Designing Effective Figures

20.109 Communication Workshop 2

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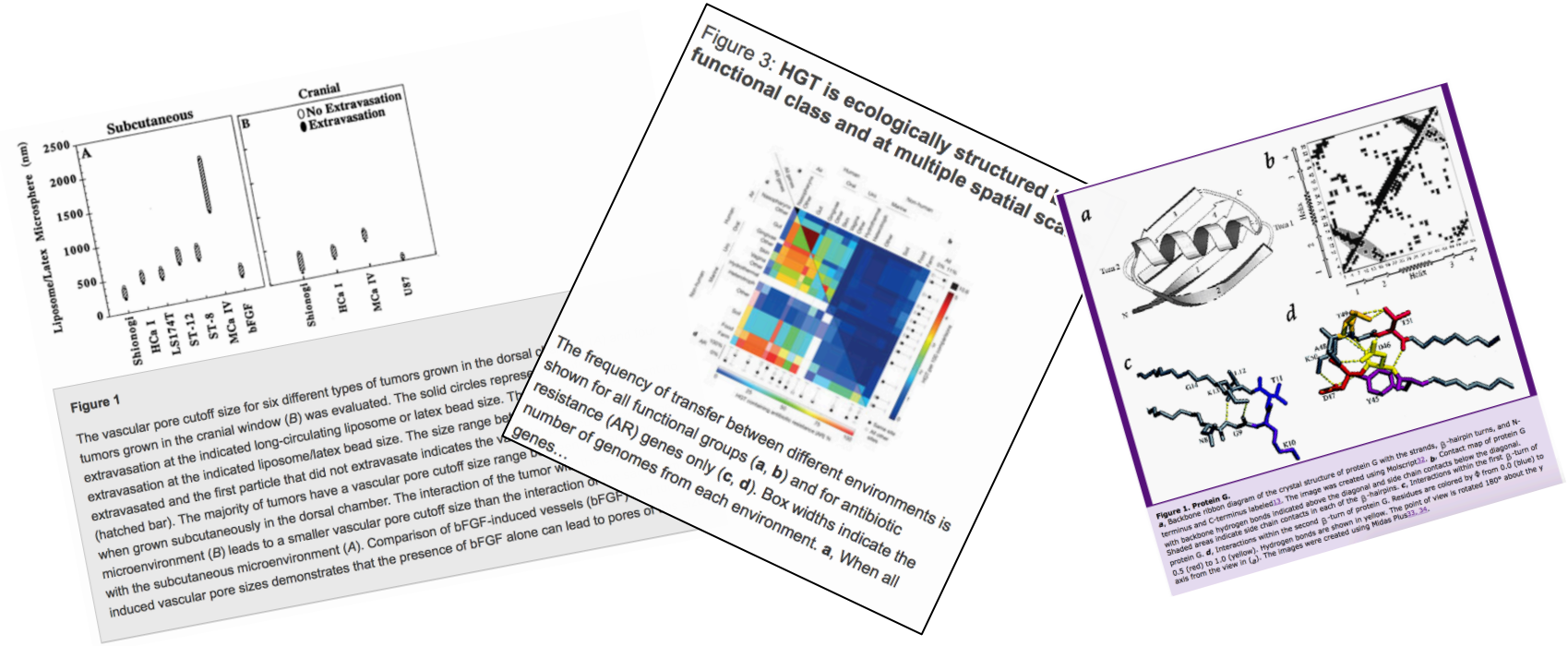


Figures (and captions)

Why are figures and captions so important?

nature food

Article | Published: 18 February 2020

Transgenic rice overproducing Rubisco exhibits increased yields with improved nitrogen-use efficiency in an experimental paddy field

Abstract

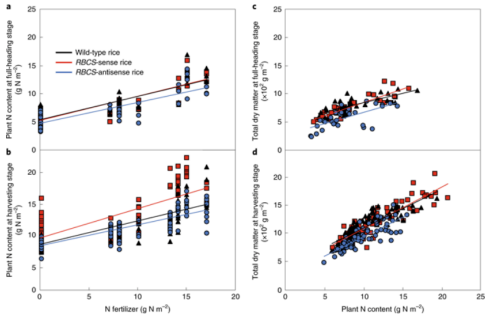
The green revolution's breeding of semi-dwarf rice cultivars in the 1960s improved crop yields, with large increases in the use of ertilizer. However, excess N application has caused ɔnmental problems, including acid rain and the n of rivers and oceans. To use N to improve crop yields, ɨing the associated environmental costs, there is a need ops with higher N-use efficiency and higher yield Here we show that transgenic rice overproducing isphosphate carboxylase–oxygenase (Rubisco)—the key otosynthesis—exhibits increased yields with improved ıcy for increasing biomass production when receiving ɛrtilization in an experimental paddy field. This field emonstrates an improvement in photosynthesis linked to yield increase due to a higher N-use efficiency in a major crop.

Main

Global population growth since the 1960s has been sustained, in part, by increased food supply due to the green revolution's successful dwarfing of major crops such as rice and wheat combined with a large input of nitrogen (N) fertilizer[1]. Large inputs of N fertilizer and

Sections | Figures | References

Fig. 1: The effect of N fertilizer on the plant N content of the above-ground section of plants and the total dry matter of wild-type, RBCS-sense and RBCS-antisense rice plants at the full-heading and harvesting stages.



View in article | Full size image

Fig. 2: Relationships between grain (brown rice) yield, yield components and the plant N content of the above-ground section per unit land area in wild-type, RBCS-sense and RBCS-antisense plants at the harvesting stage.

Figures must convince your audience of your data's impact and credibility.

- Expert audiences may ONLY read:

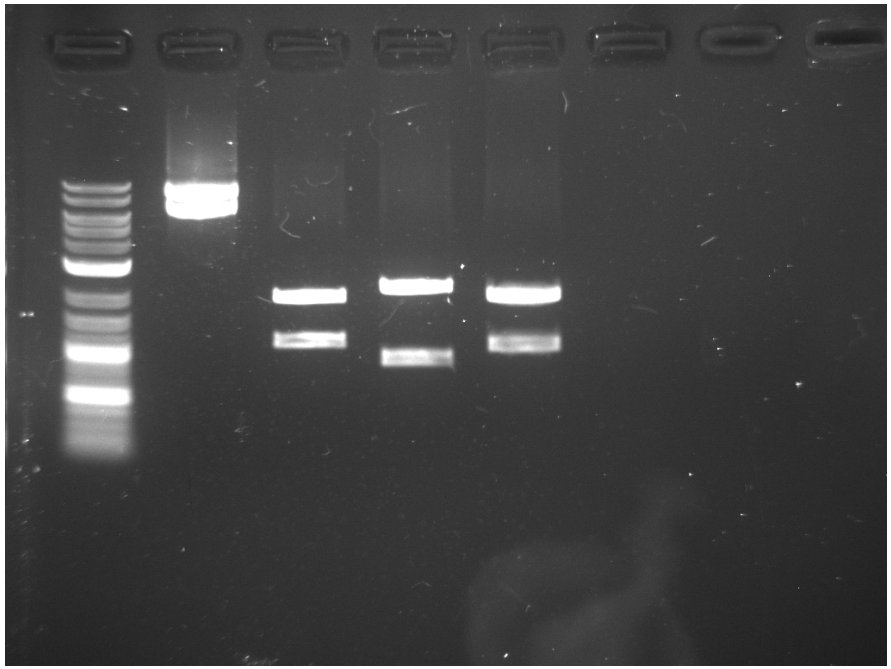
1. title
2. abstract
3. FIGURES

- Figures tell your story compellingly and honestly.
- Figures present your "naked" data for evaluation.

Today we'll derive key principles from the 4 figures you've already made!

- Just a primer today
- Look for best practices
- Don't just throw rocks

What choices did you consider in your confirmation digest figure?



Add/cut/change anything?

Labels
Caption - describes the experiment and key conditions
Title - a clear message
Schematic/additional data – What else would help the reader? Do you need to quantify this data?

There are many design choices that can help your reader understand your message

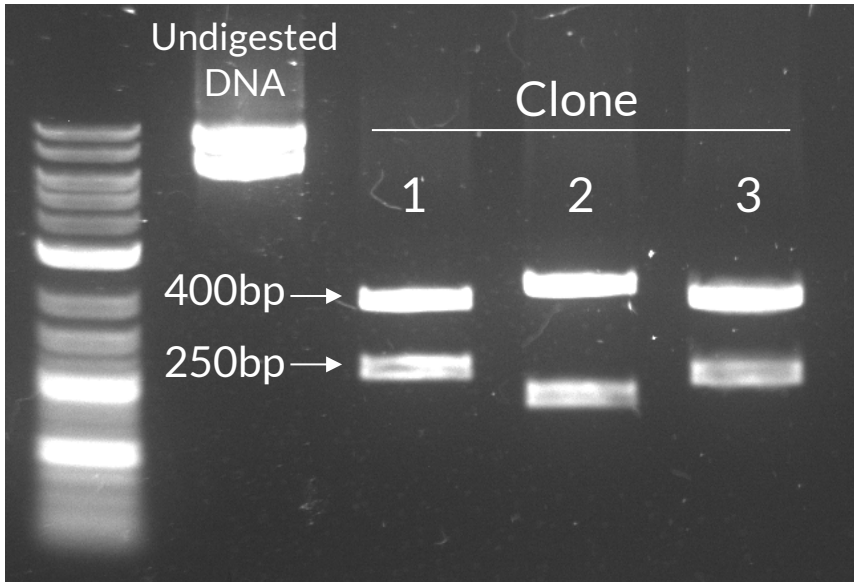


Fig 1: The conformational digest shows successful cutting in two clones. DNA from three clones was digested with BamH1 and compared to undigested DNA.

Choice of data

- Only data critical to the conclusion
- Honest data and controls

Presentation choices

- Type of graph or display, legends & labeling, design choices
- Uncluttered elements
- Allow quick evaluation of conclusions without relying on the legend or caption.

Use visual design to highlight your message

Maximize signal, minimize noise

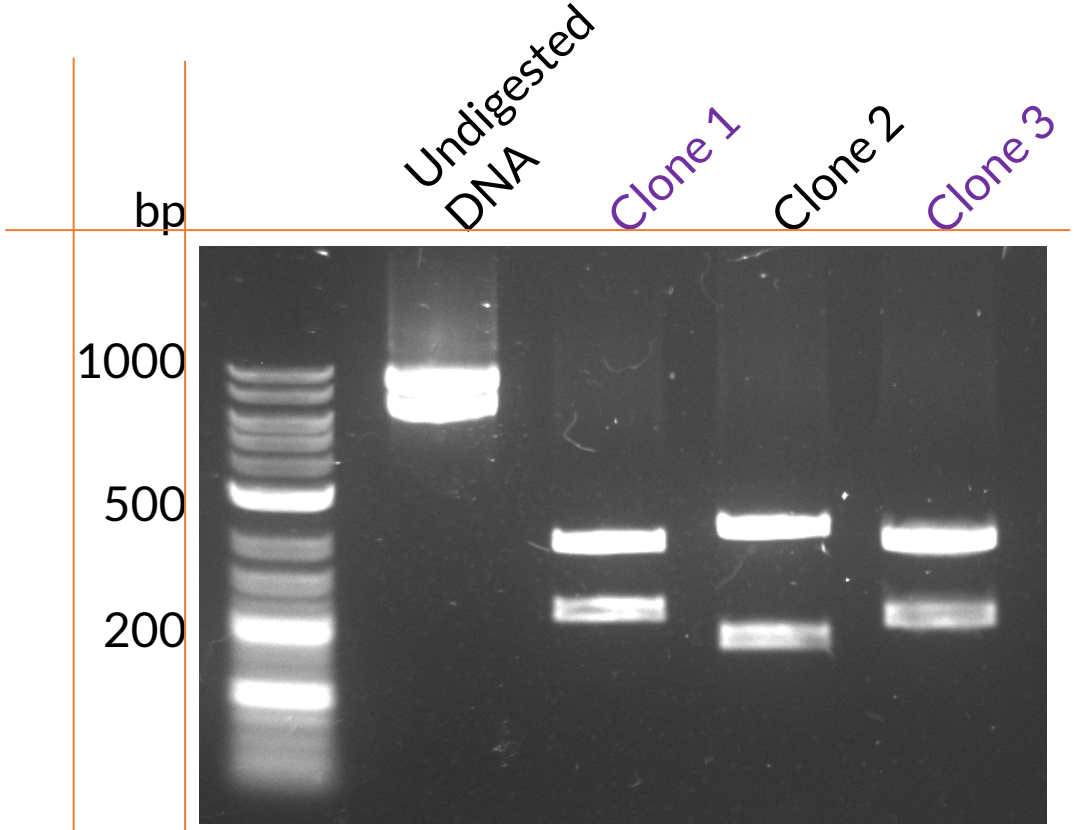
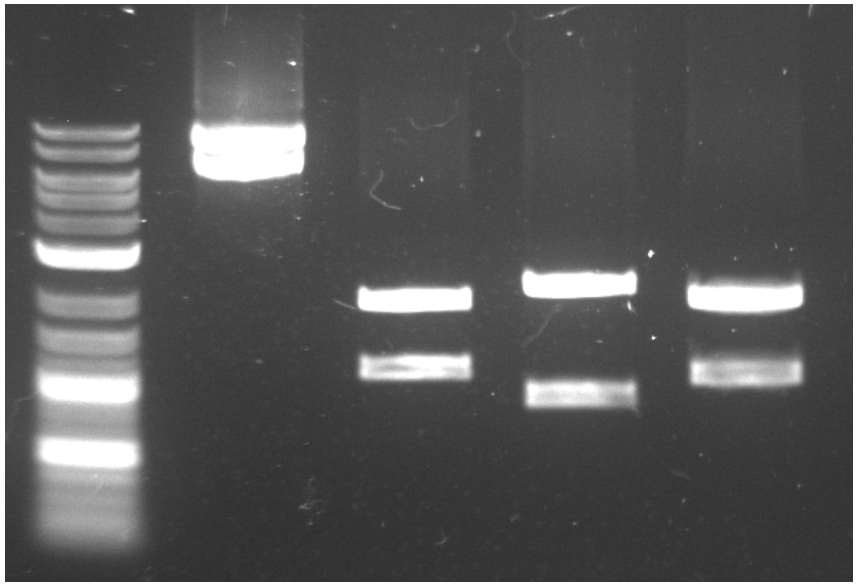


Fig 1: The conformational digest shows successful cutting in two clones. DNA from three clones was digested with BamH1 and compared to undigested DNA.

- intuitive alignments
- grayscale + a few consistent colors
- consistency in fonts, sizes, and line thicknesses

You also have the choice of how to present or augment your data

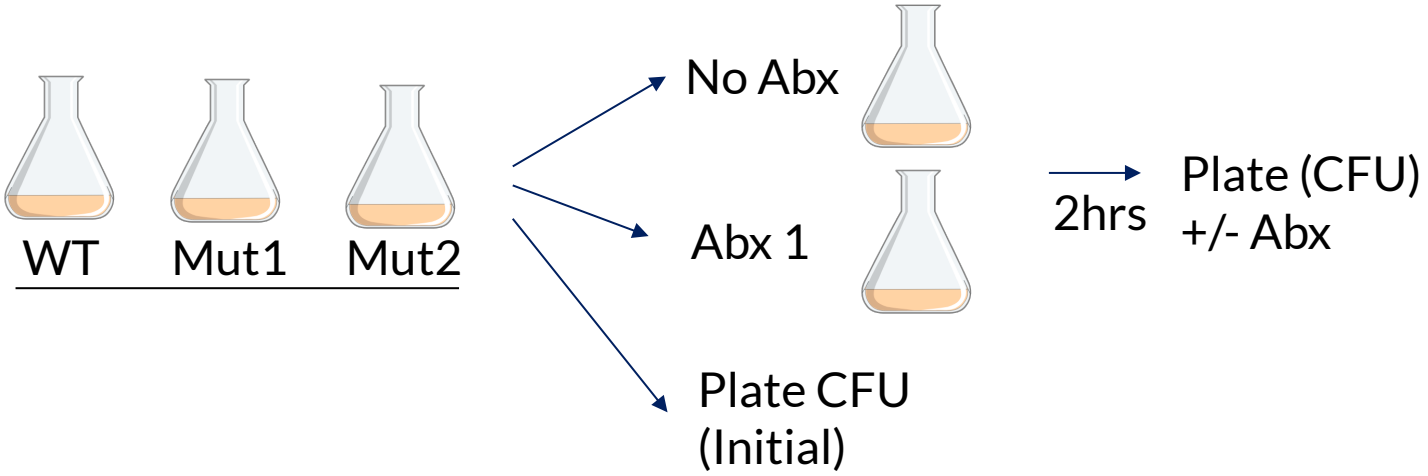


Would a schematic help the reader?

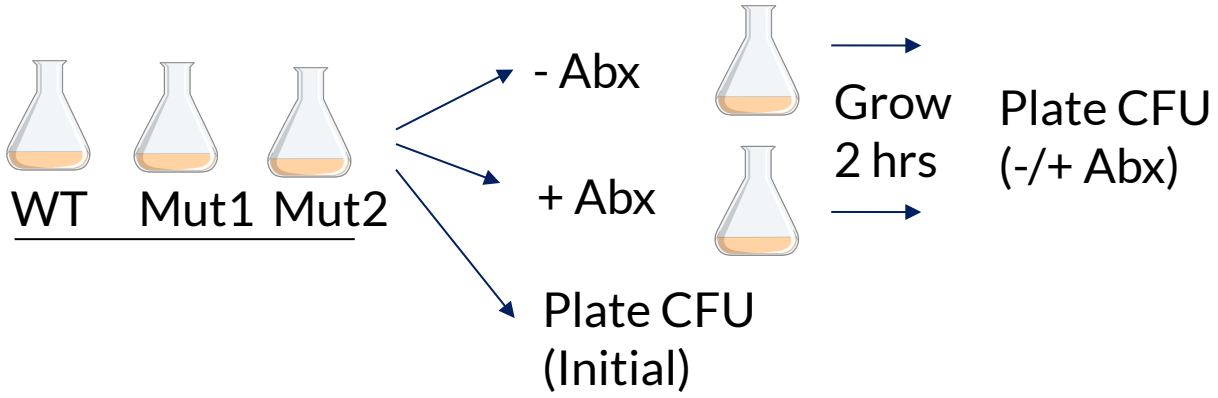
Could you quantify this data in any way?

Would it be better to show this data in a different form?

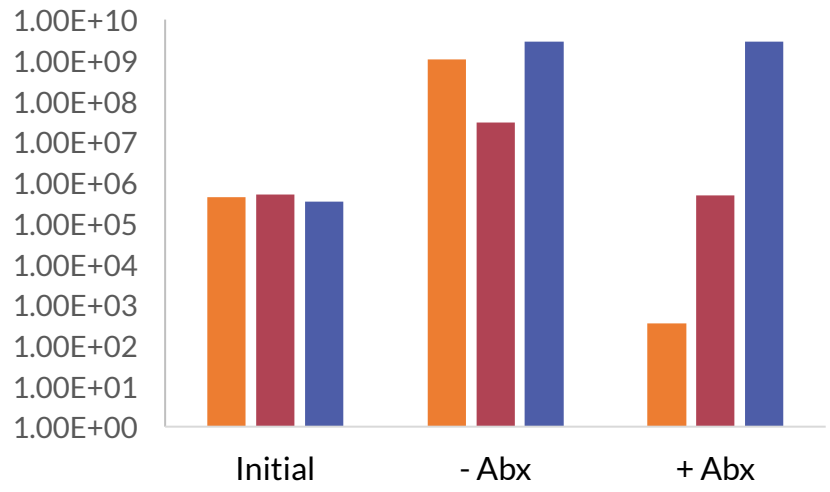
Activity: Here's an experiment



Activity: How can we present this data?



Strain	Condition	Replicate 1	Replicate 2	Replicate 3	Average
WT	Initial	1.8e5	3.2e5	7.8e5	4.3e5
WT	- Abx	1.0e9	1.3e9	8e8	1.0e9
WT	+ Abx	2.3e2	2.8e2	5.5e2	3.5e2
Mut1	Initial	2.5e5	8.3e5	4.6e5	5.1e5
Mut1	- Abx	5.5e7	2.3e7	1.1e7	3.0e7
Mut1	+ Abx	4.3e5	7.5e5	2.2e5	4.7e5
Mut2	Initial	5.3e5	3.2e5	1.3e5	3.3e5
Mut2	- Abx	3.4e9	2.2e9	3.0e9	2.9e9
Mut2	+ Abx	2.2e9	5.3e9	1.2e9	2.9e9


1.00E+10
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
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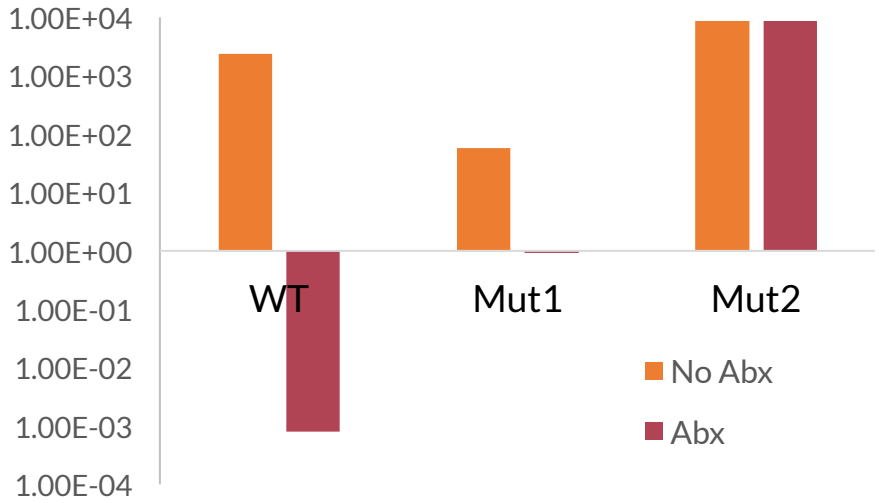
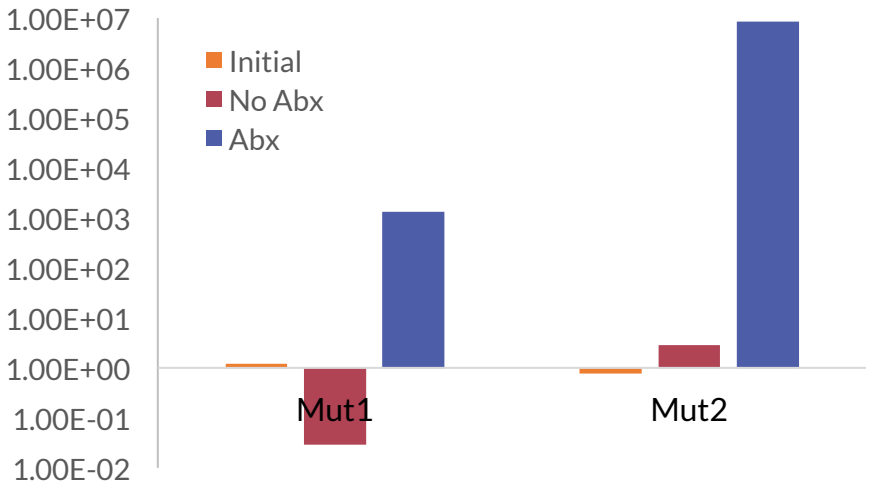
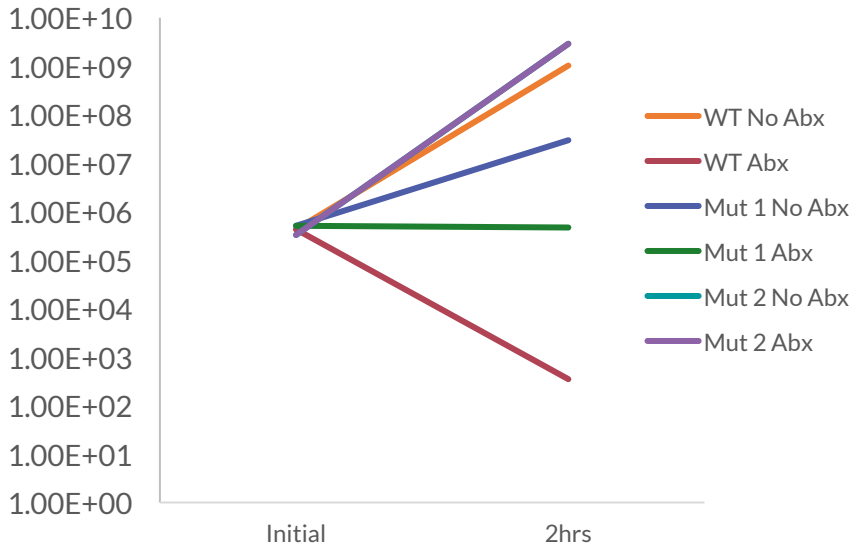
1.00E+02
1.00E+01
1.00E+00
Initial
- Abx
+ Abx


1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
WT
Mut1
Mut2
No Abx
Abx


1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
Initial
No Abx
Abx
Mut1
Mut2


1.00E+10
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
Initial
2hrs
WT No Abx
WT Abx
Mut 1 No Abx
Mut 1 Abx
Mut 2 No Abx
Mut 2 Abx

Your title should highlight your figure's take-home message

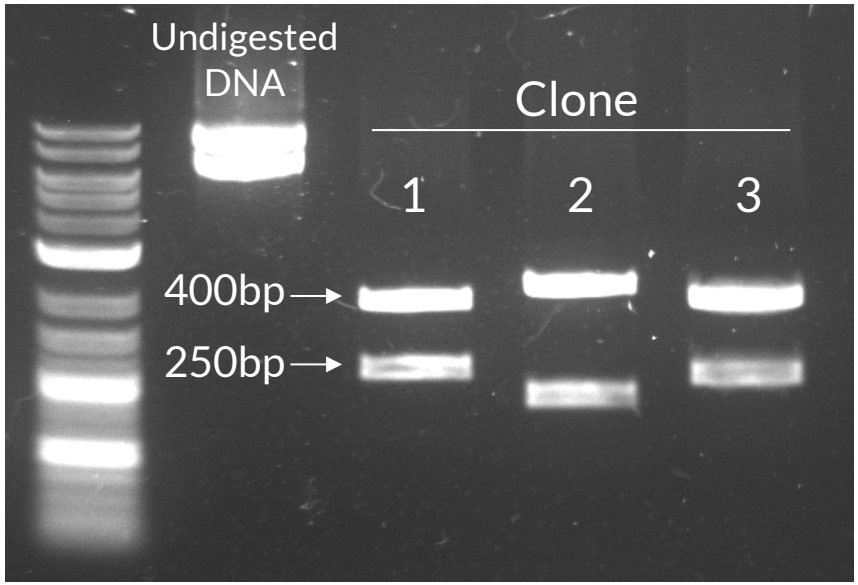


Fig 1: The conformational digest shows successful cutting in two clones. DNA from three clones was digested with BamH1 and compared to undigested DNA.

Title

- Take-home ***message***
- What conclusion should the reader evaluate when looking at the figure?

The caption should give just enough info for the reader to understand **how the data was generated**

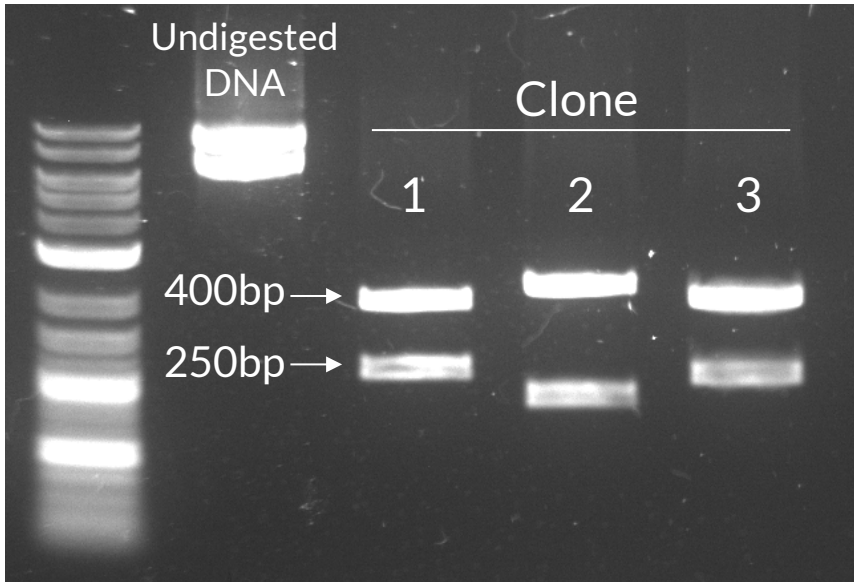
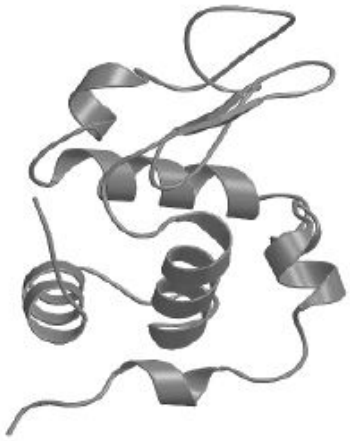


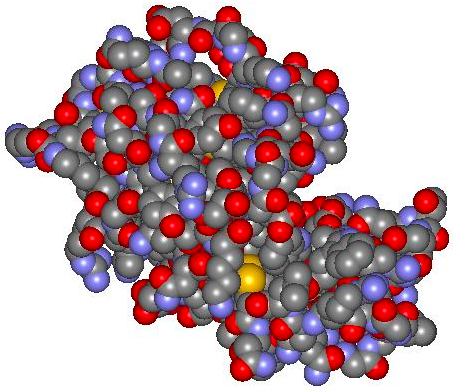
Fig 1: The conformational digest shows successful cutting in two clones. DNA from three clones was digested with BamH1 and compared to undigested DNA.

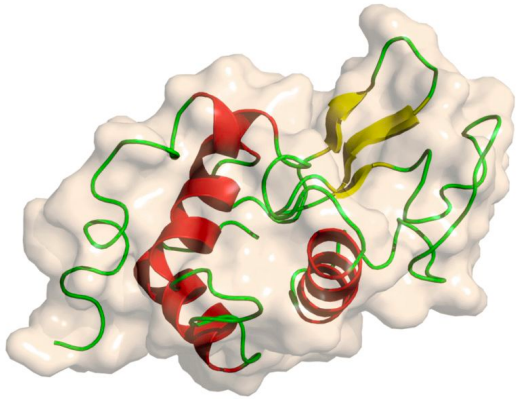
Caption

- Descriptive, not explanatory/interpretive
- Only enough method detail to make it clear how results were obtained.
- All types of figures should have captions

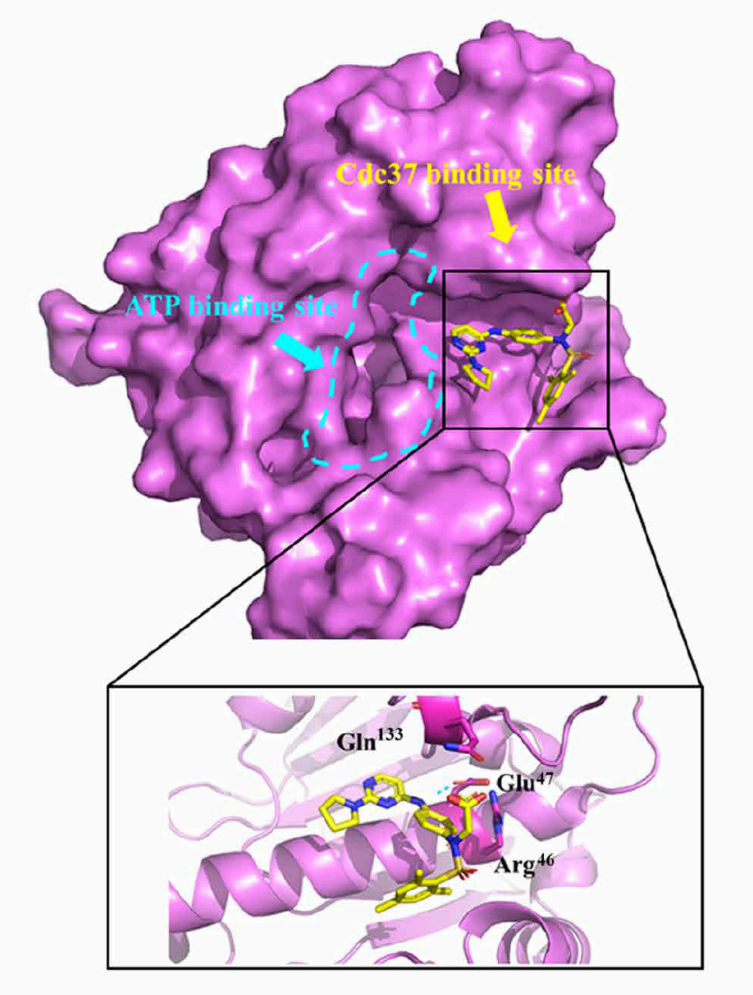
What choices did you have to consider for your protein schematic?





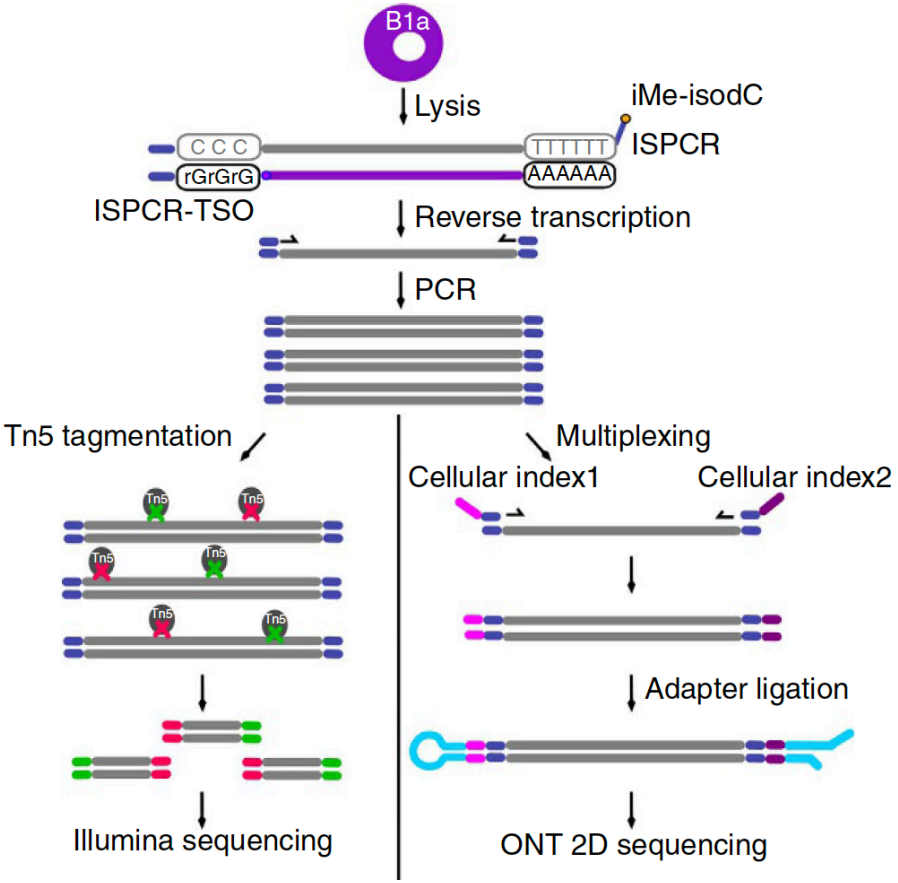


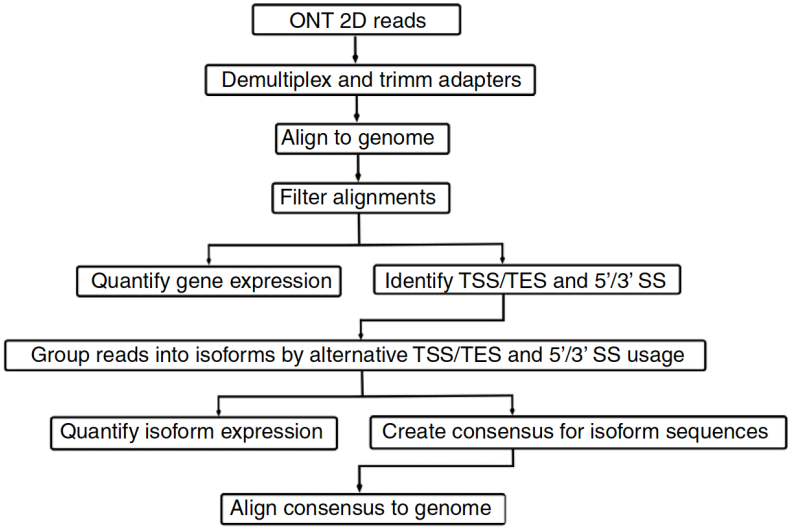
Schematics should be designed to highlight the message



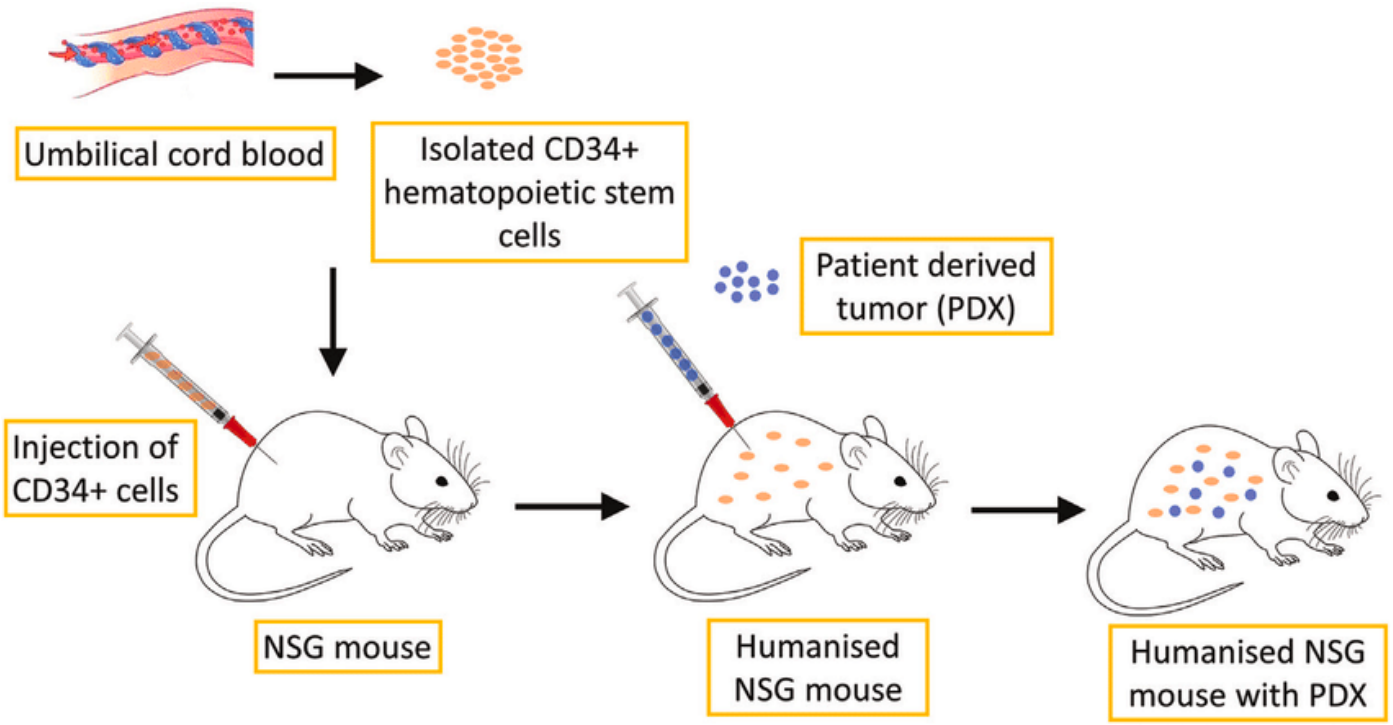
Wang et al, 2019

What are some considerations with an experimental design schematic?

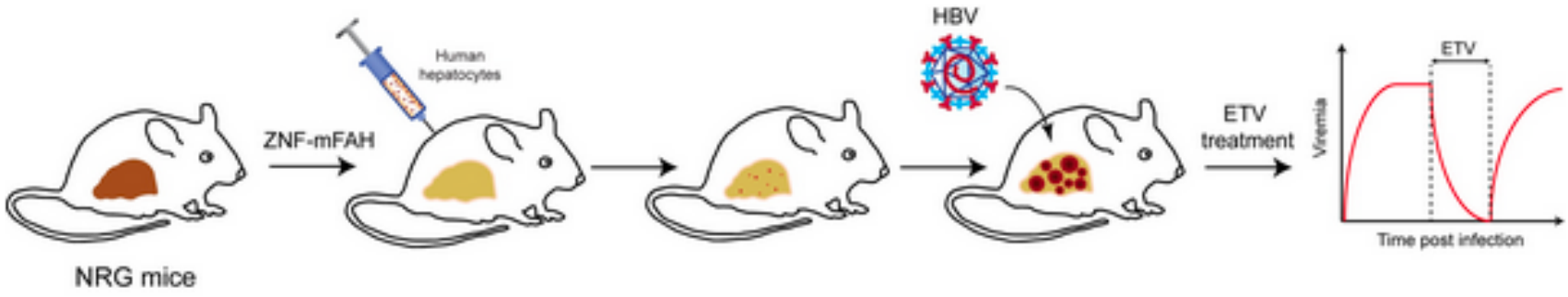




How does your eye move through this schematic?



Follow key design principles when designing a schematic

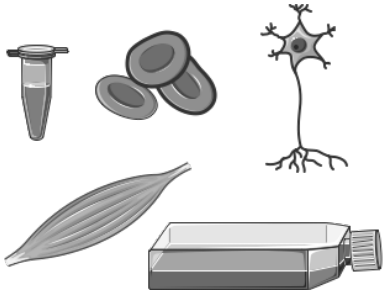


- Readers read left to right and top to bottom
- Use intuitive alignments
- Use grayscale + a few consistent colors
- Use consistent fonts, font sizes, and line thicknesses

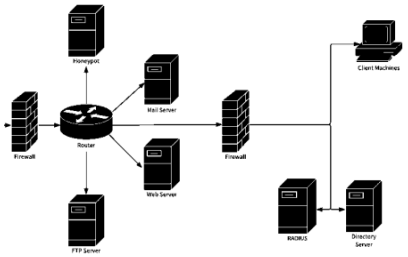
You don’t need to reinvent the wheel when making beautiful schematics!

Servier Powerpoint Image Bank &
Biorender

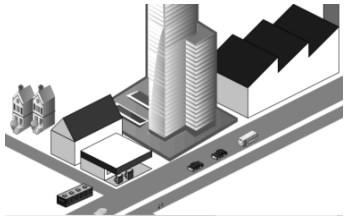
Biology, lab equipment
(free)

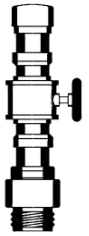


MS Visio & Lucidchart
Networks, engineering, circuits, charts
($$) & (free)



Noun Project
Everything
(free)

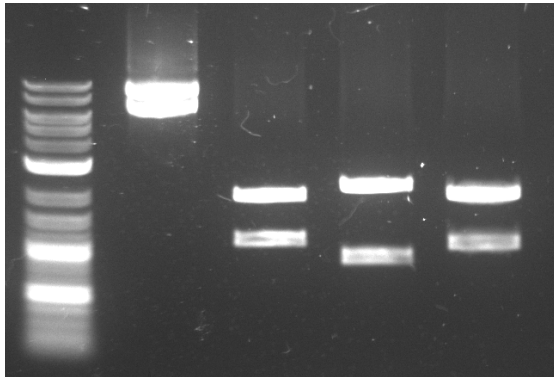


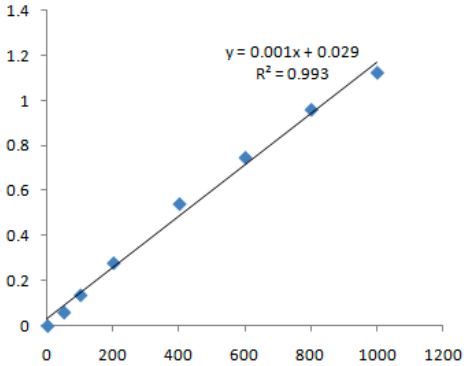


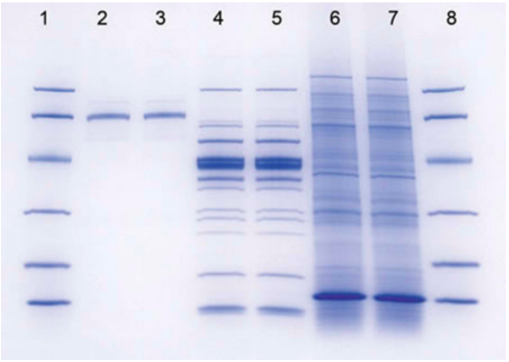
Biorender is doing a weeklong tweet-a-thon with great visual design tips

Let's talk about the last figure you made

How did you combine your various pieces of data?







What was your take-home message?

All the data in a figure should support one clear message.

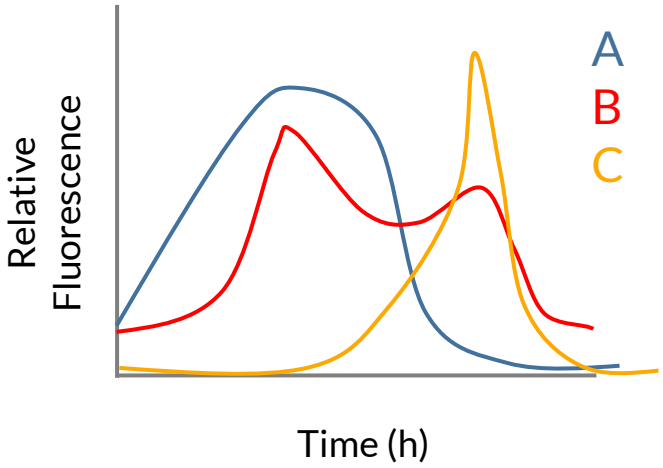


Fig. 1: A, B, and C have different dynamics under Condition X. A, B, and C were sampled using Method 1 and their fluorescence quantified with Method 2. Fluorescence data normalized to negative control.

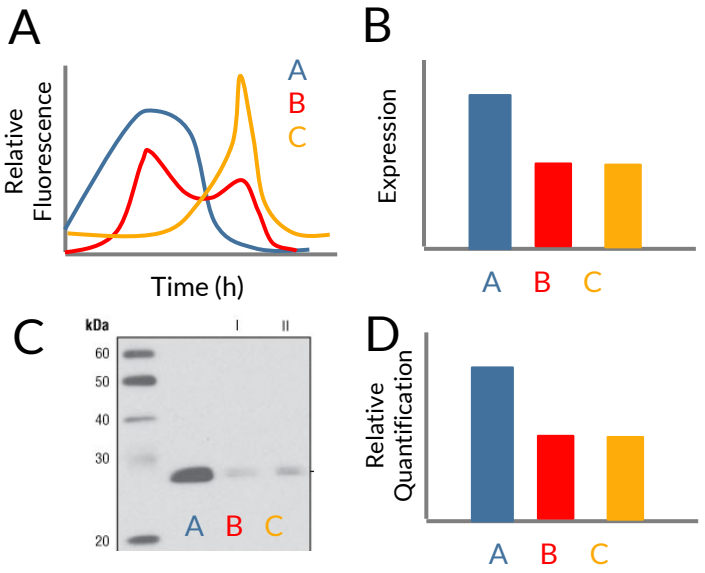
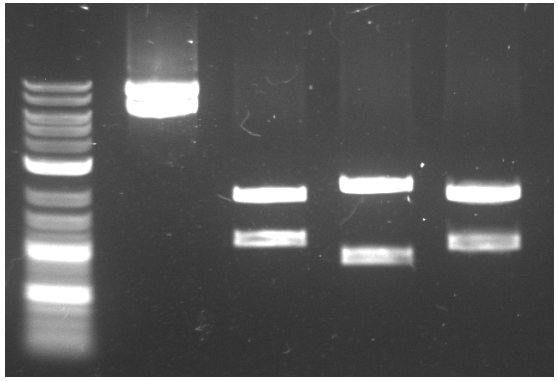
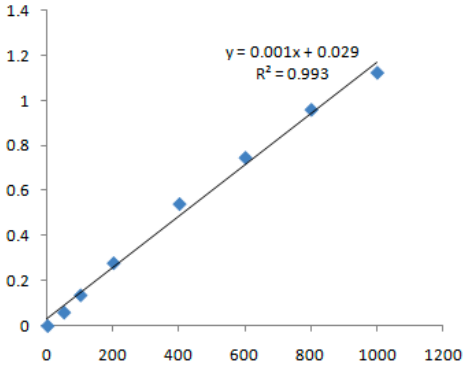
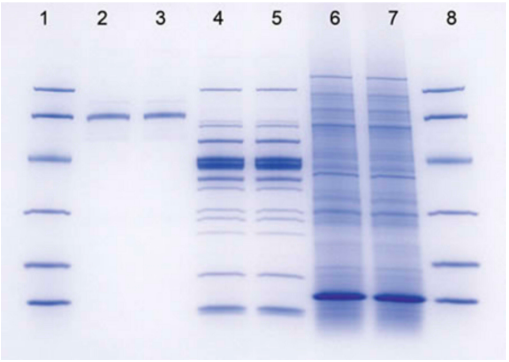


Fig. 1: A, B, and C have different dynamics under Condition X. A) A, B, and C were sampled using Method 1 and their fluorescence quantified with Method 2. Fluorescence data normalized to negative control. B) Gene expression data of samples A, B, and C, under condition X. Samples were collected at time T. C) Western blot analysis of samples A, B, and C, under condition X. D) Quantification of Western Blot.

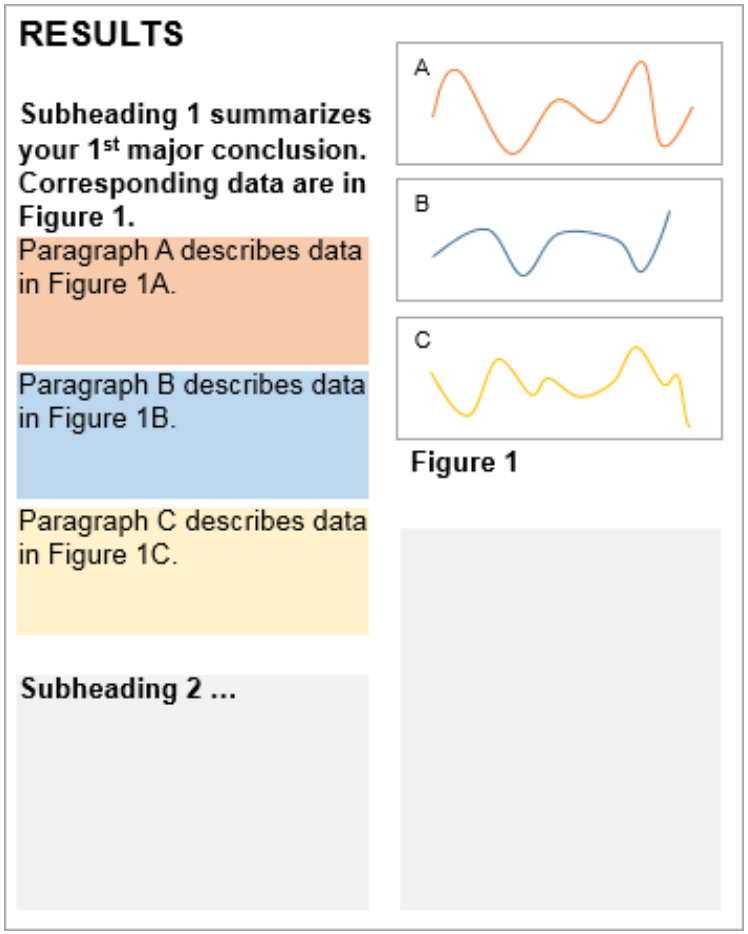
What types of information did you include in your results section compared to your caption?







The methods, results, and caption should reflect similar content, with different levels of detail



Methods: Most experimental detail

Results: Motivation for key methods you used; high-level summary of methods used to obtain results

Figure captions: high-level description of methods used

Results = rationale + data + conclusion

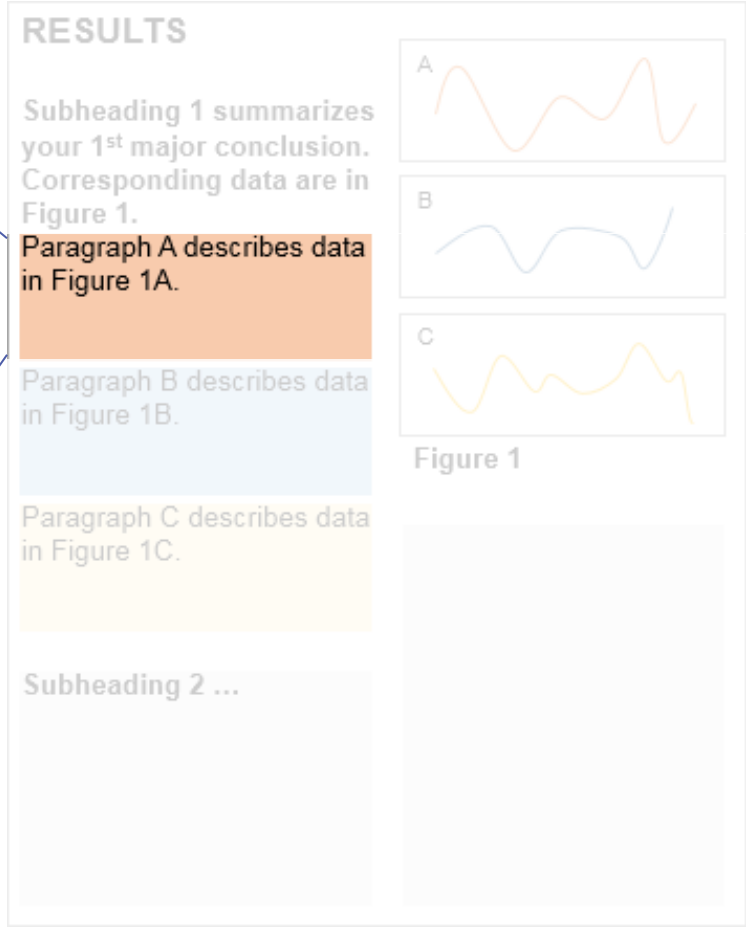
In order to determine *X*, *Y* was performed, showing *Z* major results.

Data + conclusions

- pro, then con
- most to least important
- experiment vs. control

Transition sentence

- re-summarize findings
- justify movement to next experiment or hypothesis



Identify your process for making figures that highlight the message you are trying to communicate

1 MESSAGE

What is the message of each figure?

2 DATA

What data do you include in each figure to convey your message?

How can you present your data to support your message?

3 DESIGN

What are some key design choices to think about?

For every figure, ask yourself…

- ❑ Is the central message validated by the data shown?
- ❑ Which data are irrelevant?
- ❑ Are there any data/labels missing?
- ❑ What could be done to better highlight the most important data?
- ❑ Is there a better way to present the data?
- ❑ Do the statistics actually add anything here?

So far, we've only talked about one figure at a time.

How do you put together all your figures for a paper?

What are some considerations?

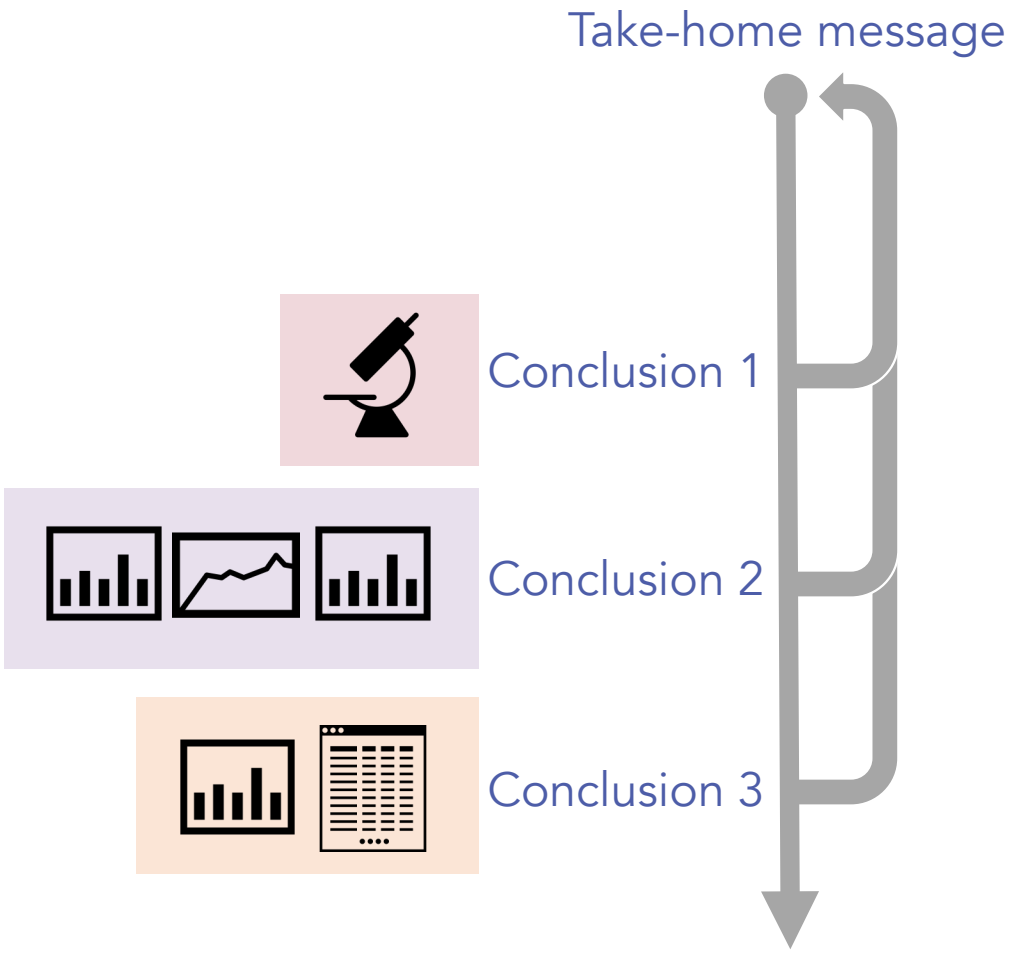
Organize your figures to build one storyline

Rearrange until you've created a **logical series** of conclusions.

Identify **modules** that correspond to **conclusions**.

Organize figures to build a single storyline

Identify **modules** that correspond to **conclusions**.



You should be able to read your figure titles and understand the main message of your paper

Fig. 1. Discovery of DDO-5936, an Hsp90-Cdc37 PPI inhibitor without ATPase inhibition, based on a site screening strategy involving critical residues identified at the binding interface.

Fig. 2. DDO-5936 binds to a critical residue on the Hsp90-Cdc37 PPI interface.

Fig. 3. DDO-5936 disrupts the Hsp90-Cdc37 interaction, represses cell proliferation through a strong correlation with the Hsp90-Cdc37 expression level, and selectively down-regulates kinase clients of Hsp90.

Fig. 4. DDO-5936 arrests the cell cycle in HCT116 cells.

Fig. 5. DDO-5936 dose-dependently impairs the growth of xenografted HCT116 cells in nude mice.

You should be able to read your figure titles and understand the main message of your paper

Figure 1 | Experimental design and Oxford Nanopore sequencing read characteristics.

Figure 2 | ONT RNAseq recapitulates Illumina RNAseq gene expression quantification.

Figure 3 | Quantifying gene and transcript expression with ONT RNAseq data.

Figure 4 | Identifying and quantifying transcript isoforms in SIRV E2 mixtures.

Figure 5 | Analysis of ONT RNAseq data identifies isoform features in mouse B1a cells.

Figure 6 | Uncovering isoform diversity in B cell surface receptors.

Put your figure design process in the context of a larger storyline

1 MESSAGE

What is the message of each figure?

2 DATA

What data do you include in each figure to convey your message?

How can you present your data to support your message?

3 DESIGN

What are some key design choices to think about?

Optimize your figures with these reminders

High-level questions

- *Strategic purpose:*
  - What do you want to convey?
  - How will you and/or your audience use this figure?
- *Organizational structure:*
  - Where does this figure fit into the communication?
  - Why?

Checklist

- ❑ Choice of data
- ❑ Title/caption
  - Can figure stand alone?
- ❑ Consistent layout
  - Fonts, spacing, colors
- ❑ Text amount and placement
- ❑ Scale, axes, tick marks
- ❑ Error analysis
- ❑ Ink-to-whitespace ratio

These are our next steps

- Slides and tips will be on the wiki
- Put these tips to work on your 109 figures today and beyond
- We’re happy to help with all parts of data summary drafts