

"Centering the Edges"

Making science communication more accessible to people with disabilities, and ultimately, everyone

American Chemical Society

ACS Fall 2024

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What do these inventions have in common?

- Curb cuts
- Closed captions
- Electric toothbrushes
- Audio books
- Speech-to-text
- Voice recognition apps (Alexa, Siri, Google Home, etc.)



A. Hoyt. [8 Everyday items originally invented for people with disabilities](#). HowStuffWorks. Feb. 2024

Whom Accessibility Impacts



- 15% of the world's population has a disability¹
- An estimated 300 million people have a color vision deficiency (color blindness)
 - 1 in 12 men; 1 in 200 women
- These numbers increase substantially with the following disability types:
 - Temporary
 - Non-disclosed
 - Age-related
- Consider the broad benefits of accessibility for *everyone...*

World Health Organization, "[Disability](#)," March 7, 2023.
Colour Blind Awareness. [About Colour Blindness](#).

Outline

- Role of accessibility, inclusion, and equity at ACS
- Who is impacted
- Steps to make your poster more accessible



Goal 5

Embrace and Advance Inclusion in Chemistry

- Promote diversity, equity, inclusion, and respect;
- Identify and dismantle barriers to success;
- Create a welcoming and supportive environment so that all ACS members, employees, and volunteers can thrive.



How We Define “Accessibility”

Accessibility

- Design of physical and digital environments...
- that ensures everyone regardless of disabilities or abilities...
- can access information, products, services, and environments...
- in a way that is inclusive and equal.

Equity

- Not the same as equality
- Refers to fairness
- Considers various advantages or disadvantages
- Adjusts processes or steps to obtain a fair outcome

Reframing Moments

1

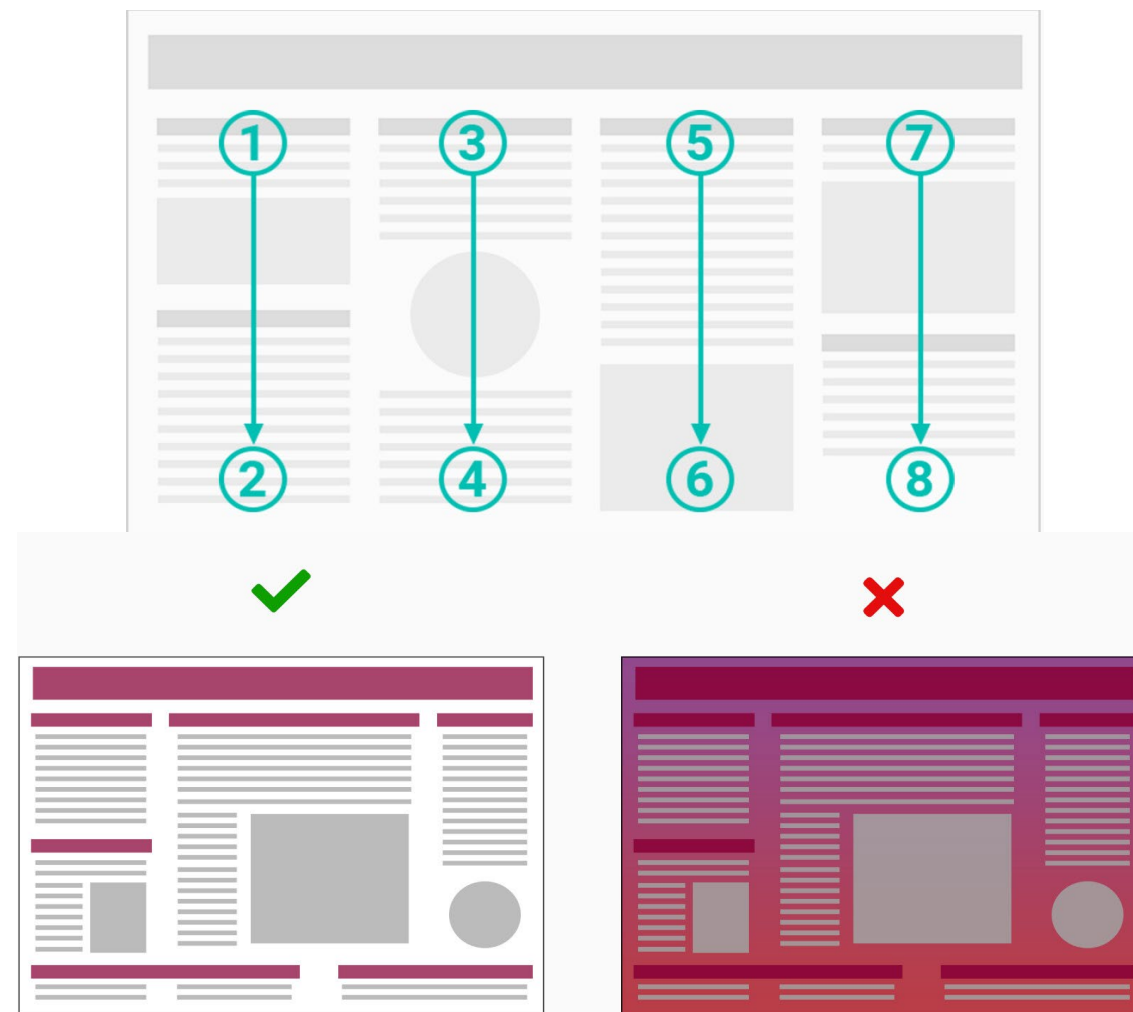
Rethink the assumption that accessibility only helps people with disabilities. It can help many more.

2

Don't design for the "average" user. Design for the "edge case" to develop a robust product for all.

Clean and Thoughtful Poster Design

- Use an easy to follow, chronological order for your data
- Limit text; use graphics rather than text where possible
- Use negative/whitespace to avoid overwhelming readers
- Use a simple background (for posters, use light background and dark text)
- Ensure that images have a minimum resolution of 300dpi for printing



A. Kreckmann. [Poster Design Principles](#). ACS Guide to Scholarly Communication.

Sizing and Font Selection

Font Sizing

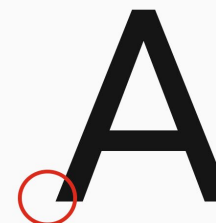
- Titles: 45 – 120 pt
- Headings and subheadings: 26 – 60 pt
- Body text: 24-30 pt

Line Spacing

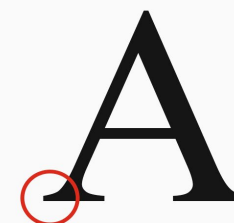
- Double or 1.5 line spacing
- Use bullet points
- Leave at least a 1-inch (25.4 mm) margin around edges

Font Choice

- Sans serif fonts
- Avoid ornate or obscure typefaces
- Adequate spacing between letters and words



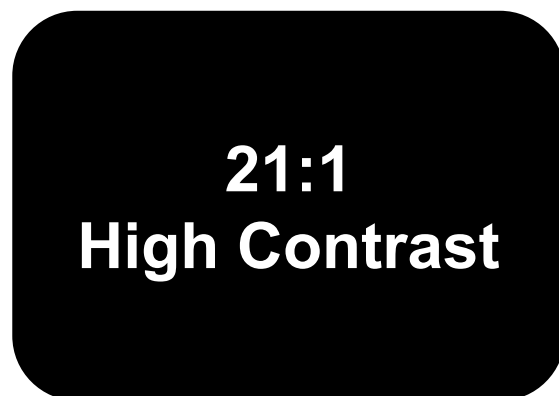
Sans serif



Serif

Use of Color Contrast

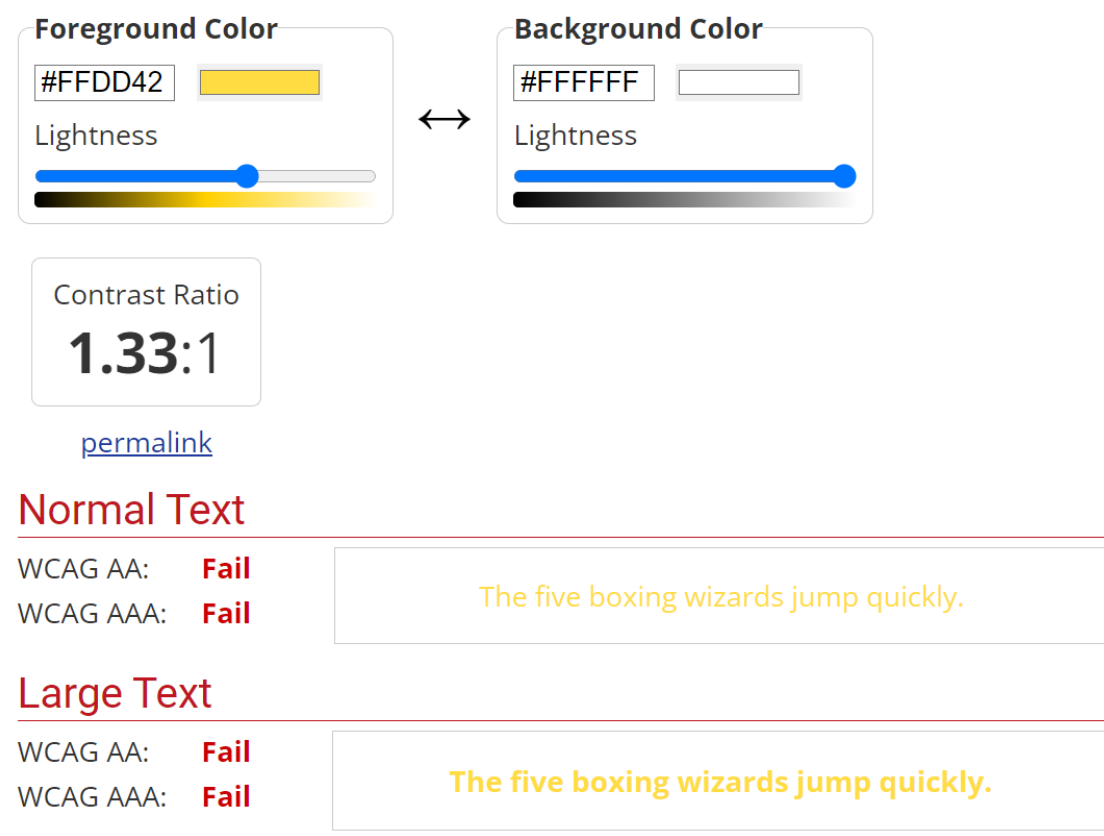
- Color contrast ratio is a measure of brightness of two adjacent colors. Aim for 9.4:1 or higher.
- Helpful for people with low vision, low contrast vision, and color vision deficiency (color blindness)
- Helpful in poor lighting conditions



Bureau of Internet Accessibility, ["The Basics and Importance of Color Contrast for Web Accessibility,"](#) Oct. 1, 2018.
AudioEye. ["Why Does Color Contrast Matter for Web Accessibility."](#) Oct. 13, 2023

How to Measure Color Contrast

- Several free online tools to measure color contrast are available
 - TPGi's [Colour Contrast Analyzer](#) (can download for Windows and Mac)
 - Web Accessibility in Mind's [Contrast Checker](#) (web-based tool)
 - Pilestone's [Color blindness simulator](#)



Foreground Color: #FFDD42

Background Color: #FFFFFF

Contrast Ratio: 1.33:1

[permalink](#)

Normal Text

WCAG AA: **Fail**

WCAG AAA: **Fail**

The five boxing wizards jump quickly.

Large Text

WCAG AA: **Fail**

WCAG AAA: **Fail**

The five boxing wizards jump quickly.

Bureau of Internet Accessibility, "[The Basics and Importance of Color Contrast for Web Accessibility](#)," Oct. 1, 2018.

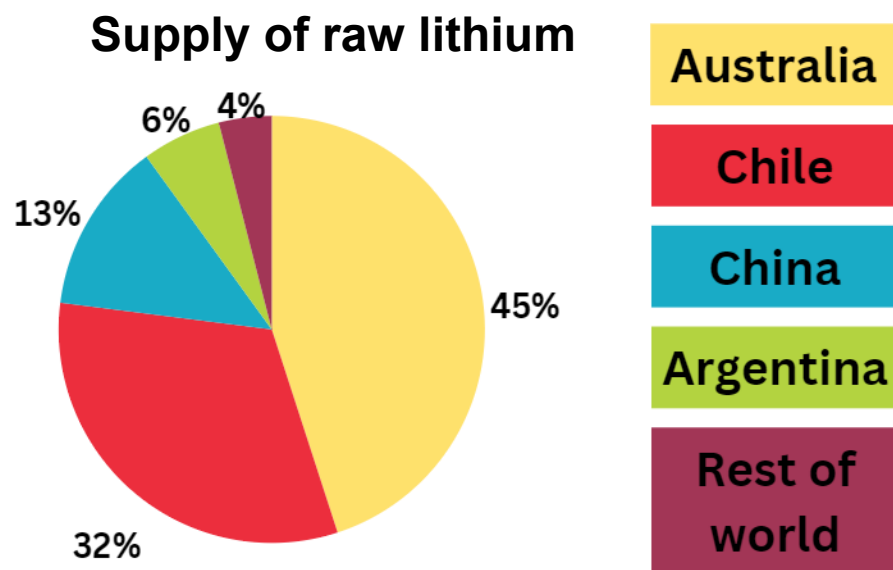
Color to Convey Information



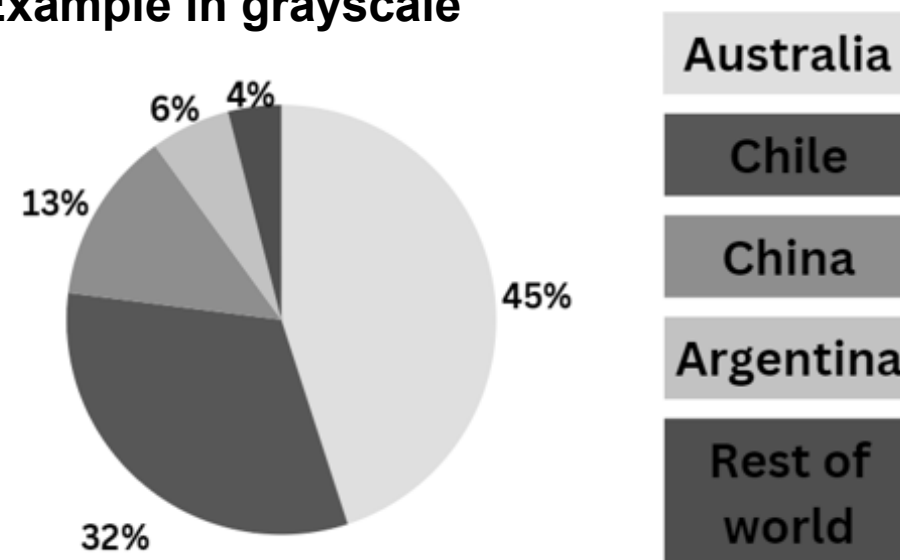
- Remember that digital versions of color can differ from printed versions
- Use more than color to distinguish data sets
- **Who does this help?**
 - People with color-vision deficiencies (color blindness)
 - If your content is viewed in grayscale or inversed colors

Addressing Color in Data (Pie Charts)

- Poor color contrast
- Only uses color to convey information



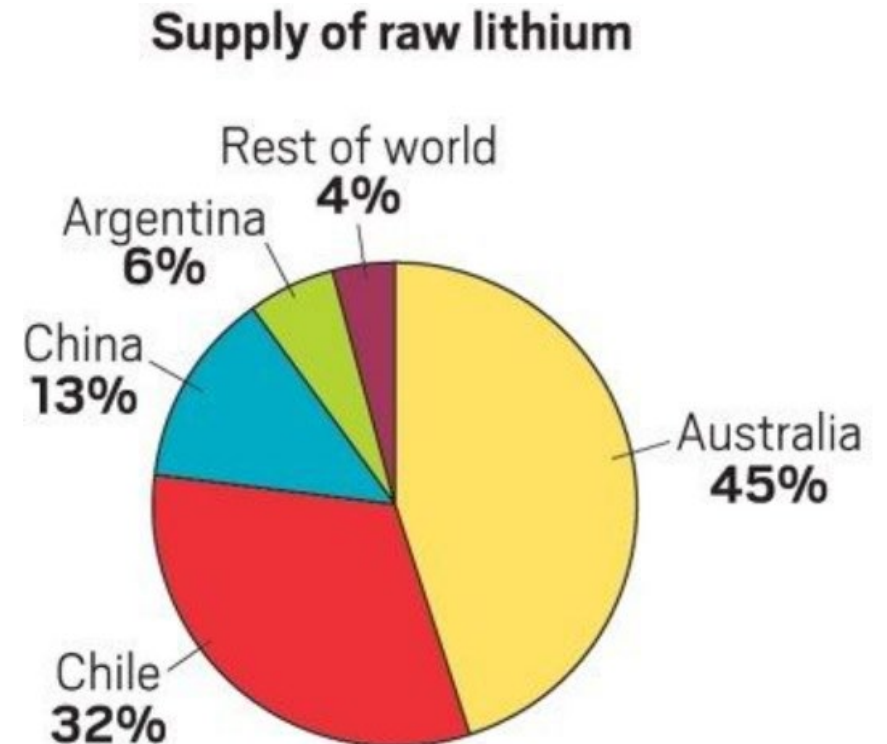
Example in grayscale



C&EN, [“Challenging China’s dominance in the lithium market,”](#) Oct 29, 2022
Source: Benchmark Mineral Intelligence.

Color Remediation Strategies

- Use text to distinguish data sets
- Use dark contrasting borders
- Additional strategies
 - Use monochromatic shades (variations of one color) to provide better contrast
 - Use texture or pattern
 - Include data tables

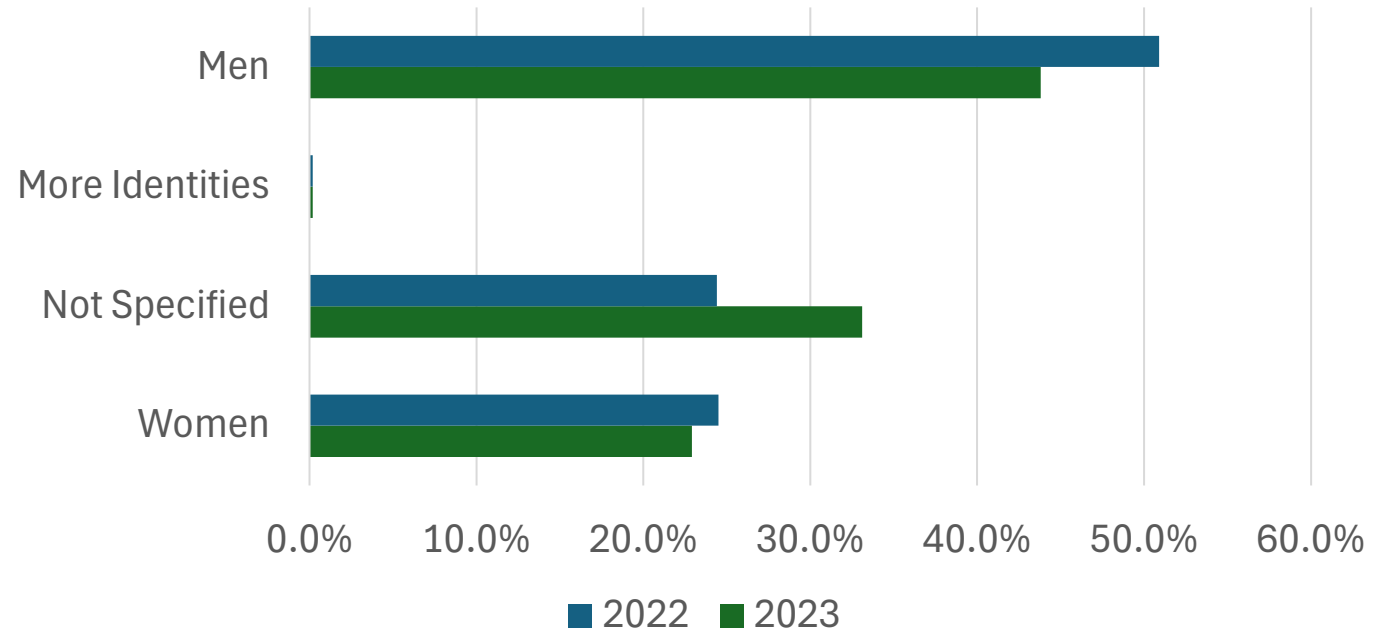


C&EN, "[Challenging China's dominance in the lithium market](#)," Oct 29, 2022
Source: Benchmark Mineral Intelligence.

Bar Graphs

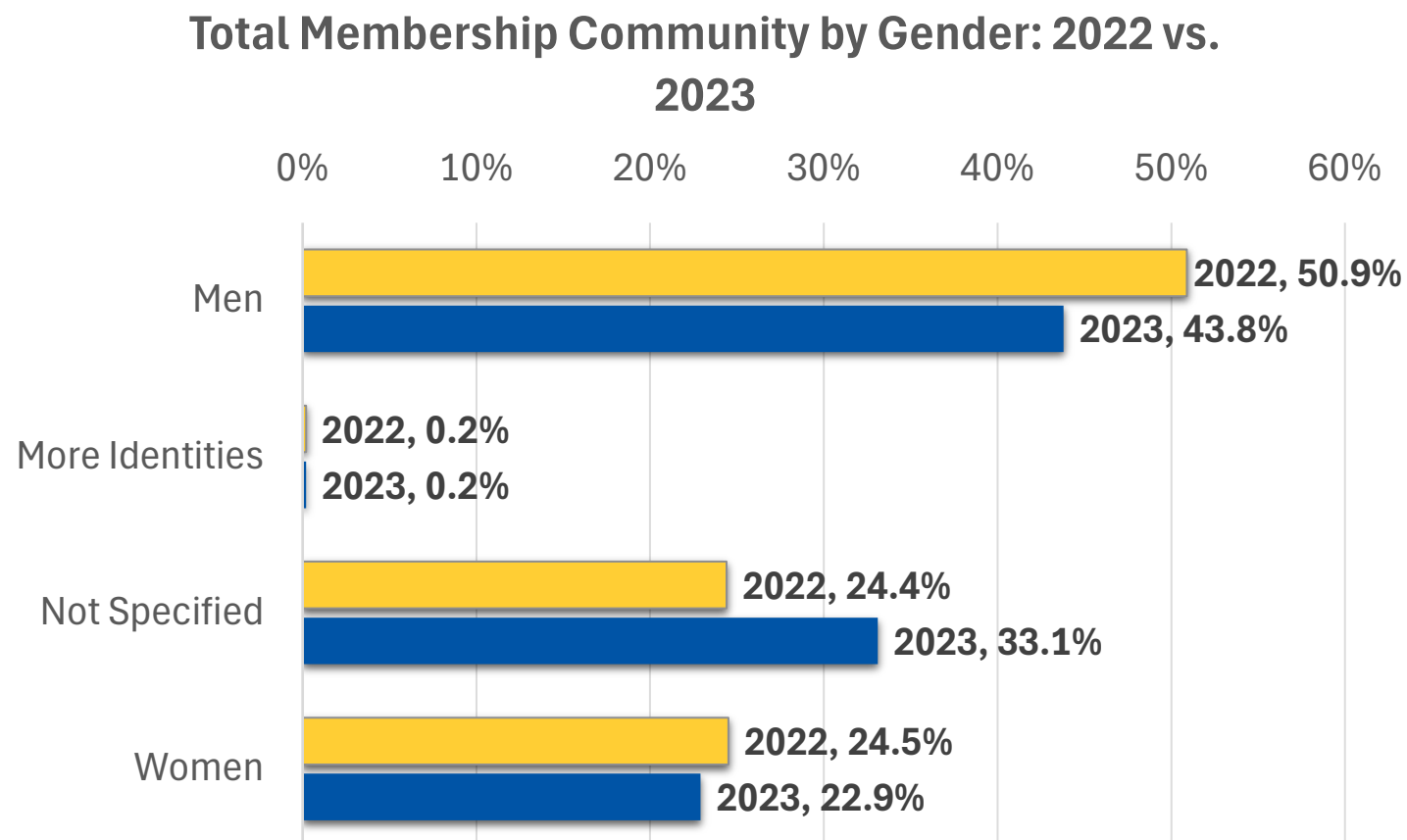
- Color is the only way to distinguish the two data sets
- The two colors may be difficult to distinguish for some

Total ACS Membership Community by Gender: 2022
vs. 2023



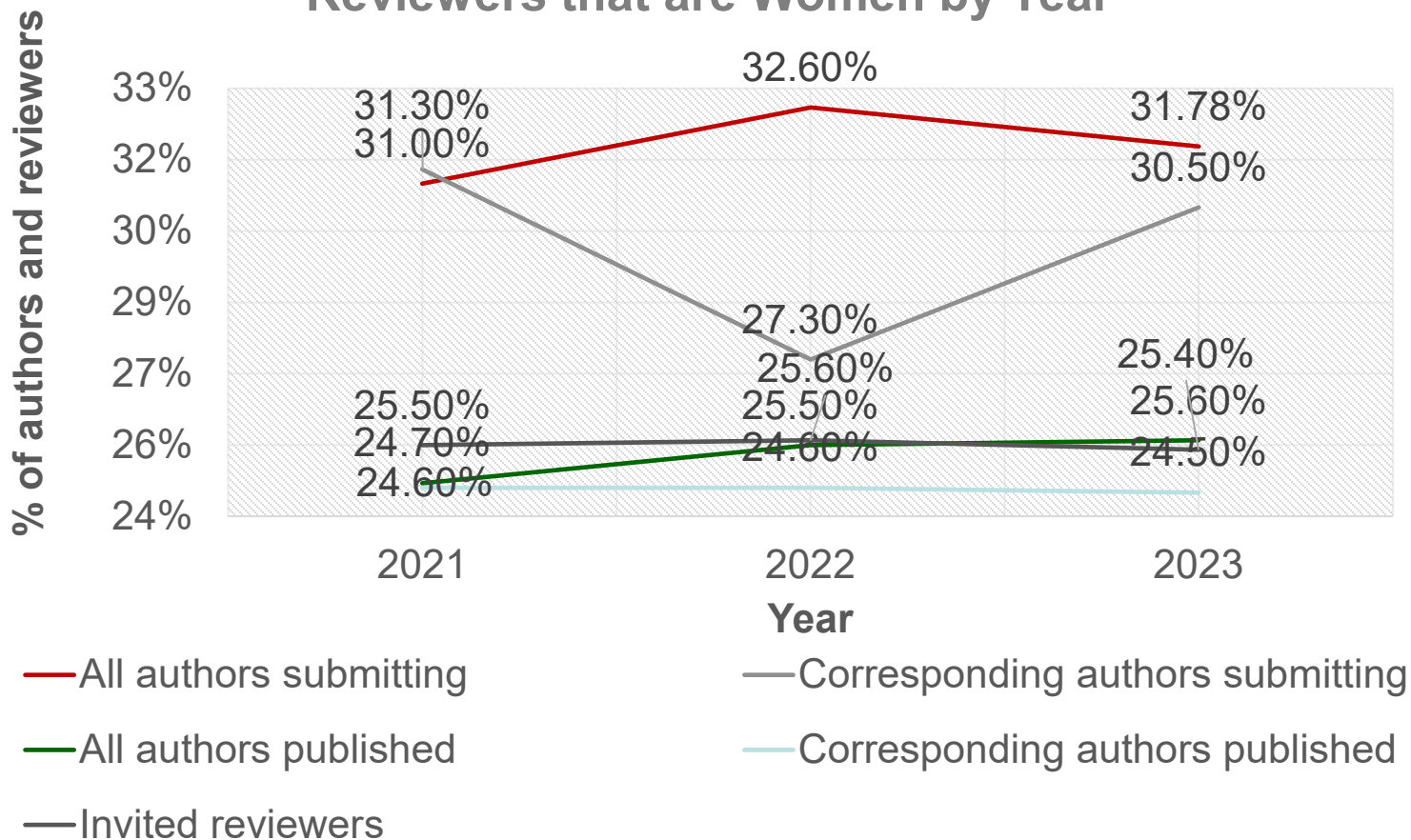
Remediation of Bar Graphs

- Use text or pattern to distinguish data sets
- Use dark contrasting borders
- Additional methods:
 - Monochromatic or color-blind friendly color combinations
 - Include data tables



Line Graphs

Percentage of ACS Journal Authors and Reviewers that are Women by Year



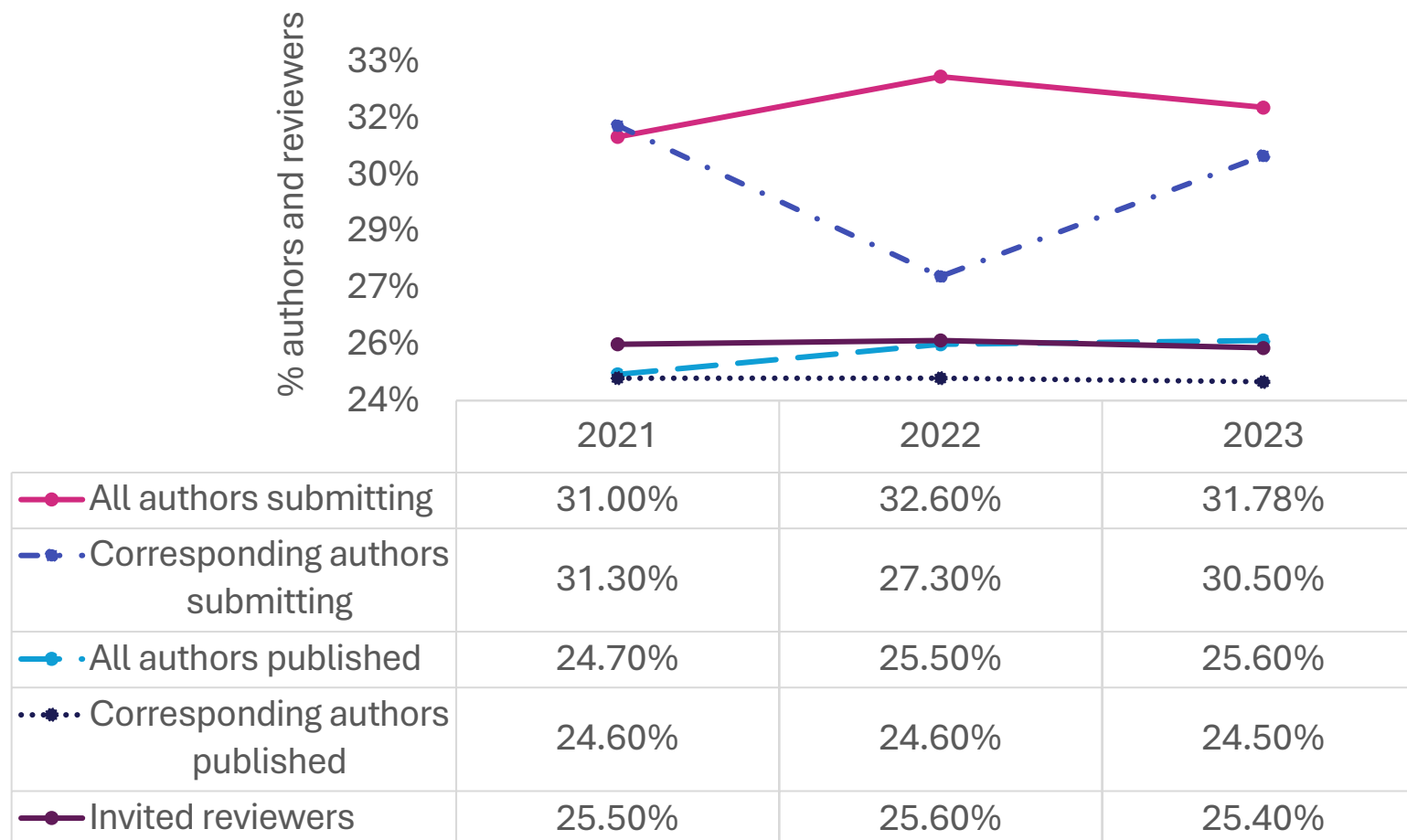
ACS Publications, [Diversity Data Report 2023](#)

- Busy/distracting background (chart junk)
- Difficult to read from a distance
- Poor color contrast of data sets
- Red and green color combinations

Remediation Options for Line Graphs

- Use clean and simple backgrounds
- Use colors with sufficient contrast to background
- Use symbols or line patterns to differentiate data sets
- Consider adding a data table

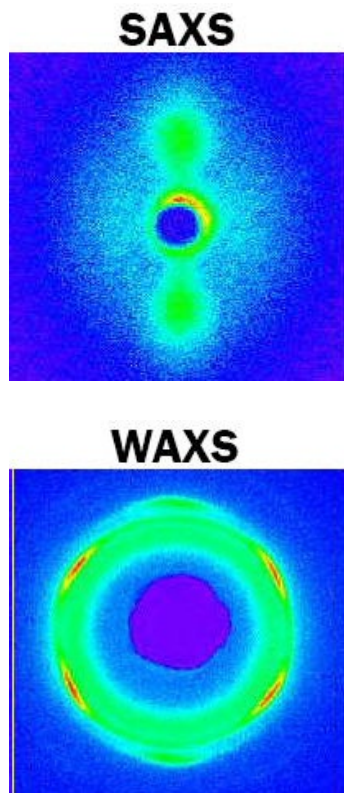
Authoring and Reviewing Activity of Women (2021-2023)



ACS Publications, [Diversity Data Report 2023](#)

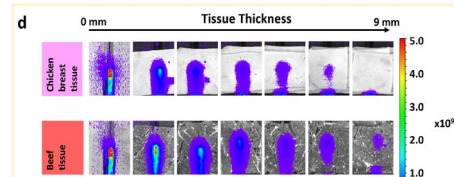
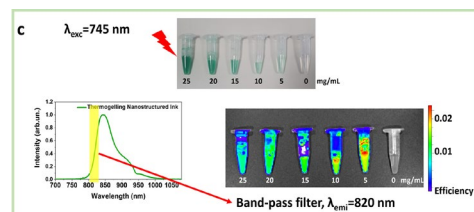
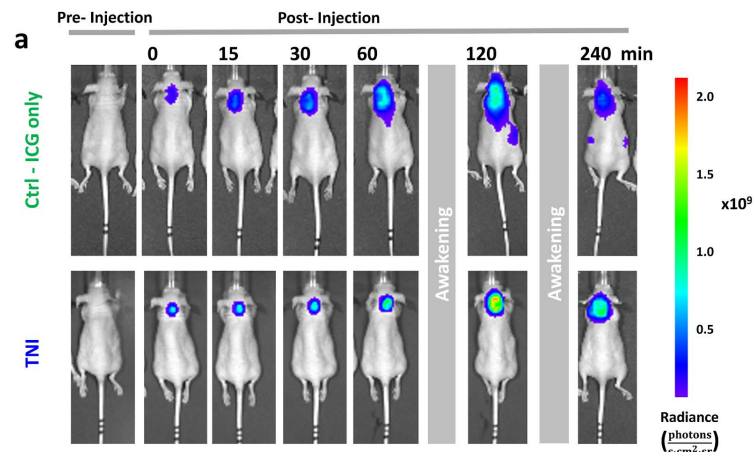
Examples of Commonly Applied Jet Maps

X-Ray Scattering
Data (Small and
Wide Angle)



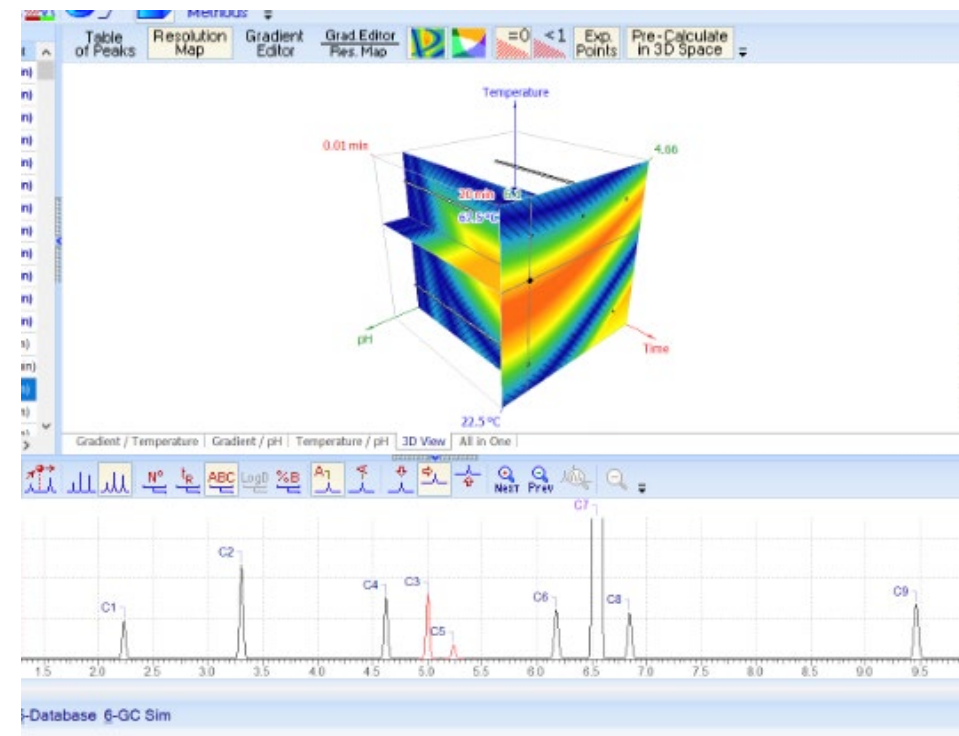
<https://rarpolymer.princeton.edu/facilities/xray-system/statton>

Fluorescence Data

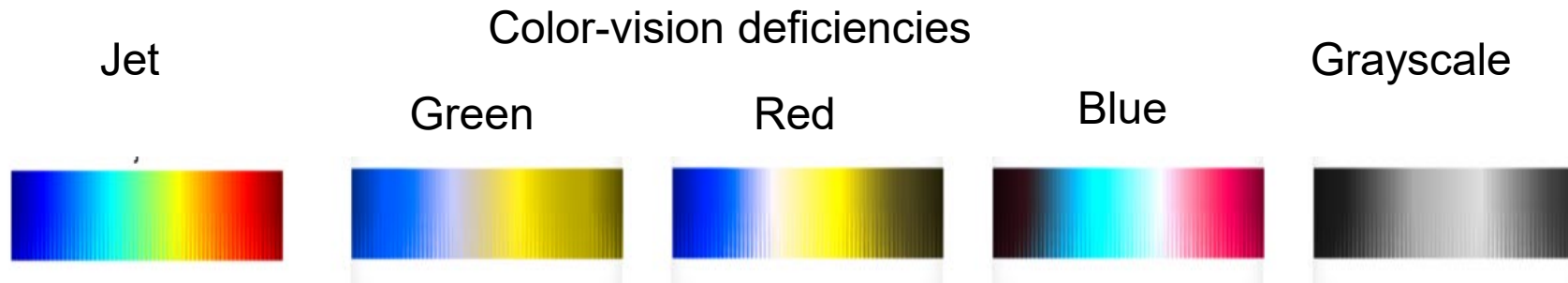


<https://pubs.acs.org/doi/10.1021/acs.biomac.4c00312>

Mapping 3 Dimensions of Data



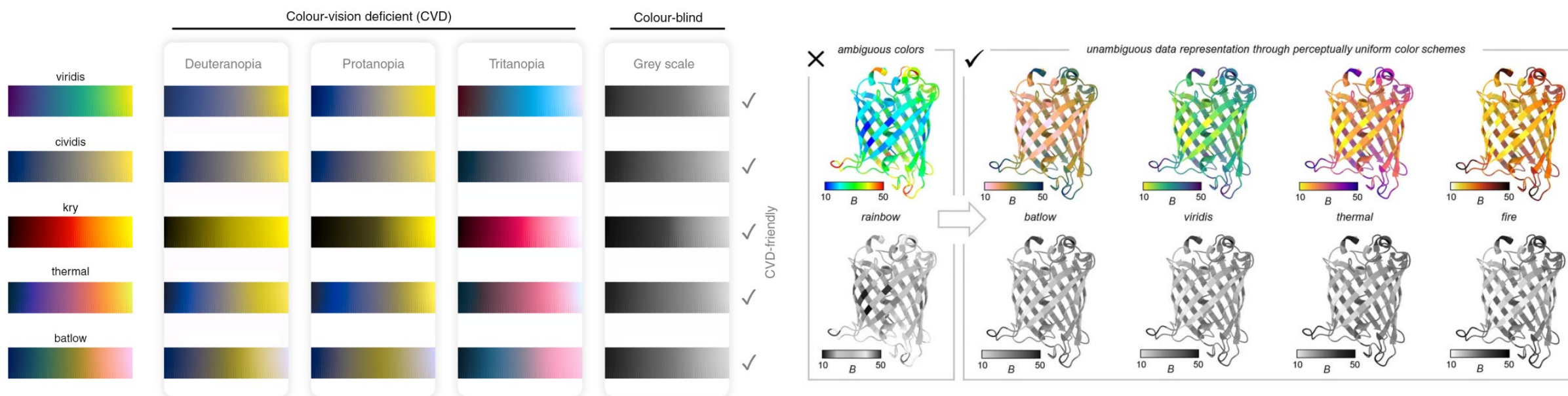
The Issue with Rainbow/Jet Maps



- Inaccurately represents the data
- Perceived brightness of certain colors draws attention to “wrong” data regions
- If viewed in grayscale, all color meaning is lost

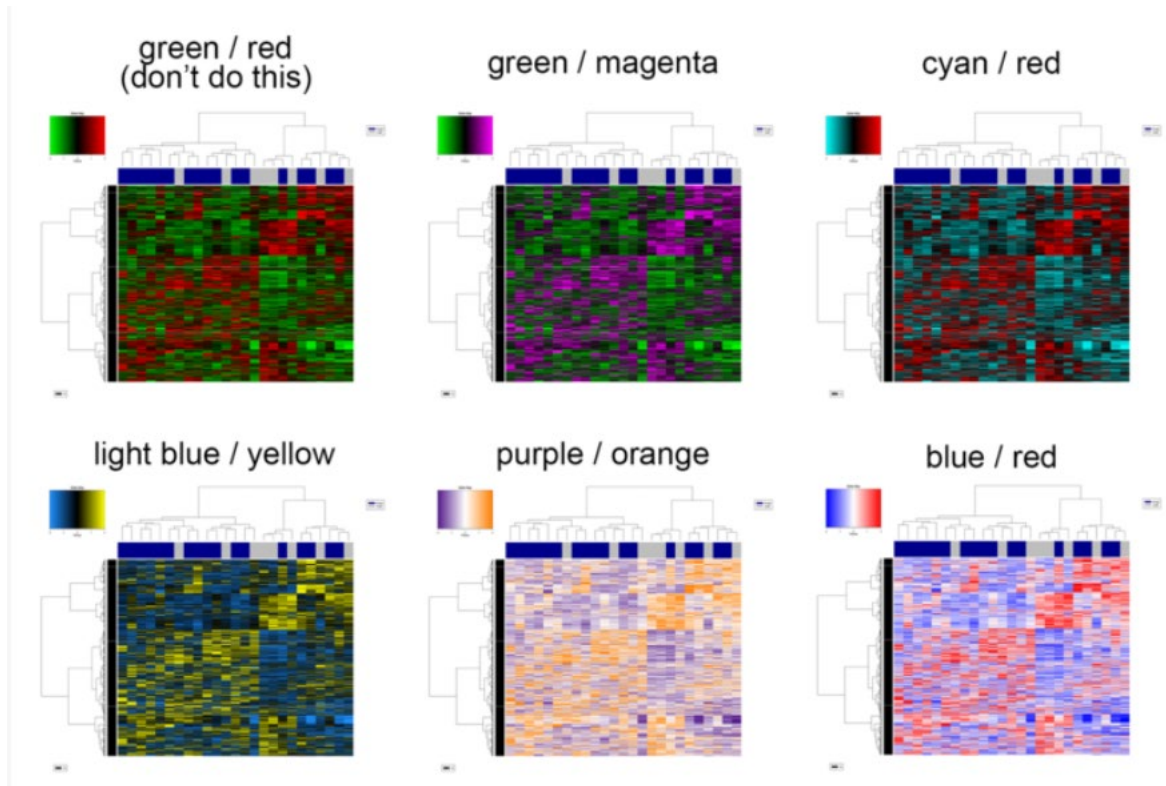
Felix Kaspar, Fabio Crameri. [Coloring Chemistry – How Mindful Color Choices Improve Chemical Communication](#). Angew. Chem. Int. Ed. 2022, 61, e202114910
Fabio Crameri, Grace E. Shephard, Philip J. Heron. [The misuse of colour in science communication](#). Nature Communications 11, 5444 (2020).

Alternatives to Rainbow/Jet Maps

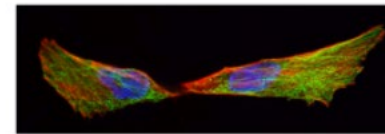


Felix Kaspar, Fabio Crameri. [Coloring Chemistry – How Mindful Color Choices Improve Chemical Communication](#). Angew. Chem. Int. Ed. 2022, 61, e202114910
Fabio Crameri, Grace E. Shephard, Philip J. Heron. [The misuse of colour in science communication](#). Nature Communications 11, 5444 (2020).

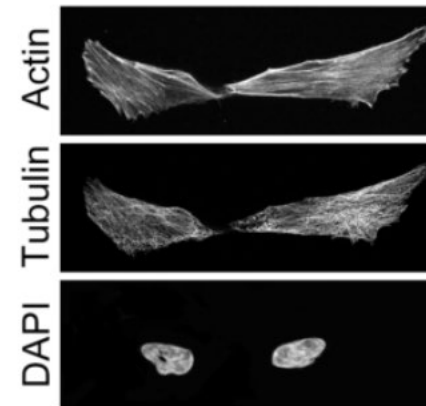
Red/Green Data and Alternatives



DON'T
Use red and green pseudocoloring
in the same image



DO
Show greyscale images
of each channel



DO
Use colors in merged images that
can still be distinguished by people
with red/green color-blindness



Emily Summerbell, [How to make scientific figures accessible to readers with color-blindness](#). ASCB, Science.

Presenting Your Work



- If possible, consider making a digital version of your poster available (screen-reader compatible)
- Don't assume that everyone can see graphics in the same way
 - Describe images and plot axes aloud; clarify what is being measured
 - Describe important trends and data points
- Keep a notepad and pen ready in case someone has difficulties hearing you

Great Resources and Additional Reads



- Recommendations for Posters and Slides
 - Ali Kreckmann. [Poster Design Principles](#). ACS Guide to Scholarly Communication.
 - Ali Kreckmann. [Design Principles for Slide Presentations](#). ACS Guide to Scholarly Communication.
- Measuring Color Contrast (some free resources)
 - TPGi's [Colour Contrast Analyzer](#) (can download for Windows and Mac)
 - Web Accessibility in Mind's [Contrast Checker](#) (web-based tool)
- Color Blindness Simulator
 - [Pilestone Color Blind Vision Simulator](#) (web-based tool)
- Color Choice with data presentation
 - Felix Kaspar, Fabio Crameri. [Coloring Chemistry – How Mindful Color Choices Improve Chemical Communication](#). Angew. Chem. Int. Ed. 2022, 61, e202114910
 - Fabio Crameri, Grace E. Shephard, Philip J. Heron. [The misuse of colour in science communication](#). Nature Communications 11, 5444 (2020).
 - Includes a guideline to select the right color map
 - Includes a list of free color maps and toolkits
 - Christopher Schmied et. al. [Community-developed checklists for publishing images and image analyses](#). Nature Methods.
 - Emily Summerbell. [How to make scientific figures accessible to readers with color-blindness](#). ASCB, Science.



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Resources and Tools: *ACS Inclusivity Style Guide*



- ACS Inclusivity Style Guide (www.acs.org/inclusivityguide)
- A free educational resource to help with decision-making around communication, including:
 - Text
 - Formatting
 - Images
- Consider applying principles with emails, newsletters, social media posts, and more...
- Contains sections on a wide range of topics (and growing)

**Communicate,
inclusively.**

Start today with the
ACS Inclusivity Style Guide.

Get Started

A square QR code is located in the upper right corner of the graphic. Below the QR code, the word 'bitly' is written in a small, lowercase font.

ACS
Chemistry for Life®

The graphic has a light blue background with a white diagonal line. The text is in a clean, sans-serif font. The 'Get Started' button is a solid blue rectangle with white text. The ACS logo is in the bottom left corner of the graphic.



ACS FALL 2024

ELEVATING CHEMISTRY

Thank you!
Questions welcomed.



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