

Reflection Activity

1. What is science communication?

What are some ways to communicate science?

2. What makes you feel that any communication has been successful?

As a receiver? As a sender?

1. What is science communication?

What are some ways to communicate science?

There are many ways to communicate science. In this class we will focus on the tasks that are highlighted below:

Papers

Opinion Editorial Pieces

Podcasts

Videos

Journal Clubs

Blog posts

Twitter

Talking to friends/family

Illustrations

Posters

Pitches

Proposals

Review Articles

TED Talks

2. What makes you feel that any communication has been successful? As a receiver? As a sender?

You can ask questions after

You can explain it to someone else

You get a good grade

People cite your paper

It leads to more exciting science

Science communication is complex



Educational principles to follow:

- Science communication is discipline specific
- Best way to learn science communication is to do it and get feedback
- Learn the basic rules and then find your own style

In this class, we have 5 Communication Workshops to support your large assignments

Workshop 1: Figures overview

Workshop 2: Captions and Titles

Workshop 3: Abstracts and Titles

Workshop 4: Journal Clubs

Workshop 5: Manuscripts

Workshop 6: Proposals

Your assignments:

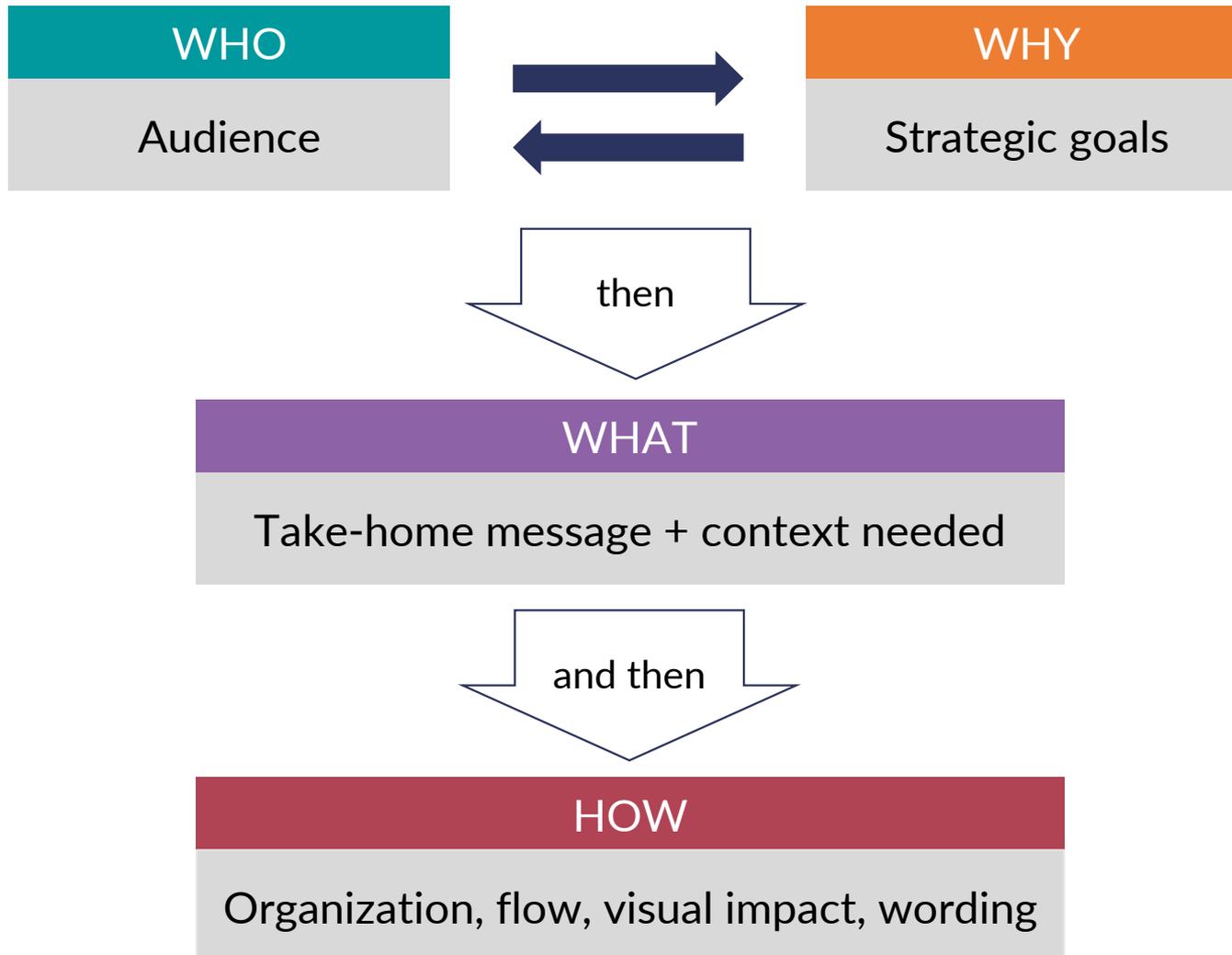
Mod 1 Report

Journal Club Presentation

Mod 2 Report

Proposal

We approach all communication tasks with a focus on **message**



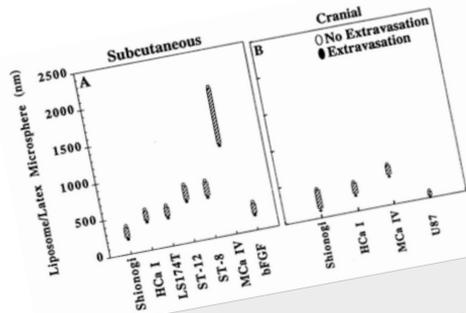
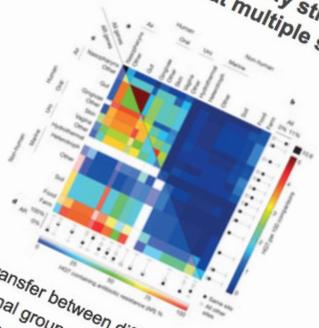


Figure 1

The vascular pore cutoff size for six different types of tumors grown in the dorsal of tumors grown in the cranial window (B) was evaluated. The solid circles represent extravasation at the indicated long-circulating liposome or latex bead size. The size range below the indicated liposome/latex bead size indicates the size range of pores that extravasated and the first particle that did not extravasate indicates the vascular pore cutoff size. The majority of tumors have a vascular pore cutoff size range between 500 and 1000 µm. The interaction of the tumor with the subcutaneous microenvironment (B) leads to a smaller pore size than the interaction of the tumor with the subcutaneous microenvironment (A). Comparison of bFGF-induced vessels (bFGF) with the subcutaneous pore sizes demonstrates that the presence of bFGF alone can lead to pores of induced vascular pore sizes.

Figure 3: HGT is ecologically structured by functional class and at multiple spatial scales



The frequency of transfer between different environments is shown for all functional groups (a, b) and for antibiotic resistance (AR) genes only (c, d). Box widths indicate the number of genomes from each environment. a. When all genes...

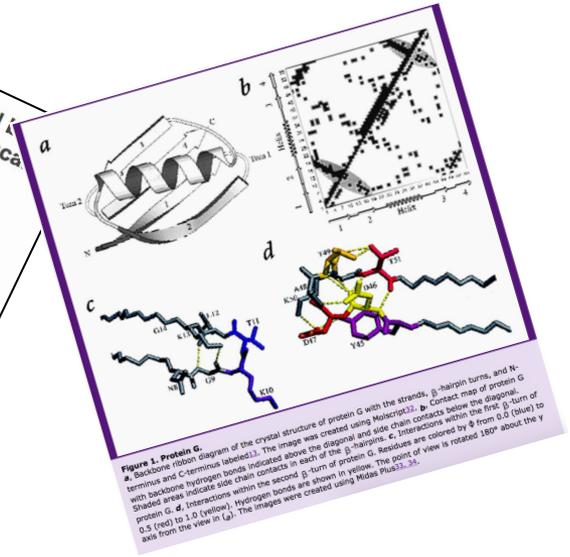


Figure 1. Protein G. a. Backbone ribbon diagram of the crystal structure of protein G with the strands, β -hairpin turns, and N-terminus and C-terminus labeled. The image was created using Molscript(3). b. Contact map of protein G with backbone hydrogen bonds indicated above the diagonal and side chain contacts below the diagonal. Shaded areas indicate side chain contacts in each of the β -hairpins. c. Interactions within the first β -turn of protein G. d. Interactions within the second β -turn of protein G. Residues are colored by ϕ from 0.0 (blue) to 0.5 (red) to 1.0 (yellow). Hydrogen bonds are shown in yellow. The point of view is rotated 180° about the y-axis from the view in (a). The images were created using Midas Plus(3). 24

Figures

Why are figures 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

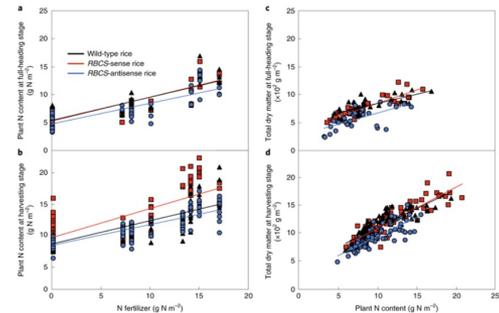
The green revolution's breeding of semi-dwarf rice cultivars in the 1960s improved crop yields, with large increases in the use of fertilizer. However, excess N application has caused environmental problems, including acid rain and the eutrophication of rivers and oceans. To use N to improve crop yields, while reducing the associated environmental costs, there is a need for crop cultivars with higher N-use efficiency and higher yield. Here we show that transgenic rice overproducing ribulose-1,5-bisphosphate carboxylase-oxygenase (Rubisco)—the key enzyme in photosynthesis—exhibits increased yields with improved N-use efficiency for increasing biomass production when receiving high N-fertilization in an experimental paddy field. This field experiment demonstrates 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) fertilizer¹. 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.

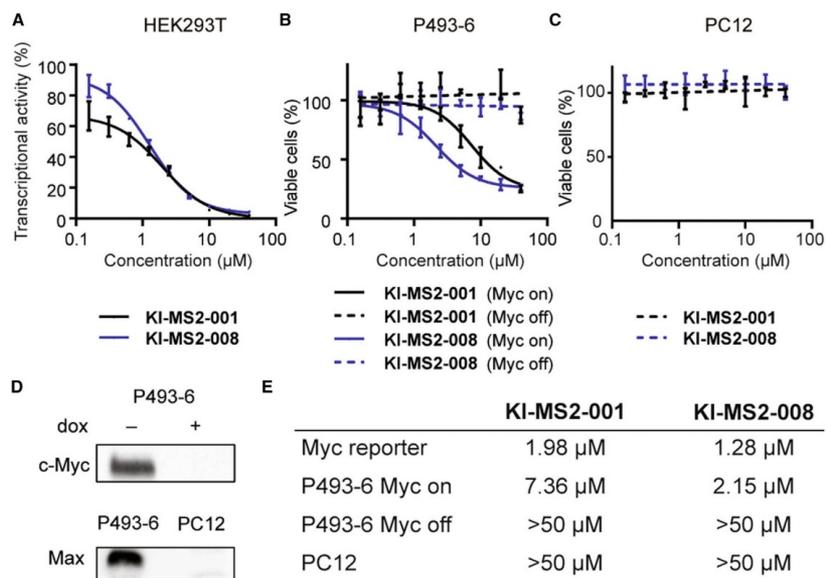
Today we'll derive key principles from some example figures!

- Just a primer today, focusing on printed figures
- Look for best practices
- Don't just throw rocks

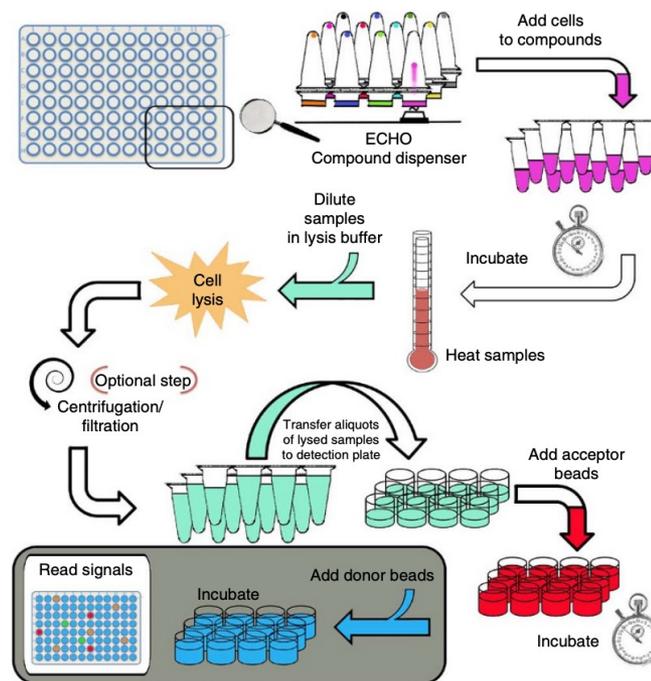
You'll have an opportunity to try it out on your own data.

Next workshop: Bring your questions and figure making thoughts!

There are two kinds of figures: schematics and data figures



Data Figure



Schematic

All figures have these four elements

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.

Title

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

Caption

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

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

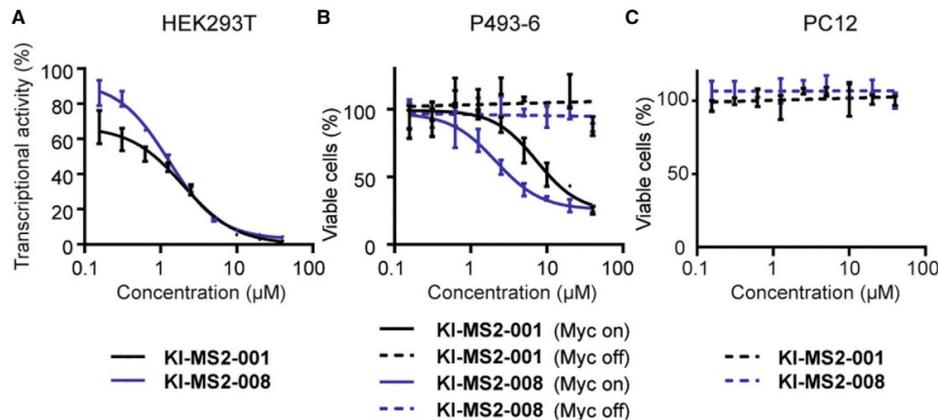


Figure 2. KI-MS2-001 and KI-MS2-008 Modulate Myc-Driven Transcription in Cells and Inhibit Viable Cell Levels in a Myc-Dependent Manner (A) Dose-response curves for the Myc dual luciferase reporter assay in HEK293 cells in response to KI-MS2-001 or KI-MS2-008 treatment after 16 h (n = 3 technical replicates, error bars represent mean ± SD). (B) Dose-response curves for P493-6 viable cell levels in response to KI-MS2-001 or KI-MS2-008 treatment with Myc expression left on or shut down with doxycycline after 3 days (n = 3 technical replicates, error bars represent mean ± SD). (C) Dose-response curves for PC12 viable cell levels in response to KI-MS2-001 or KI-MS2-008 treatment after 5 days (n = 3 technical replicates, error bars represent mean ± SD).

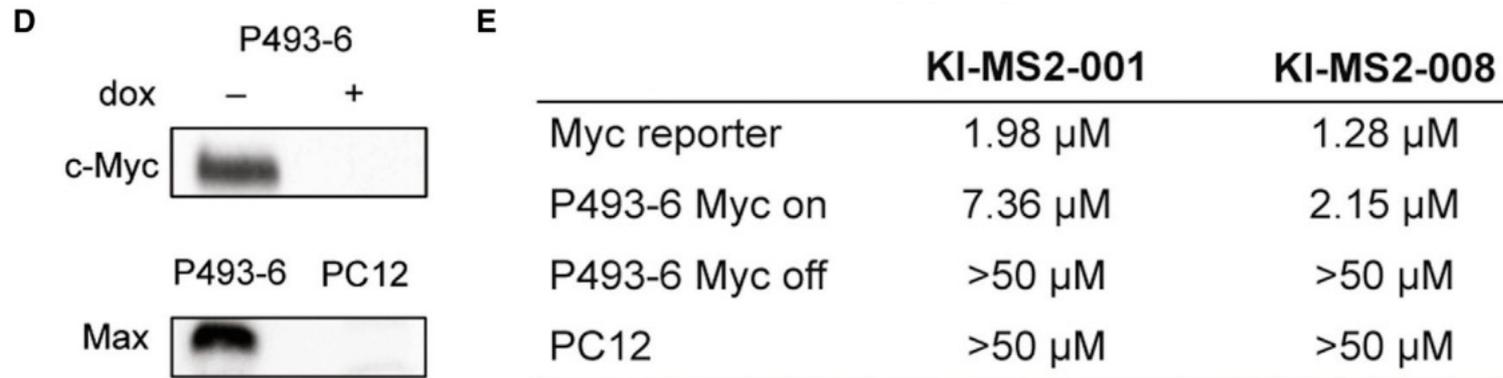
Choice of data

- 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.

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



Could you quantify this data in any way?

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

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

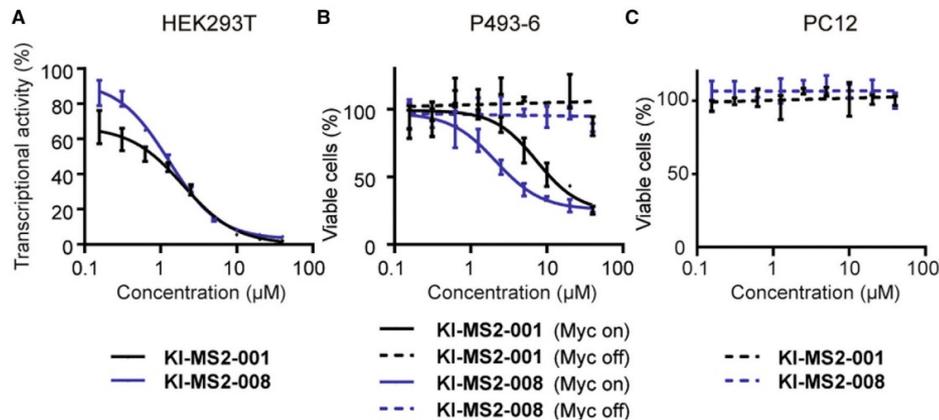


Figure 2. KI-MS2-001 and KI-MS2-008 Modulate Myc-Driven Transcription in Cells and Inhibit Viable Cell Levels in a Myc-Dependent Manner (A) Dose-response curves for the Myc dual luciferase reporter assay in HEK293 cells in response to KI-MS2-001 or KI-MS2-008 treatment after 16 h (n = 3 technical replicates, error bars represent mean ± SD). (B) Dose-response curves for P493-6 viable cell levels in response to KI-MS2-001 or KI-MS2-008 treatment with Myc expression left on or shut down with doxycycline after 3 days (n = 3 technical replicates, error bars represent mean ± SD). (C) Dose-response curves for PC12 viable cell levels in response to KI-MS2-001 or KI-MS2-008 treatment after 5 days (n = 3 technical replicates, error bars represent mean ± SD).

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**

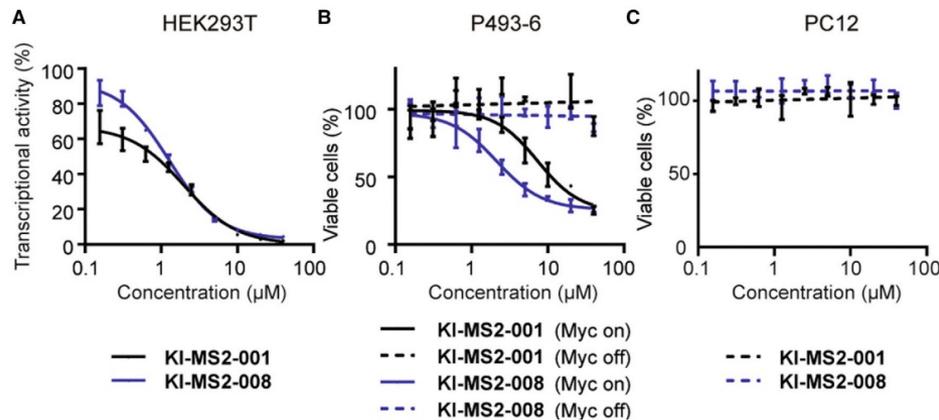


Figure 2. KI-MS2-001 and KI-MS2-008 Modulate Myc-Driven Transcription in Cells and Inhibit Viable Cell Levels in a Myc-Dependent Manner (A) Dose-response curves for the Myc dual luciferase reporter assay in HEK293 cells in response to KI-MS2-001 or KI-MS2-008 treatment after 16 h (n = 3 technical replicates, error bars represent mean ± SD). (B) Dose-response curves for P493-6 viable cell levels in response to KI-MS2-001 or KI-MS2-008 treatment with Myc expression left on or shut down with doxycycline after 3 days (n = 3 technical replicates, error bars represent mean ± SD). (C) Dose-response curves for PC12 viable cell levels in response to KI-MS2-001 or KI-MS2-008 treatment after 5 days (n = 3 technical replicates, error bars represent mean ± SD).

Caption

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

A well designed figure gets your audience to identify your message quickly....

I'll put some figures up on the screen.

Tell me what you think.

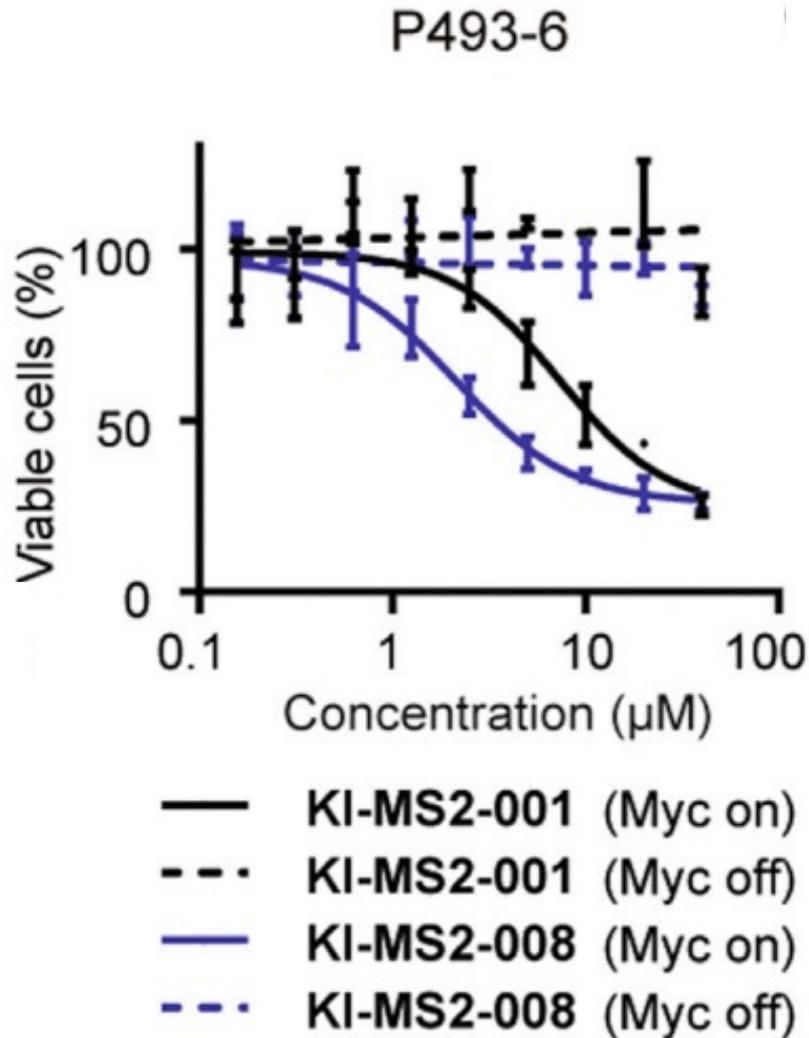
Things to consider:

What stands out to you?

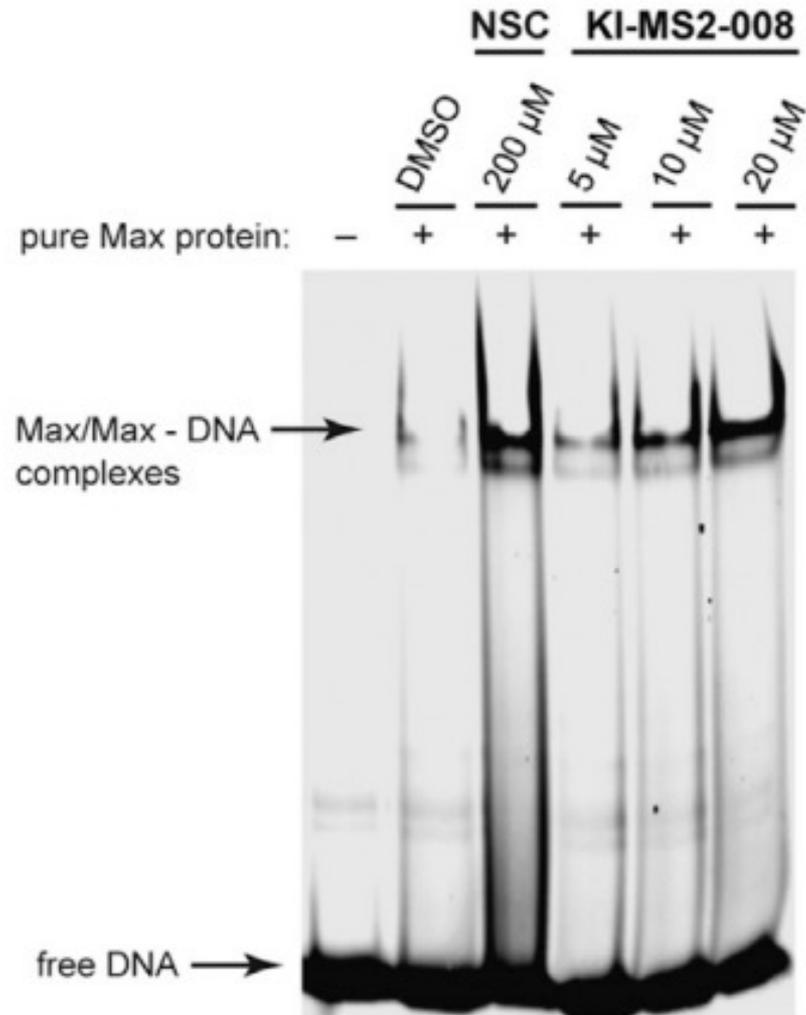
Can you understand what is happening?

Is there anything that is distracting?

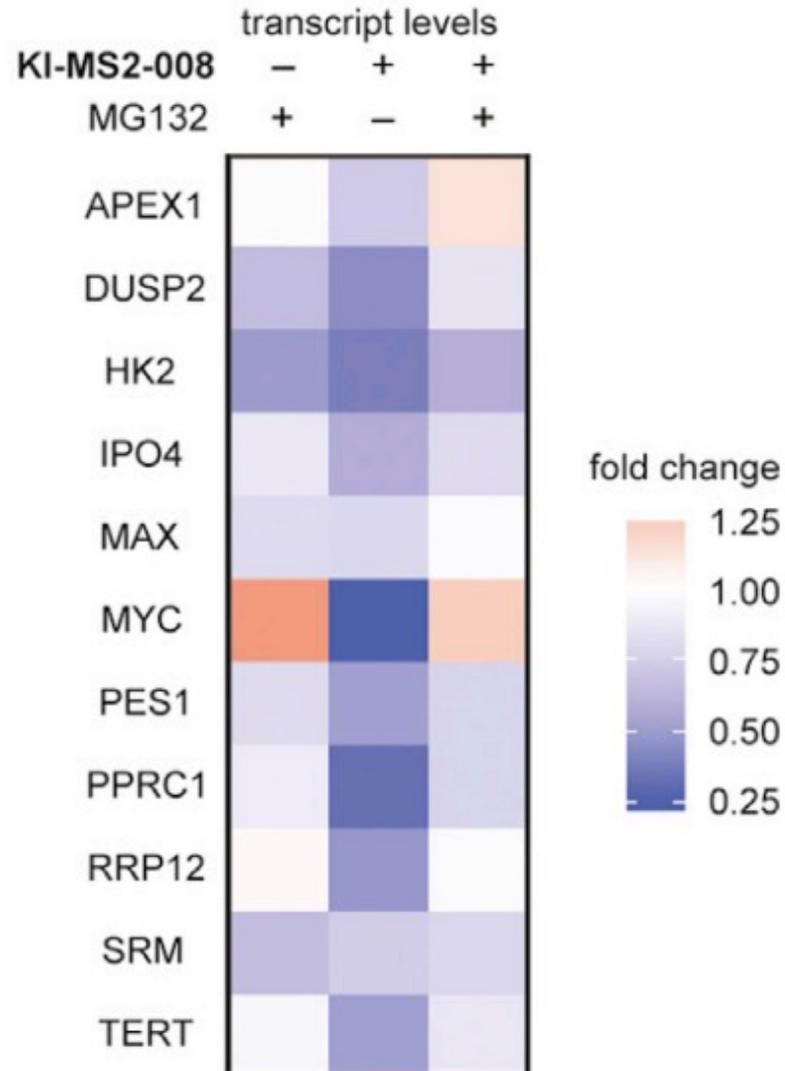
Where does your eye go with this figure?



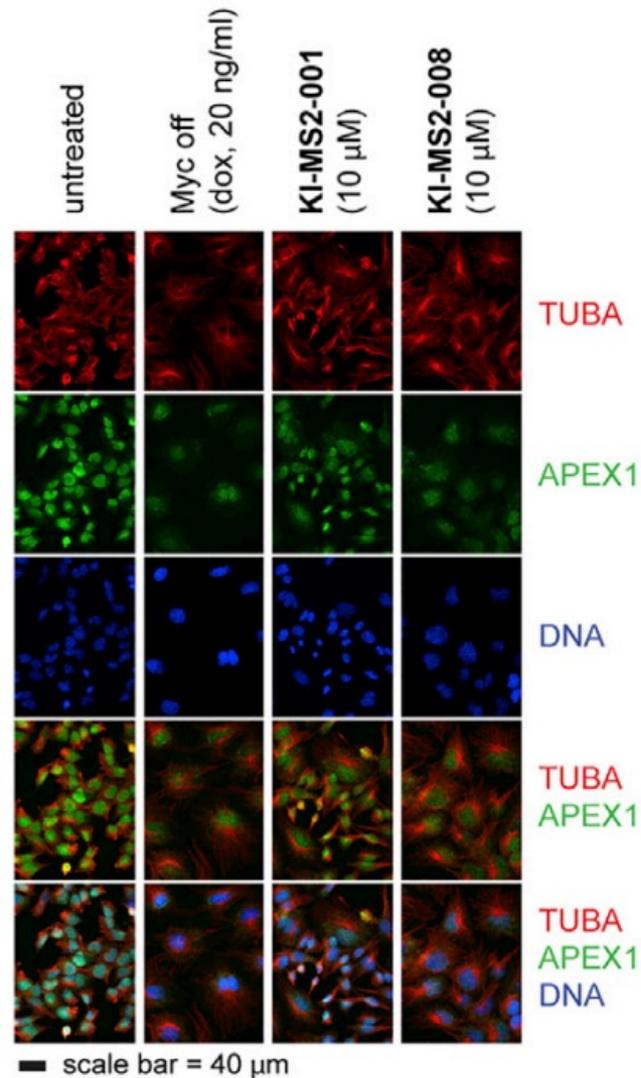
Where does your eye go with this figure?



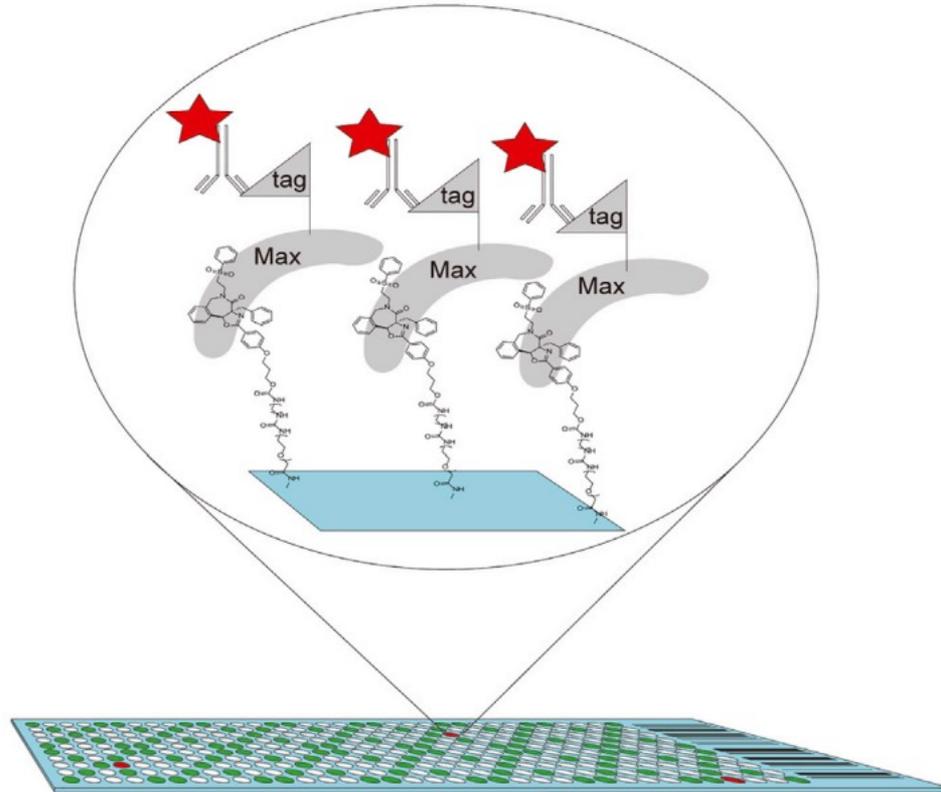
Where does your eye go with this figure?



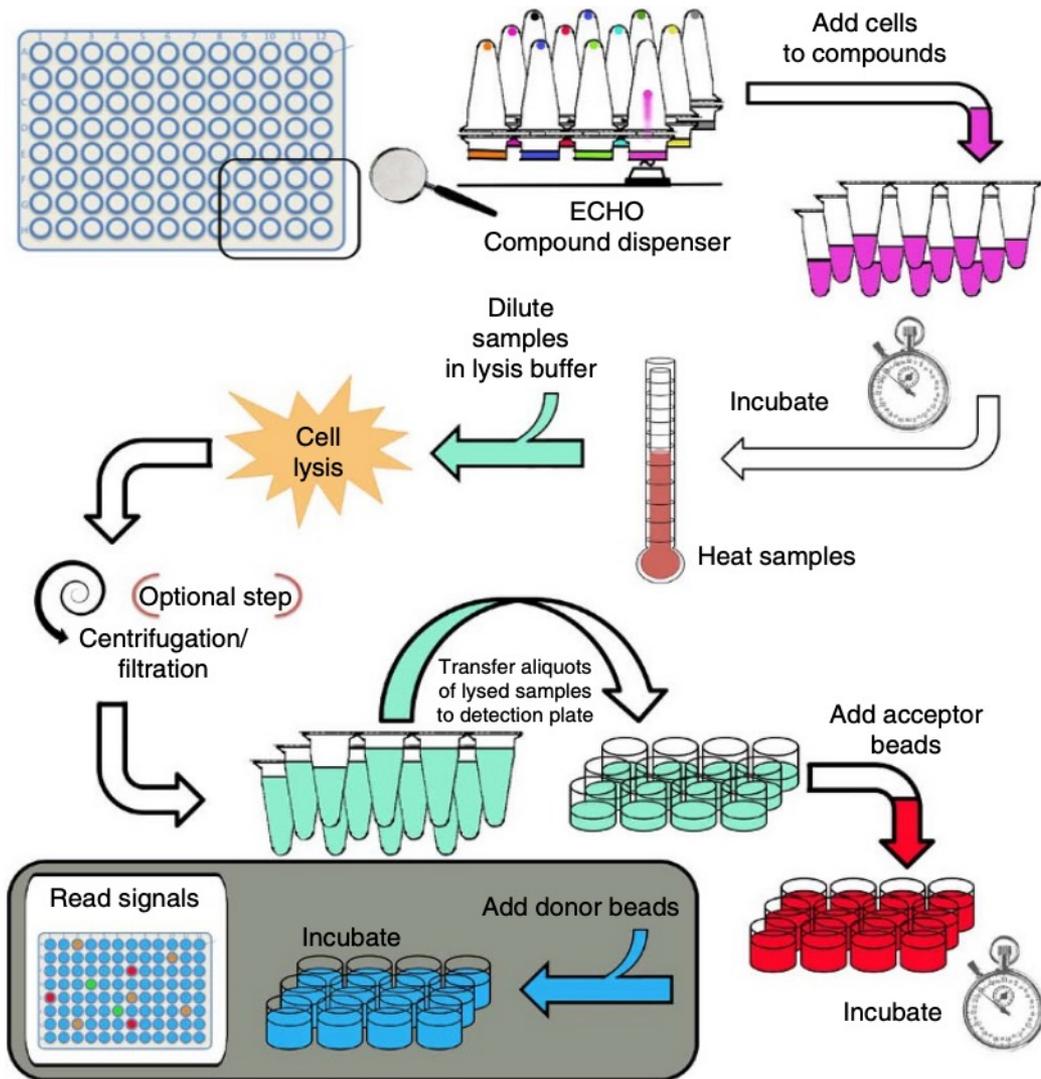
Where does your eye go with this figure?



Where does your eye go with this figure?



Where does your eye go with this figure?

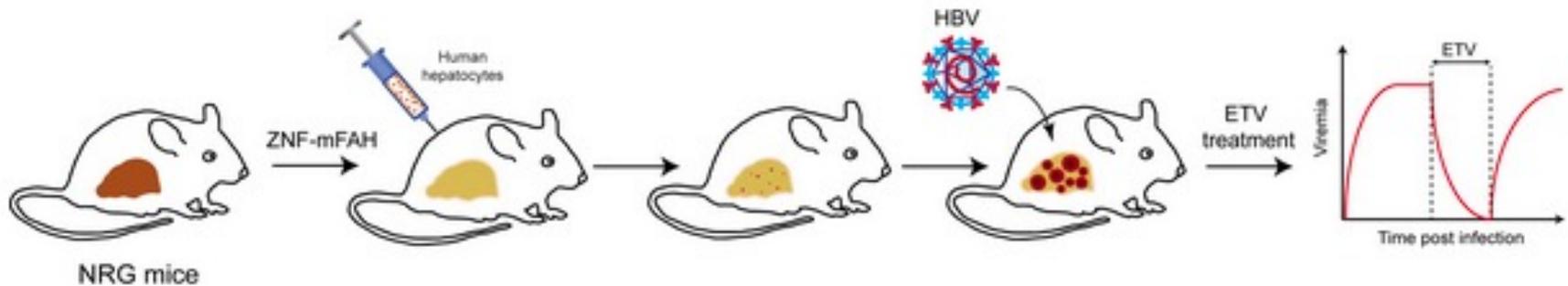


This is a fun exercise because it helps you to quickly test if the message of your figure is coming across clearly.

After you make a figure, ask a friend to look at it and tell you where their eye goes or how their eye moves across the page.

Based on this feedback, you can edit your figure!

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

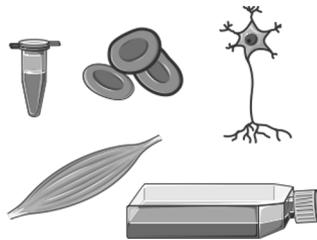
You don't need to reinvent the wheel when making beautiful schematics!

Servier Powerpoint Image Bank

Biorender

Biolcons

(<https://github.com/duerrsimon/bioicons>)

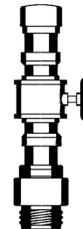
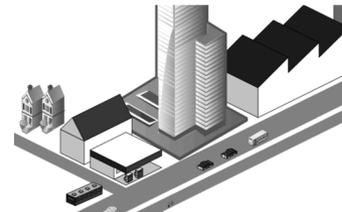
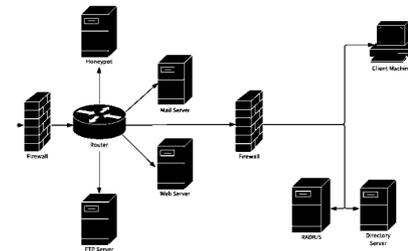


Noun Project
Everything
(free)



MS Visio & Lucidchart

Networks, engineering, circuits, charts
(\$\$) & (free)



...but if you want to, now is a good time to try out some vector design programs

[Adobe Illustrator Intro Videos](#) – Free through MIT now
(and the entire Adobe Suite)

(https://helpx.adobe.com/illustrator/how-to/ai-basics-fundamentals.html?playlist=/services/playlist.helpx/products:SG_ILLUSTRATOR_1_1/learn-path:get-started/set-header:ccx-designer/playlist:ccl-get-started-1/en_us.json&ref=helpx.adobe.com)

[BE Comm Lab Illustrator Guide](#)

<https://mitcommlab.mit.edu/be/2021/09/09/introduction-to-illustrator-and-helpful-resources/>

Inkscape – Free, open source

<https://inkscape.org/learn/tutorials/>

If you are interested in learning more about visual design, you can check out:

Jean Luc Dumont – Trees, Maps, and Theorems
<https://www.principiae.be/book/X0301.php>

Claus O. Wilke – Fundamentals of Data Visualization
<https://clauswilke.com/dataviz/>

Resources

Please respect the copyrights and licenses of the creators

Data Visualization Checklist

Evergreen Data. “Stephanie Evergreen Data Visualization Checklist.” Accessed January 25, 2021. <https://stephanieevergreen.com/data-visualization-checklist/>.

Selecting A Visualization Type

- Search by Function: <https://datavizcatalogue.com/index.html>
- Search by Data Type: <https://www.data-to-viz.com/>
- Chart Chooser diagram: <https://www.labnol.org/software/find-right-chart-type-for-your-data/6523/>
- Visual Vocabulary: <http://ft-interactive.github.io/visual-vocabulary/>

Visual Encodings

- Properties and Best Uses of Visual Encodings: <http://complexdiagrams.com/properties>

Managing Color

- ColorBrewer 2.0: <http://colorbrewer2.org/>
- ColorLab Colorblindness Simulator: <http://colorlab.wickline.org/colorblind/colorlab/>
- I Want Hue color palette generator <http://tools.medialab.sciences-po.fr/iwanthue/>
- Colour Contrast Analyser (CCA): <https://developer.paciellogroup.com/resources/contrastanalyser/>

Examples

Schwabish, Jonathan A. “An Economist’s Guide to Visualizing Data.” *Journal of Economic Perspectives* 28, no. 1 (February 2014): 209–34. <https://doi.org/10.1257/jep.28.1.209>.

Schwarz, C J. “A Short Tour of Bad Graphs,” 2016, 29. <http://people.stat.sfu.ca/~cschwarz/Stat-650/Notes/PDF/ChapterBadgraphs.pdf>

“Top Ten Worst Graphs.” Accessed January 30, 2020. https://www.biostat.wisc.edu/~kbroman/topten_worstgraphs/.



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

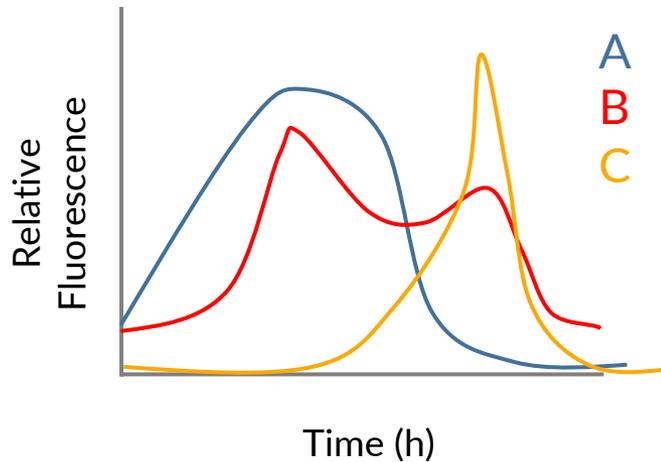


Fig. 1: A, B, and C have different dynamics under Condition X. A, B, and C were sampled using Method 1 and their fluorescence quantified with Method 2. Fluorescence data normalized to negative control.

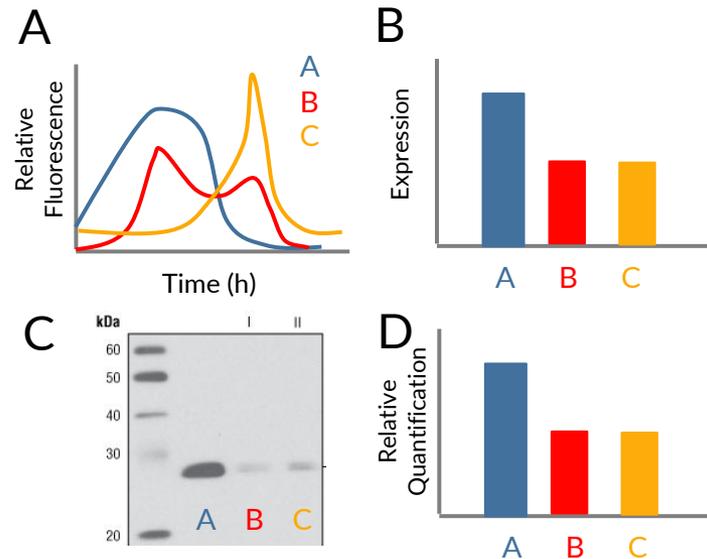


Fig. 1: A, B, and C have different dynamics under Condition X. A) A, B, and C were sampled using Method 1 and their fluorescence quantified with Method 2. Fluorescence data normalized to negative control. B) Gene expression data of samples A, B, and C, under condition X. Samples were collected at time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

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?

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

Your next steps

- Watch this short video or read the following slides to learn more about the BE Communication Lab and BE Data Lab
- Bring a draft figure and your questions to our next workshop



<https://bit.ly/BECL109>

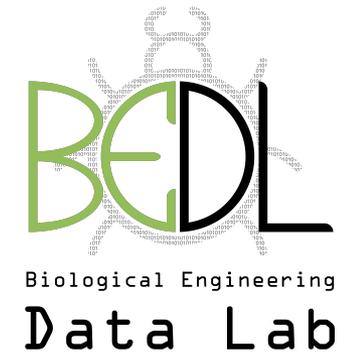
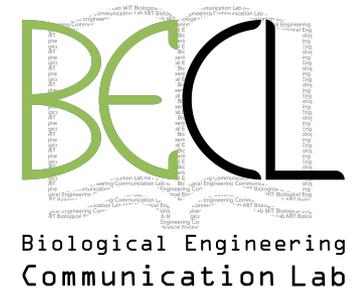
56-211 Team



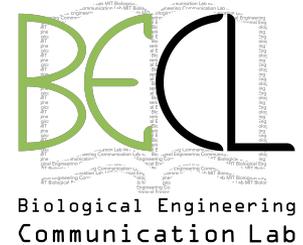
Instructor &
BECL/BEDL
Manager



Instructor &
Biotech Liaison



From brainstorming to final edits,
**we offer discipline-specific feedback
for your communication tasks**



Cover letters, resumes, and interviews

Application essays

Manuscripts, proposals, and theses

Figure and poster design

Slide design and oral presentations

The BE Communication Lab is staffed by a team of
trained BE grad students and postdocs.

Use our online guides!

CommKit | GitHub Resources | Templates | Blog Posts

Fellowship Applications

- Graduate School Personal Statement
- NSF Personal Statement
- NSF Research Proposal
- Postdoc Fellowships: Index of Life Sciences Fellowships

Career Focused Tasks

- Cover Letter: For a Faculty Position
- Cover Letter: General
- CV/Resume
- Elevator Pitch
- Interviewing
- Professional Bio
- Professional Email

Figure Design

- Introduction to Figure Design

Poster Design

- Introduction to Poster Design

Presentations

- Slideshow
- Public Speaking

Manuscripts

- Abstract
- Introduction
- Methods
- Results
- Discussion

MIT BE-specific

- BATS seminar

Science Policy

- Introduction to Policy Communication

GitHub Resources

- Introduction to Resources

Coding

- Coding, File Organization, and Documentation



Paper got accepted? Do the work to increase visibility!

August 19, 2020

You did a lot of work to get your paper accepted. Now do a little bit more to make sure people know about your paper! Learn some ways that people share their work with the world!



Editing Checklist

August 11, 2020

Working on writing a long document. Use our editing checklist when you think you are done to make sure you don't miss any details!



Fellowships – Fall 2020

July 29, 2020

It's that time of year again! Fellowship deadlines are fast approaching. Writing a fellowship is an important exercise for any scientist and winning a fellowship is important for any career.



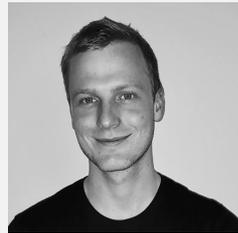
Remote Teaching Tips and Tricks

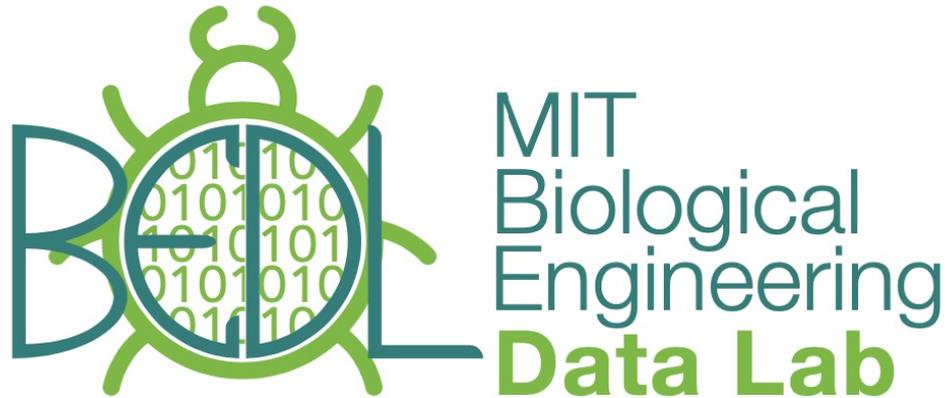
July 20, 2020

Remote teaching comes with its own challenges. The BE Comm Lab, in collaboration with the BE-TLL Teaching Fellow Program, compiled this list of remote teaching tips and tricks.

Make an appointment: mitcommlab.mit.edu/be

Comm Lab Fellows are available to help you revise, rehearse, and get fresh perspective



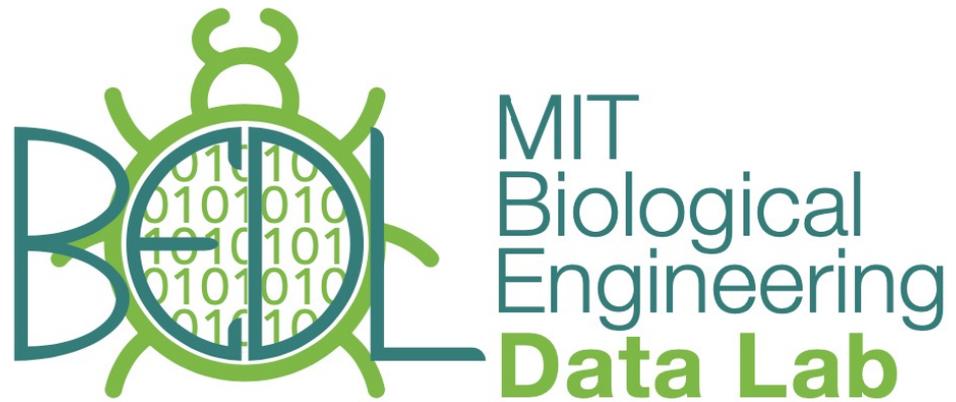


A peer-to-peer educational community supporting computational novices, competent practitioners, and experts in their journey to learn new languages and use those languages to answer important world problems.

Find us at: bedatalab.github.io

Policies:

- Appointments need to be made at least 1 day in advance
- Please respect the fellows time!
- Double check if you made an in person or virtual appointment



56-211 Team