20.109 Communication Workshop 1: Designing Effective Figures

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Why care about science communication?

What do you think of the quality of science communication that you've encountered?

We often blame ourselves for struggling to understand talks or papers,

but poor communication is often the barrier – not your scientific understanding.

You're already a good *reader* of science,
and that means you can give good feedback.

"I got stuck here. I feel like there was a
huge logical leap I couldn't follow."

"There's way too much going on in this plot.
What am I supposed to be looking at?"

What makes you feel that communication was successful?

As the reader…

"I got it!"

Message, "so what?"	Context justifies importance Scientific question is clear, compelling Significance + novelty explained
Visuals	Appealing Uncluttered All relevant information present + easily located
Overall style	Logical flow Concise Minimal jargon

What makes you feel that communication was successful?

As the writer…

"I got what I wanted!"

useful feedback
a good grade
a grant
an investor
a citation

In these workshops, we'll work on turning your instincts as a reader of science into a toolset for…

- identifying when scientific communication is confusing
- identifying WHY it's confusing
- fixing the problem

…and start applying these tools to your 20.109 communication tasks.

Workshop structure

1. Discuss an example from the field
2. Derive principles and strategies
3. Practice strategies
4. Go home with a checklist/rubric

Figures and Captions: why start here?

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

- Hold your "naked" data up to be judged.

- Tell your story compellingly AND honestly.

- Expert audiences may read only Title, Abstract, and Figures.
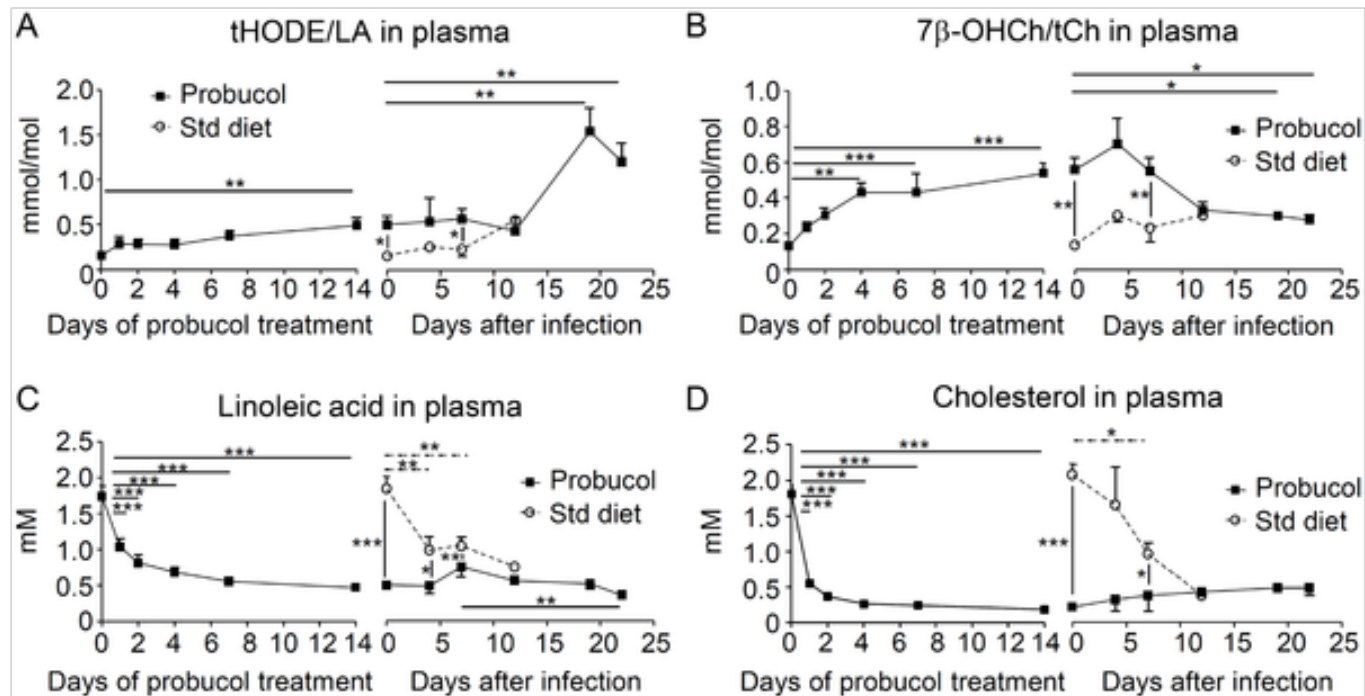
What are the basic components of a figure?

Fig 4. The ratios of lipid peroxidation products to parent lipids in plasma increased after probucol pre-treatment.
Six-week-old C57BL/6J mice were treated with 1% w/w probucol in the diet for 2 weeks and then infected with 0.2 mL of 1×10^5 erythrocytes /mL infected with *Plasmodium yoelii* XL-17. Plasma samples were obtained at day 0, 1, 2, 4, 7, and 14 after starting the probucol diet (n = 5 per group) and at day 0, 4, 7, 12, 19, and 22 post-infection (n = 2 to 7). The ratio of total hydroxyoctadecadienoic acid (HODE), a peroxidation product of linoleic acid (LA), to linoleic acid (tHODE/LA) in plasma (A) and the ratio of 7β-hydroxycholesterol (7β-OHCh), a peroxidation product of cholesterol, to total cholesterol (7β-OHCh/tCh) in plasma (B) were measured. The concentration of LA (C) and tCh (D) were measured by using gas chromatography-mass spectrometry (GC-MS). All data are expressed as mean ± SE. Statistical analysis was carried out by analysis of variance (ANOVA). *$p < 0.05$, **$p < 0.025$, and ***$p < 0.001$. The solid bars indicate the significant changes in probucol-treated groups and the dotted bars indicate the significant changes in standard (Std) diet-fed mice.

Basic figure components

Figure = message + data

Title

Choice of data

Presentation choices
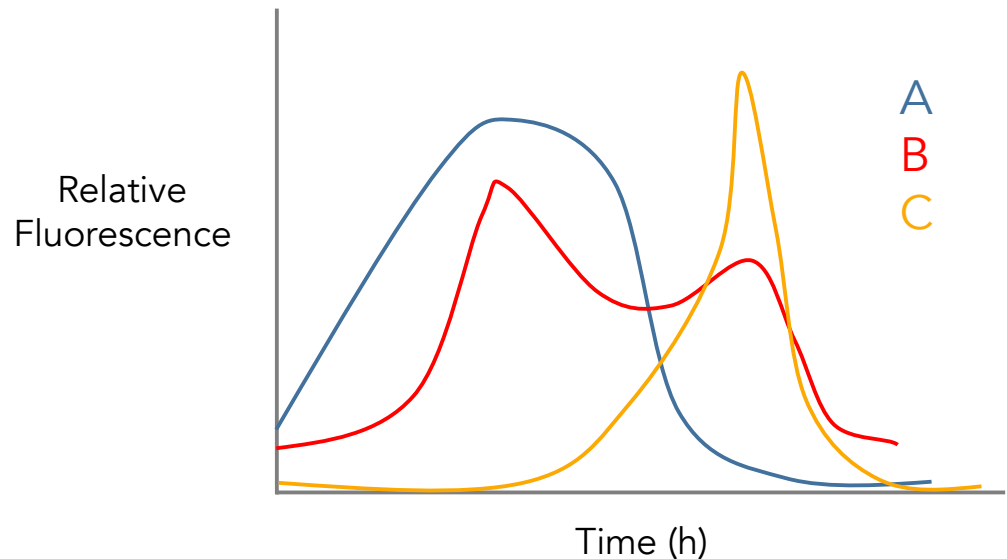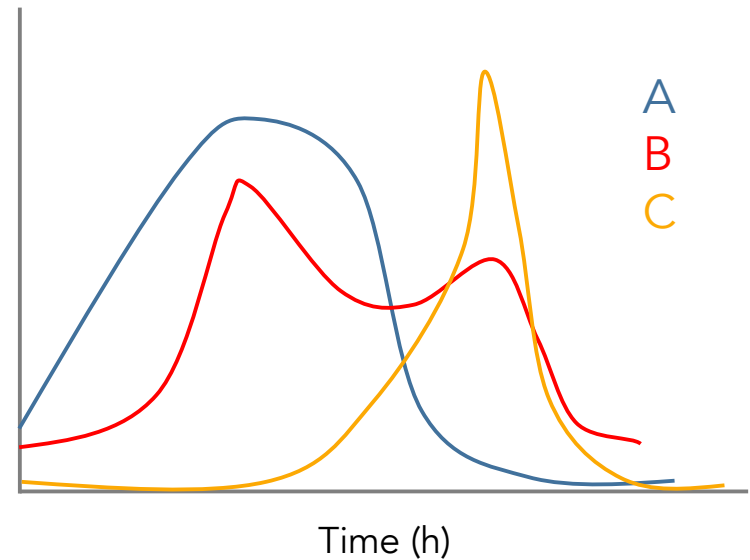
Caption

Relative Fluorescence

A
B
C

Time (h)

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.

Basic figure components

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Relative
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Time (h)

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.

Basic figure components

Figure = message + data

| Title	• Take-home **message** of the figure • What conclusion should the reader evaluate when looking at the figure?
Choice of data	• Only data that are critical to the conclusion
Presentation choices	• Type of graph or display, legends & labeling, design choices • Uncluttered • Allow quick evaluation of conclusions, without referring to legend or caption.
Caption	• **Descriptive**, not explanatory/interpretive. • Only enough methodological detail to make it clear how results were obtained.

Maximize signal-to-noise:

State your message.
Eliminate anything that distracts from it.
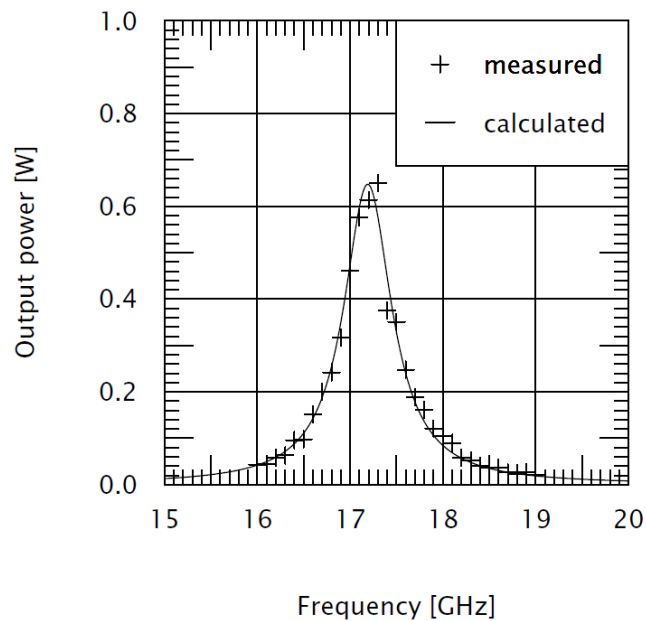
Low signal-to-noise ratio

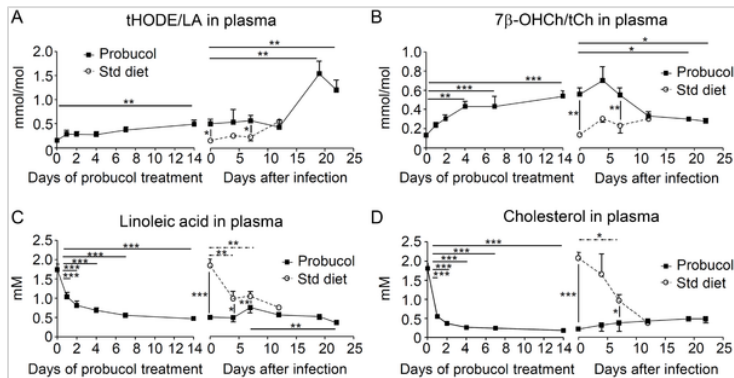The background interferes with the data.
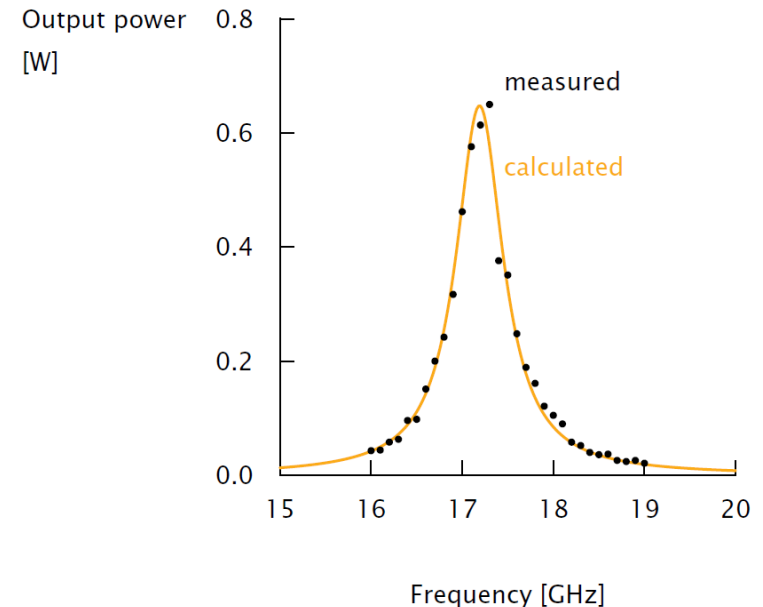
High signal-to-noise ratio

Only the necessary information is shown.

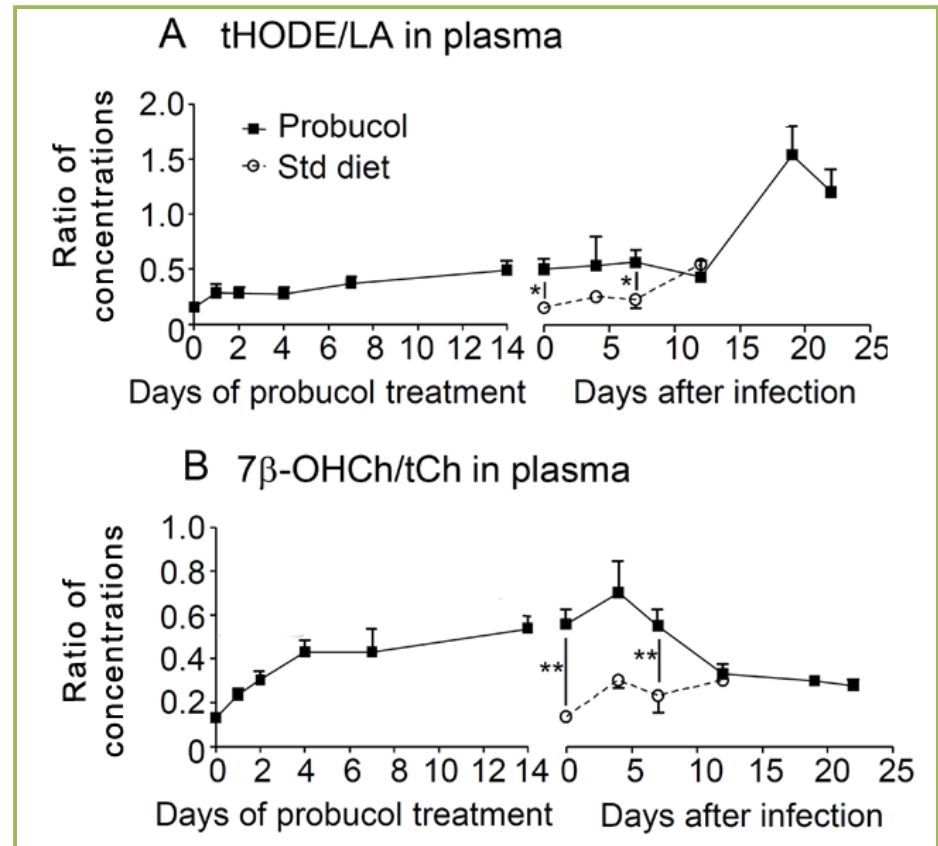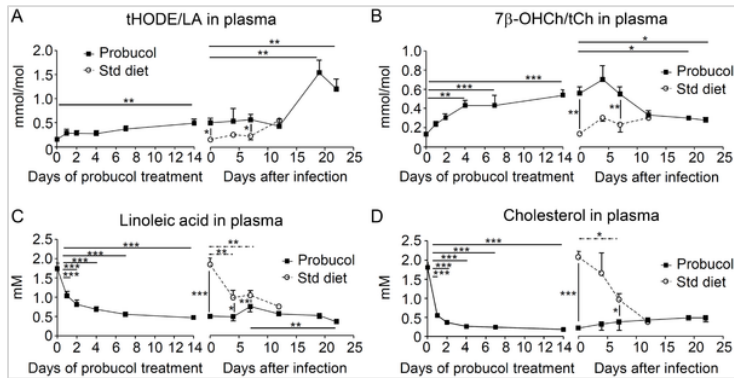# Activity: Evaluate and improve this figure.

Checklist

☐   Choice of data

☐   Title/caption

    •   Can figure stand alone?

☐   Consistent layout

    •   Fonts, spacing, colors

☐   Text amount and placement

☐   Scale, axes, tick marks

☐   Statistics

☐   Ink-to-whitespace ratio

Only include the minimum information necessary to draw a conclusion.

Schematics and diagrams need titles and captions, too.

Although captions may become more title-like.

Phrase a title as a complete sentence to make sure it's a message.

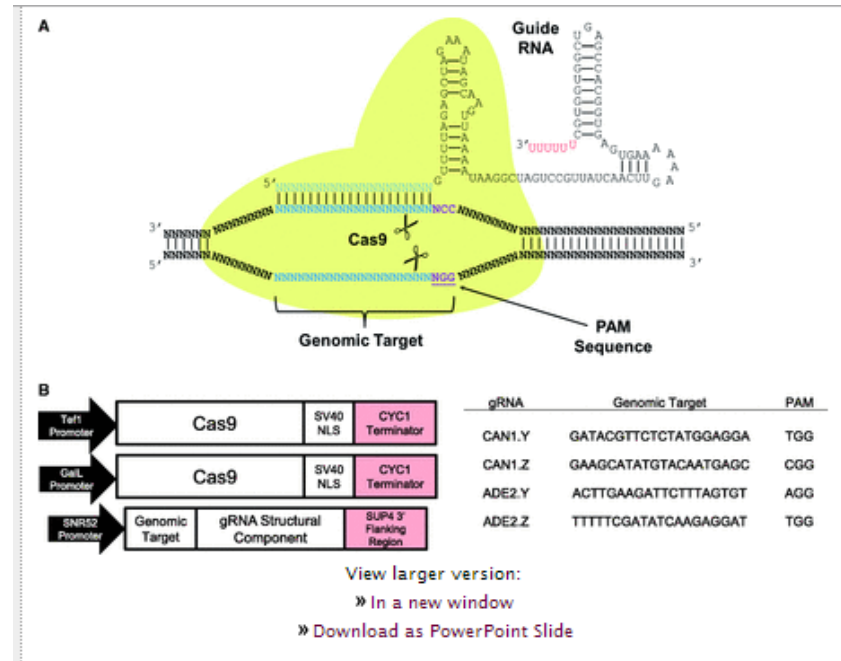*(B) Cas9 and gRNA constructs were designed to target SV40.*

Figure 1.
Diagram of Cas9 complex and schematic of genetic constructs. (A) Illustration of Cas9 protein interacting with CRISPR gRNA to direct 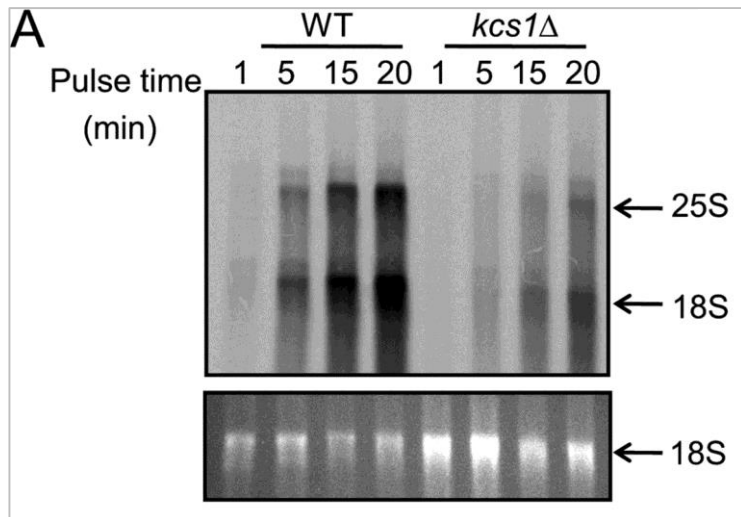endonuclease activity proximal to the PAM sequence. (B) Design of the Cas9 and gRNA constructs. Cas9 gene contained a SV40 nuclear localization signal and was expressed under the Gal-L inducible promoter in CAN1 experiments and the TEF1 constitutive promoter in ADE2 experiments. The gRNA was

DiCarlo et al., 2013 Nuc. Acids. Res.

Next steps

- Presentation → Wiki

- How can these workshops serve you better?

  Let me know: dchien@mit.edu

- Two weeks: Abstracts and Titles

- Suggestion for M1D4 polyacrylamide gel figure (and beyond): Find published examples and copy presentation strategies that you like.
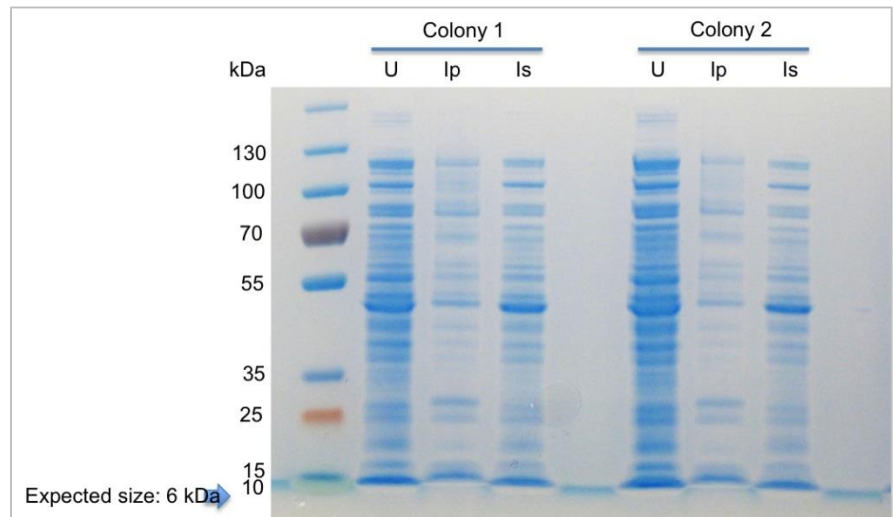
Activity: share and critique your M1D3 schematic drafts.

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