Creating clear & informative images for scientific publications

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BIH QUEST
Transforming Biomedical Research

BIH Berlin Institute of Health
Charité & MDC

Aus Forschung wird Gesundheit

Data presentation is the foundation of our collective scientific knowledge

Figures are especially important.

They often show data for the most important findings.

Common, but incorrect, assumptions

1. Readers read the abstract, introduction & methods before seeing the figures
2. If I can interpret the figure, then my readers can interpret the figure

Design figures for your audience, not for yourself

Your readers include:

- Scientists in your field or related fields
- Reviewers & editors
- Grants officers
- Educators
- Patients

Things that are clear to you may be very confusing to readers with different expertise

Rolandi et al., DOI: 10.1002/adma.201102518

Example: How much information would you need to interpret this image?

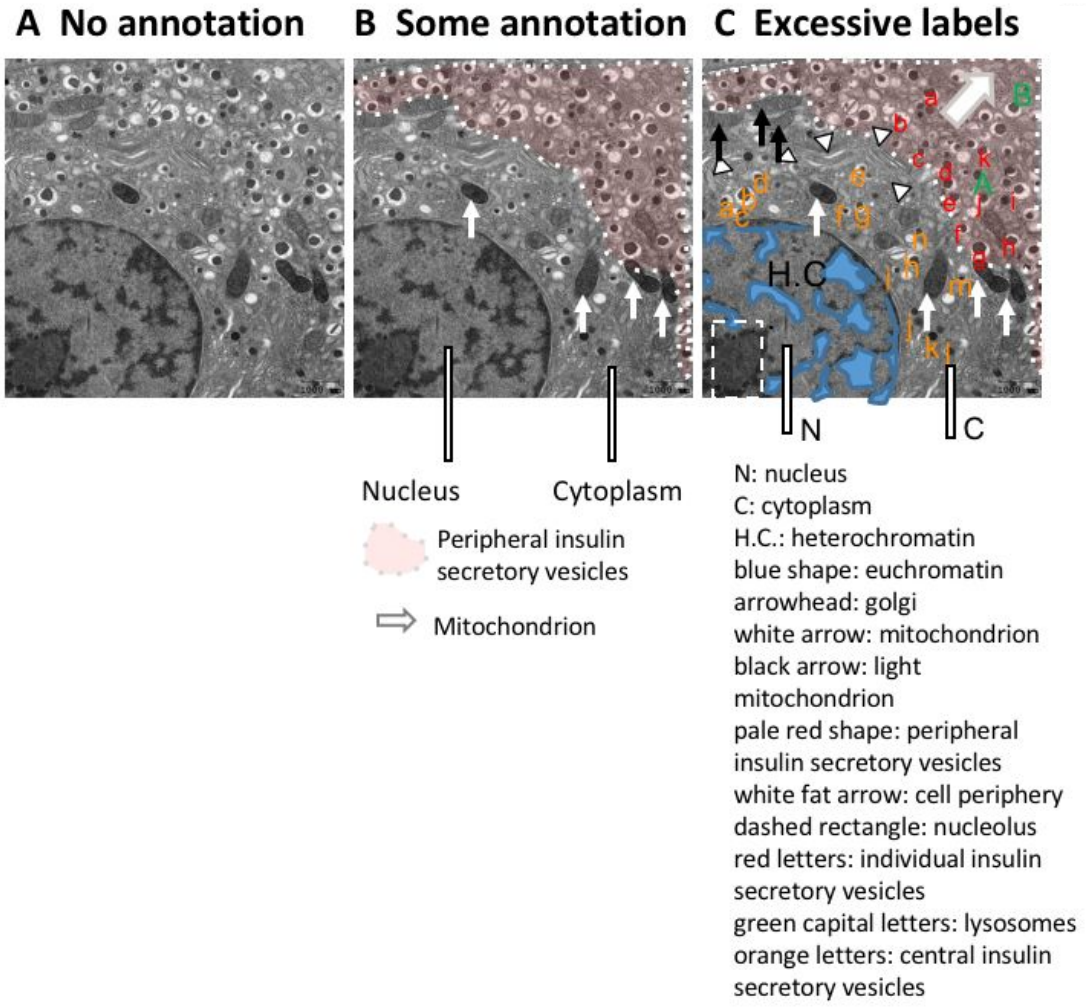

Figure from Jambor et al., DOI: 10.1371/journal.pbio.3001161

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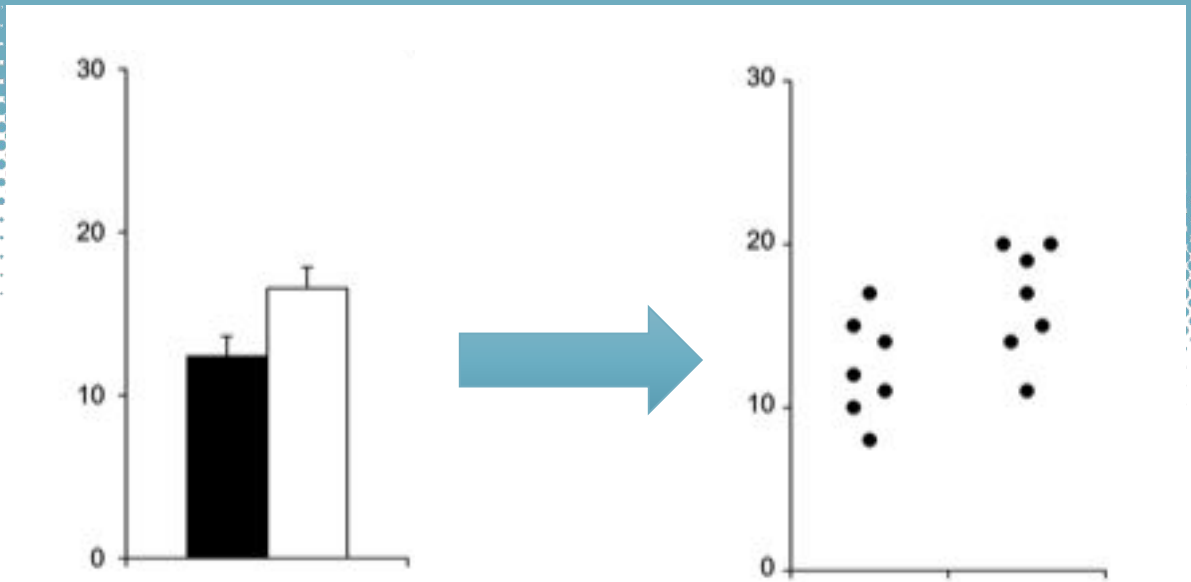
Fixing common visualization problems

Replace bar graphs of continuous data with more informative graphics



“Why shouldn’t I use a bar graph to present continuous data?”

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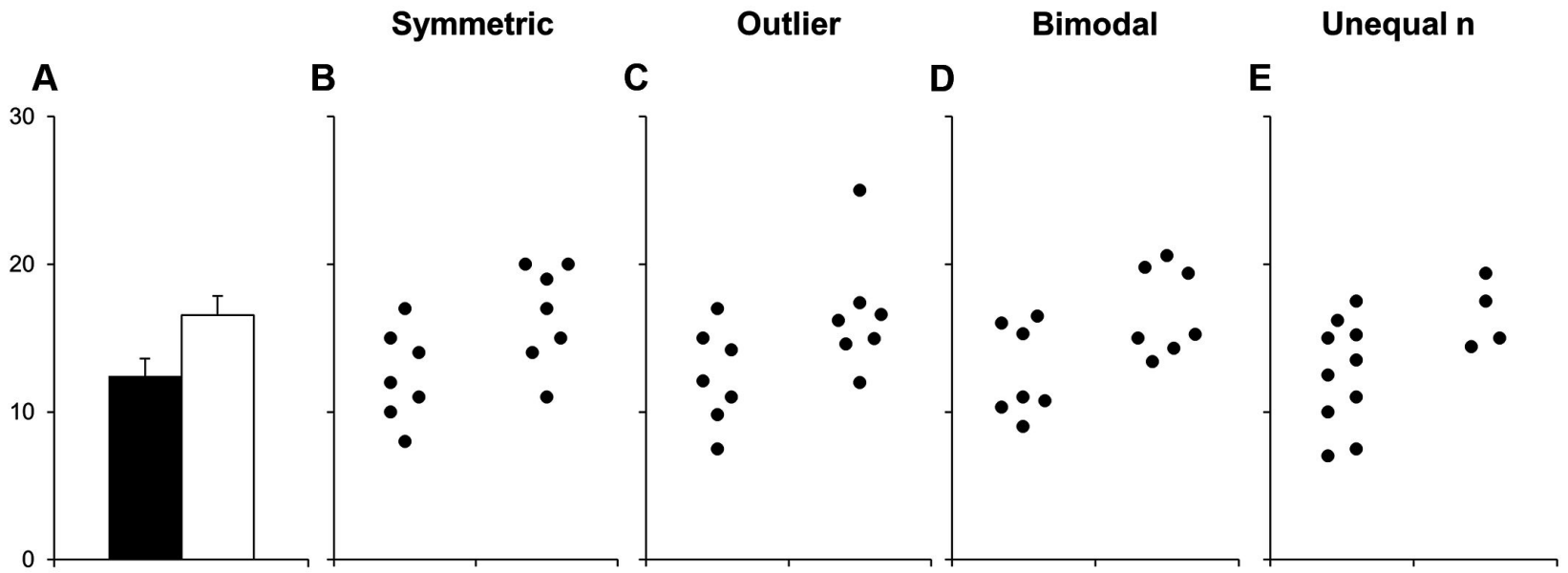
Many different data distributions can lead to the same bar graph...



Test	p value			
T-test: Equal var.	0.035	0.050	0.026	0.063
T-test: Unequal var.	0.035	0.050	0.026	0.035
Wilcoxon	0.054	0.073	0.128	0.103

The actual data may suggest different conclusions from the summary statistics alone

DOI: 10.1371/journal.pbio.1002128

“Can I still use a bar graph if I know that my data are normally distributed?”

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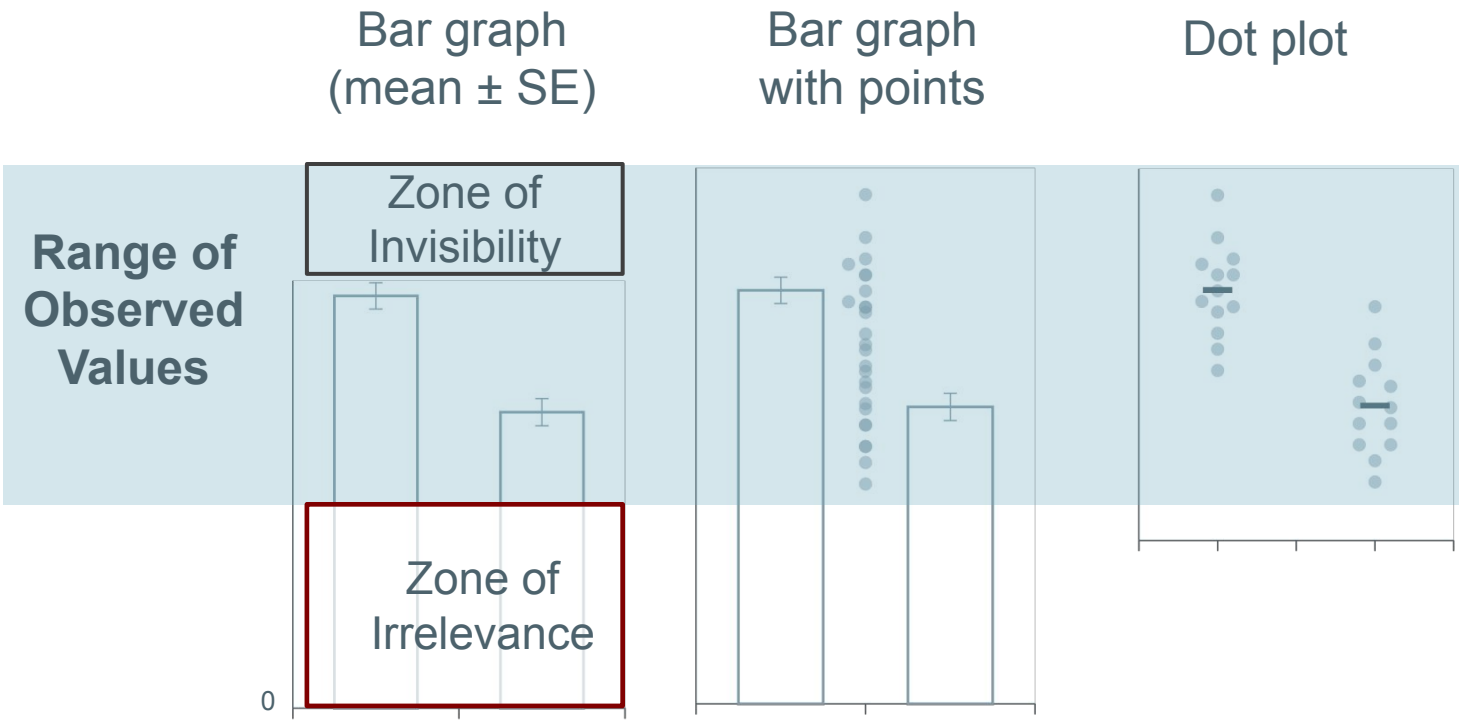
Why you shouldn't use a bar graph even if your data are normally distributed



Bar graphs

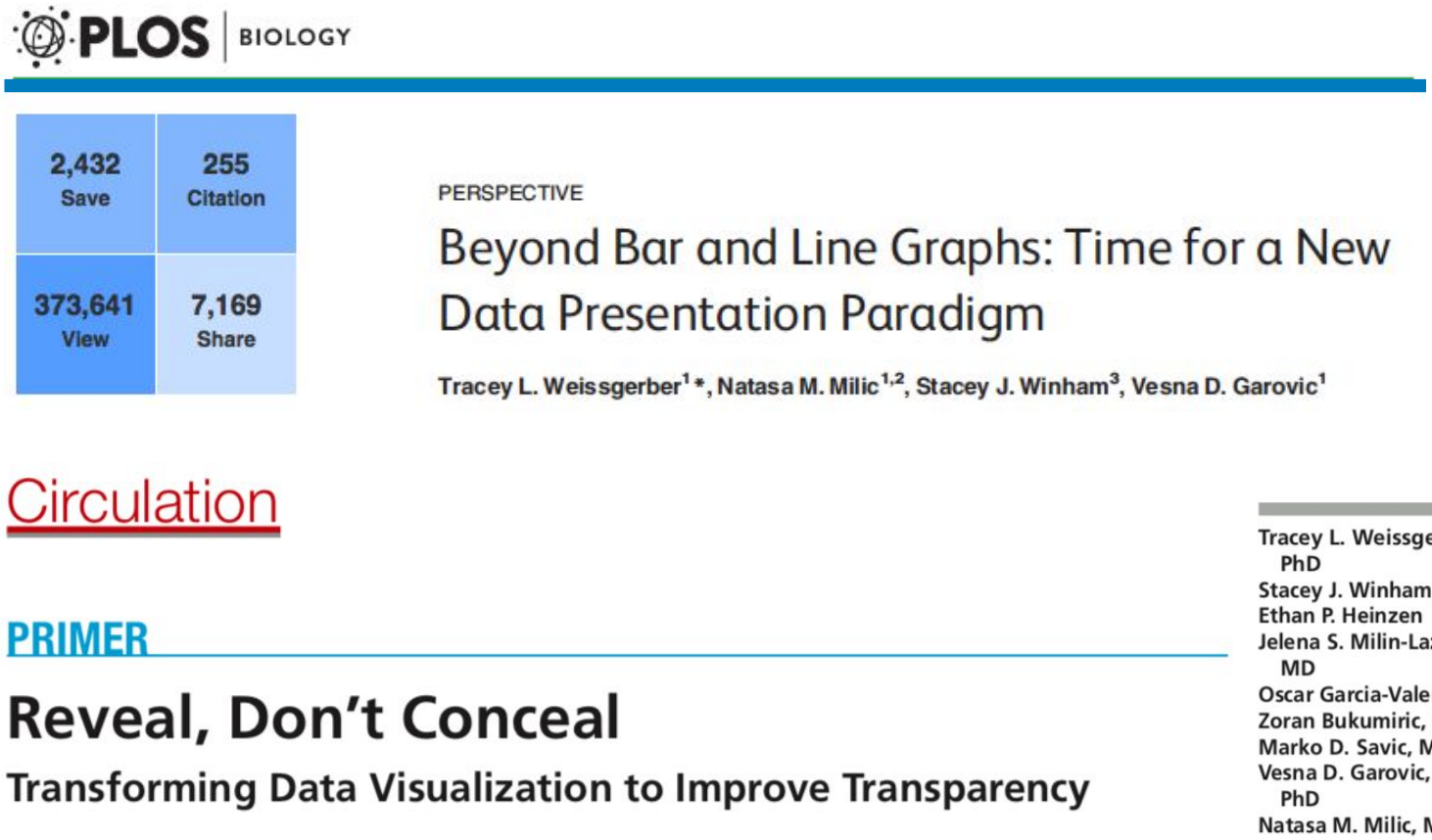
1. Don't allow you to critically evaluate continuous data
2. Arbitrarily assign importance to bar height, rather than focusing on how the difference between means compares to the variability in the data

DOI: 10.1074/jbc.RA117.000147

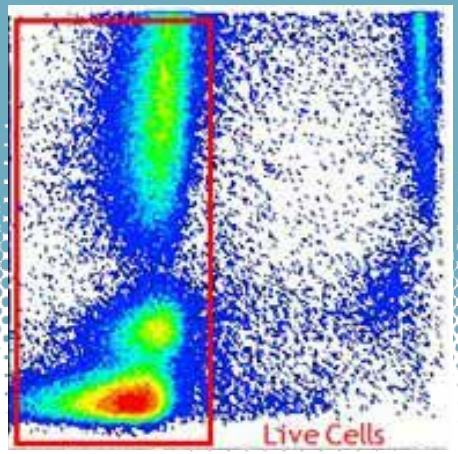
What should you use instead of bar graphs?

Everything you need to know in a Twitter thread:
https://twitter.com/T_Weissgerber/status/1192694904603992064

See the webinar resources list for solutions, including papers & a free webinar



Replace jet (rainbow) colormaps with colorblind safe alternatives (e.g. Viridis, Cividis)



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Rainbow colormaps create contrast where none exists

Normal

Jet colormap

Virdis colormap

Visualizations created by Hyujun Ji, posted at peterjamesthomas.com

We interpret the data incorrectly

Also, rainbow colormaps aren’t colorblind safe

Make your figures colorblind accessible

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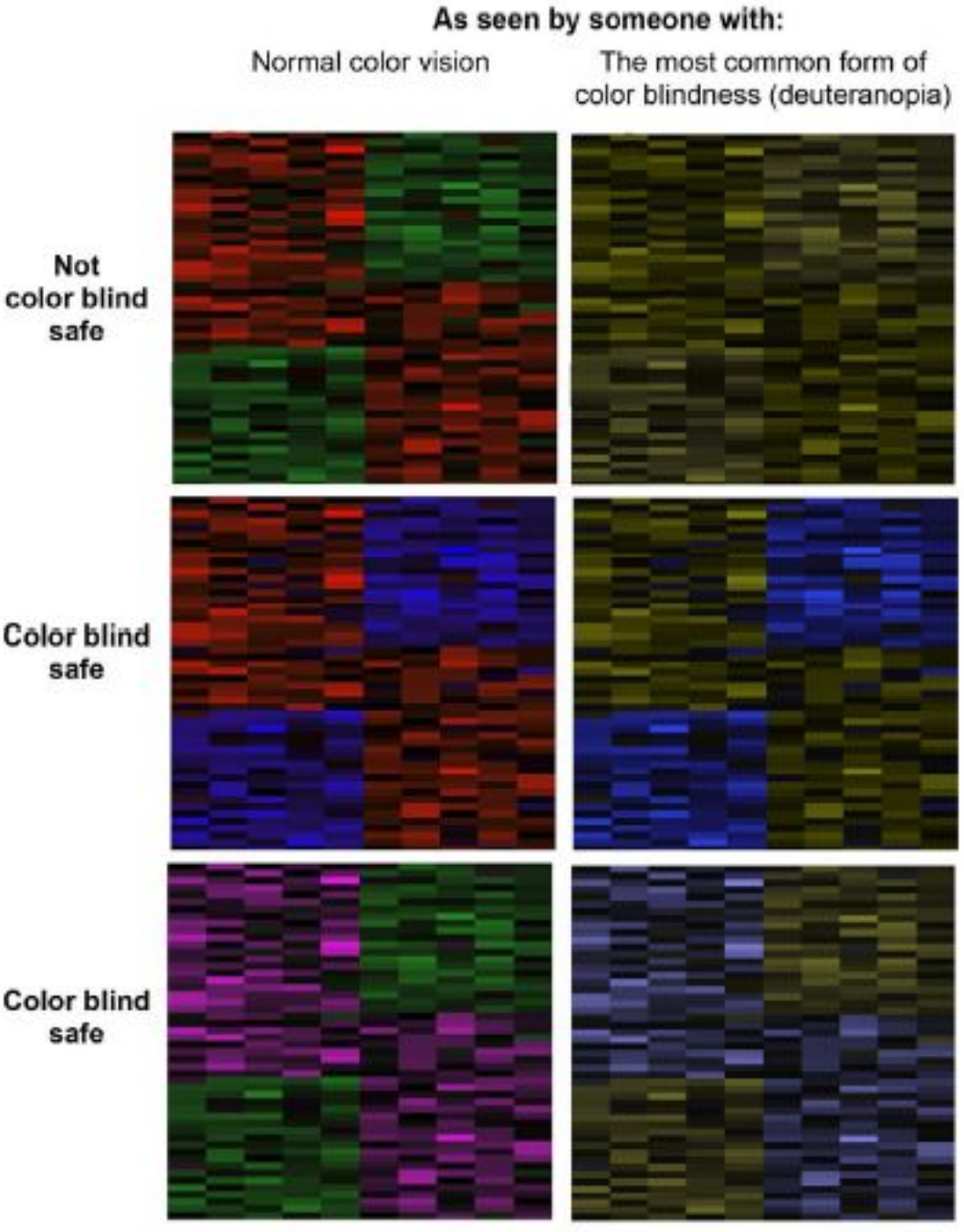

1. Choose colorblind accessible colors for figures & annotations
2. Use free tools to simulate what a colorblind person would see (e.g. Color Oracle https://colororacle.org)

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Include a flow chart
to help readers understand your study design & assess the risk of bias

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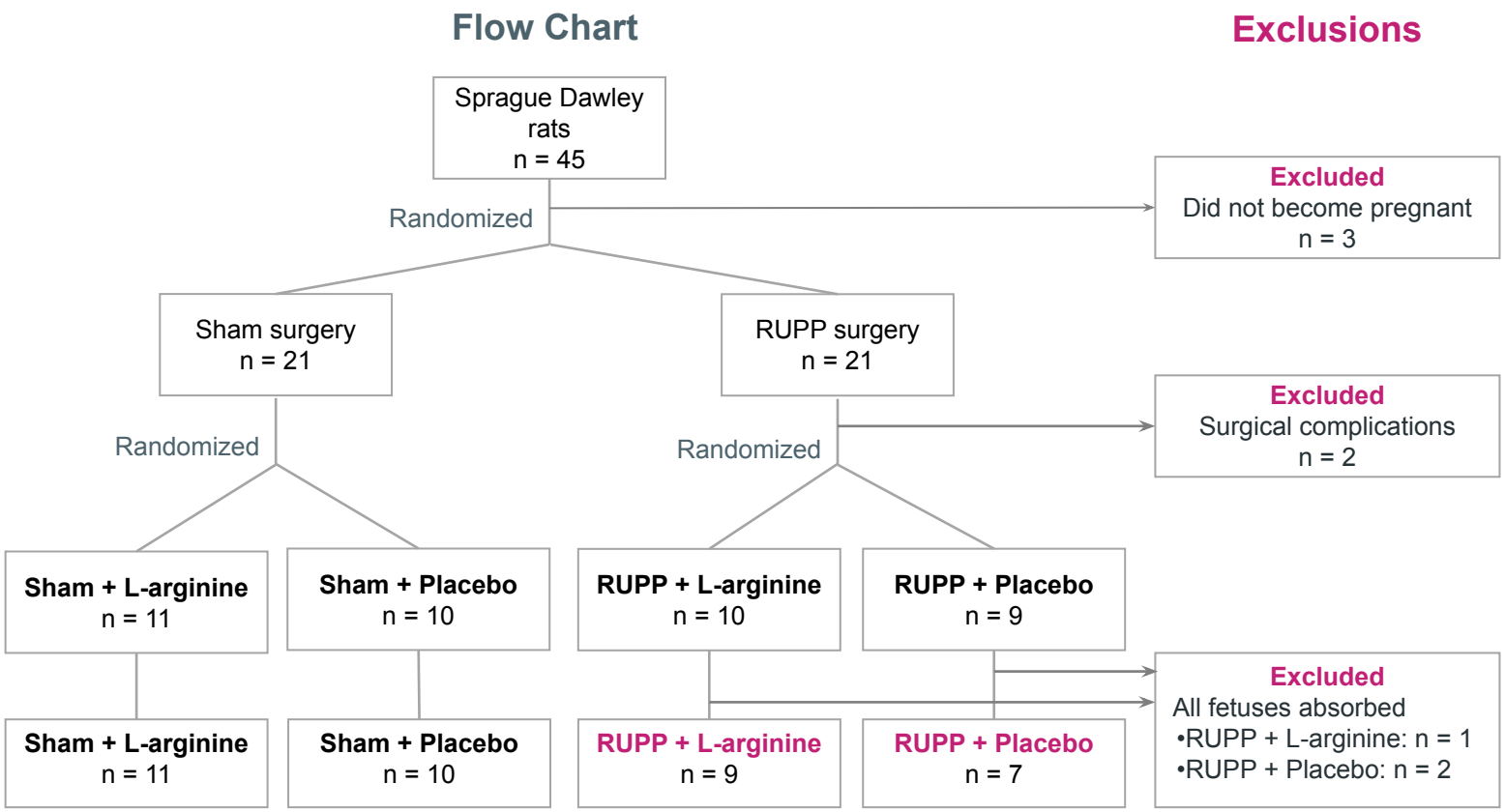
Flow charts tell readers when you excluded observations, and why



Check reporting guidelines for your study type to find flow chart templates (e.g. ARRIVE for animal studies, STROBE for observational studies, CONSORT for RCTs)

Most papers don't include flow charts

Only 20.4% articles published in top peripheral vascular disease journals had flow charts


OPEN ACCESS PEER-REVIEWED

META-RESEARCH ARTICLE

Where Have All the Rodents Gone? The Effects of Attrition in Experimental Research on Cancer and Stroke

Constance Holman, Sophie K. Piper, Ulrike Grittner, Andreas Antonios Diamantaras, Jonathan Kimmelman, Bob Siegerink, Ulrich Dirnagl

Biased exclusion of animals greatly increases the likelihood of false positive findings in small studies

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Next speaker

Guillaume Rousselet
University of Glasgow

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