(n) health-related / environmental-related / technology-related issue?

Please pay close attention to the feedback you received from the Instructors on your homework assignments as you prepare your discussion.

The discussion will account for 10% of the final grade for this assignment.

# Connect the results text to the figures!

## RESULTS TEXT:

### Homologous Recombination Deficiency Rationalizes the Synthetic Lethality between *MSH3* and *PRKDC*

Given the substantial homologous recombination defect that we had observed in *MSH3*-mutant cells (Fig. 3 and Supplementary Fig. S9A), we next hypothesized that pharmacologic NHEJ abrogation through DNA-PKcs inhibition might lead to the generation of persistent unrepaired DSBs in these cells. To directly test this hypothesis, we induced DSBs in homologous recombination-proficient (H1568, HCC1359, and *Msh3*<sup>wt/wt</sup> MEFs) and homologous recombination-defective (HCC44 [*MSH3*<sup>mut</sup>]

## FIGURE CAPTION:

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**Figure 3.** *MSH3*-mutant or *MSH3*-deficient cells display a robust homologous recombination defect. **A.** DNA (0, 4, and 72 hours) after short (1 hour) exposure to a low-dose (0.1  $\mu\text{mol/L}$ ) etoposide pulse. Representative in  $\gamma$ -H2AX or RAD51 nuclear foci; blue, 4',6-diamidino-2-phenylindole (DAPI) counterstain] are shown for HCC44 I

# Reporting versus Interpreting your data

## RESULTS

1. What was the overall goal of these data?
  - State concisely as an introductory sentence.
2. If applicable, what was the result of your control?
  - Was it expected?
3. What was your result?
  - Was it expected?
4. What does this motivate you to do next?
  - Specifically, what experiment follows?

## DISCUSSION

1. What evidence do you have that your result is correct or incorrect?
  - How do your controls support your data?
2. In sum, what do your data suggest or indicate?
  - Do your data support your hypothesis? Why?
3. What does this motivate you to do next?
  - Specifically, what is the next research question?



# Ideas for Future works:

- What are some next steps?
  
  
  
  
  
  
  
  
  
  
- What are some broader possibilities?

# Remember to 'tell a story' with your data

- Introduction and Discussion should match
  - Preview / Review of the key findings
- Results should be tied together with transitions
  - Figures should be connected to Results (titles should match headers)
- Discussion should integrate the results together into a cohesive take-home message
- Effective redundancy provides a broader impact
  - Each section is crafted for a particular audience, naïve or expert