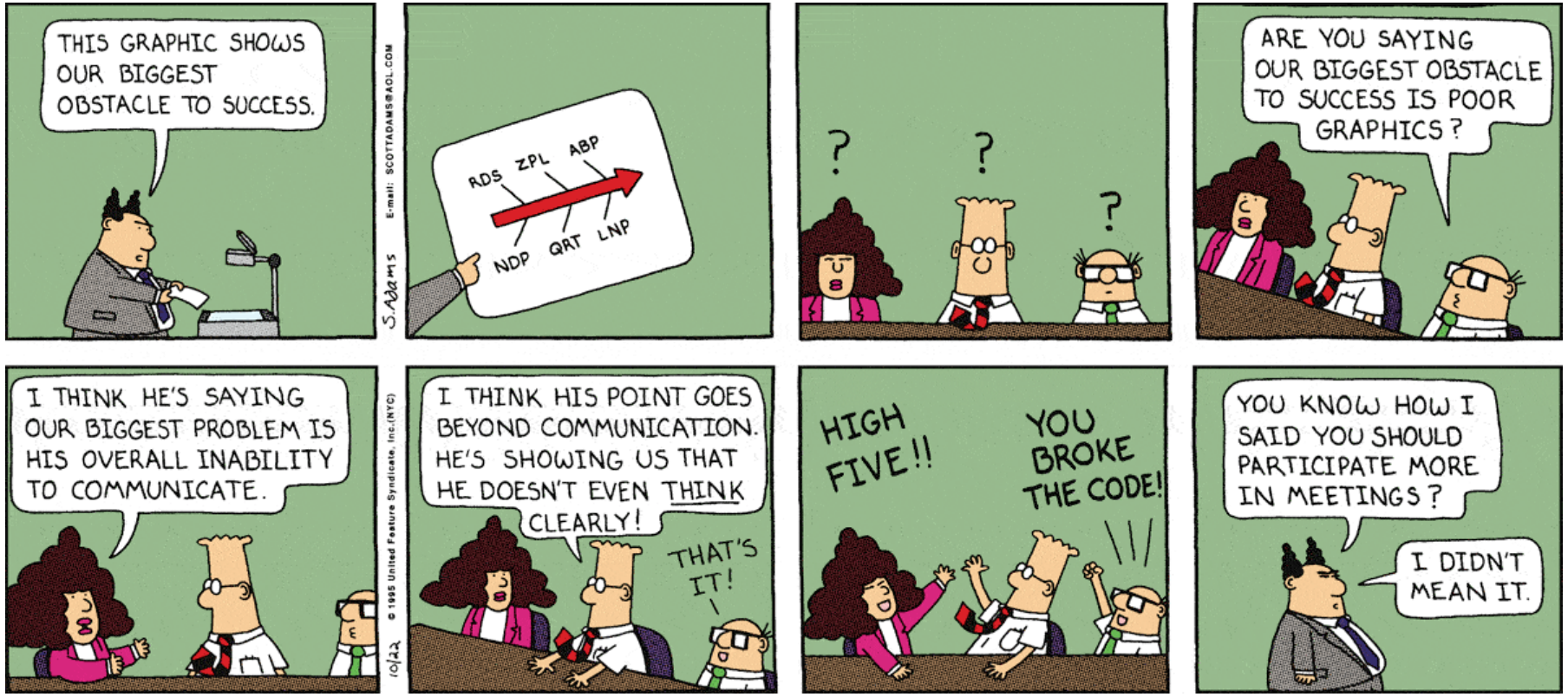
How To Make a Great Research Poster

and other tips for effective science communication



Prof. Alexander (Alex) Dowling adowling@nd.edu

UNIVERSITY OF NOTRE DAME

Special thanks to Prof. David Go for providing a previous version of these slides!

June 30, 2022

Why Should We Communicate Our Research?

To our scientific community:

- Research findings need to be vetted, critically assessed, and evaluated for correctness – *part of the scientific method*
- Discoveries only have value to the broader community (and even humanity) if effectively communicated
- Science is ‘communal’ not ‘solo’ sport.

To the broader community:

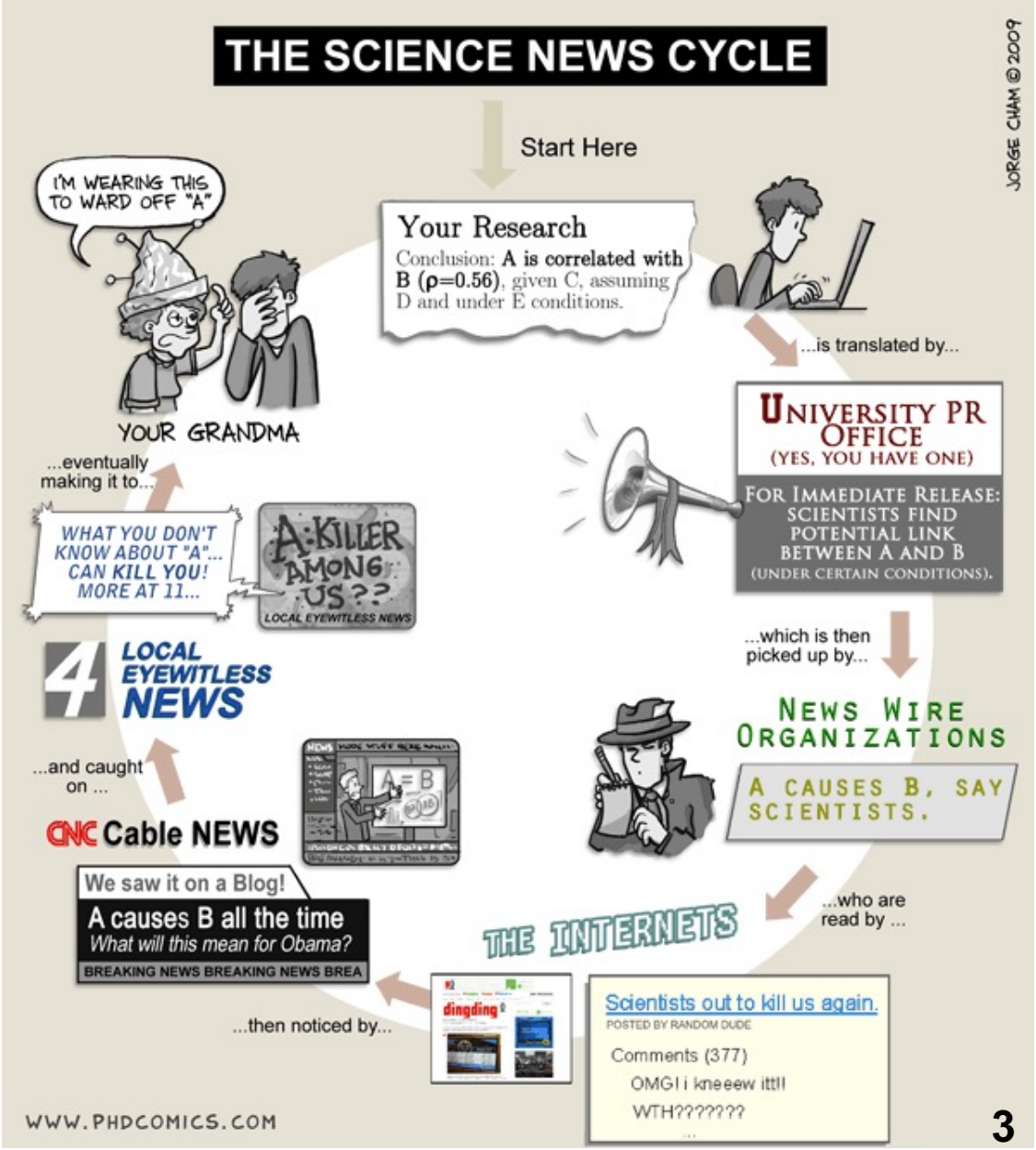
- Promotes understanding of our world
- Builds support for science so that it can continue to advance
- Enables more effective and informed decision making (at *all* levels)

“Science communication is part of a scientist’s everyday life. Scientists must give talks, write papers and proposals, communicate with a variety of audiences, and educate others. Thus to be successful, regardless of field or career path, scientists must learn how to communicate. ”

https://blogs.scientificamerican.com/guest-blog/effective-communication-better-science/

How Do We Communicate Our Research?

- Lectures, presentations, interviews and **posters**
  - Scientific conferences
  - Other research institutions/universities
  - Federal/state agencies
  - Broader public
- Archival (peer reviewed) journals
  - Extensive review and revision process
- Grant proposals
  - Federal/state agencies
  - Industry
  - Foundations



What is Effective Communication?

- Transmitting a **message** clearly and concisely so that it is understood by the **target audience**

- You must have a **MESSAGE**
  - **What** is the take away information?
  - **Why** is the take away information important?
  - **How** was the take away information determined?
  - **Who** does the take away information impact?

- You must have **TARGET AUDIENCE**
  - Specific scientific community (*e.g.*, only cell biologists)
  - Broader scientific community (*e.g.*, all biologists)
  - General technical community (*e.g.*, any scientist or engineers)
  - General audience (*e.g.*, school children or politicians)

Image: https://quickbooks.intuit.com/au/blog/growing-a-business/how-to-identify-your-target-audience-in-five-steps/

The purpose is **not** to chronicle your experience – the purpose is to communicate what you determined/discovered/advanced, why it is important, and in many cases, what more work is to be done.

The Process

1. **Write, revise, and submit an abstract**

2. Outline your poster on paper or whiteboard, iterate!

3. Create a digital version of the poster and print it out

4. Present the poster at a poster session

Abstract

Title: A declarative statement is better than a generic description

Which is better?

1. "Study of graphene etching with oxygen plasma"
2. "High-pressure oxygen plasma enhances etching rate of graphene"

List of authors & affiliations

- Who is a contributor? Who is not a contributor?
- You should be **first author** and your advisor/professor should be **last author**. Graduate student mentors and others that helped should be somewhere in between

Abstracts represent the research group: *Your research advisor and any co-authors* ***MUST*** *see and approve the abstract*

Abstract

Text: 250 words

- Describe the big picture/context of the work, the general methods used, the main results, and a sentence or two about the significance of the findings.
- Do **not** include specific experimental details ("0.0034 mg of ferric chloride was mixed with excess sulfide…").
- Do **not** use a stream of consciousness style or a chronological retelling of your experience … ("First, I tried the optical microscope, but that didn't have good resolution, so I used the electron microscope.")

Abstract generation algorithm:

1. Distill your main message into **2 to 4 bullet points** (each 1 tweet in length)
2. Brainstorm **titles** that summarize the main message bullet points
3. **Reorder** the bullet points into the most logical presentation order.
4. What is the **minimum background information** needed to contextualize the bullet points? This because the **glue** that holds together the main message.
5. What interesting fact or motivation can **hook** the audience?
6. Write a draft and get feedback

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Do not open Power Point until you make a plan on paper

15 minutes here

Image: https://womenlead2021.nd.edu/jane-cleland-huang/

will save you **hours** here

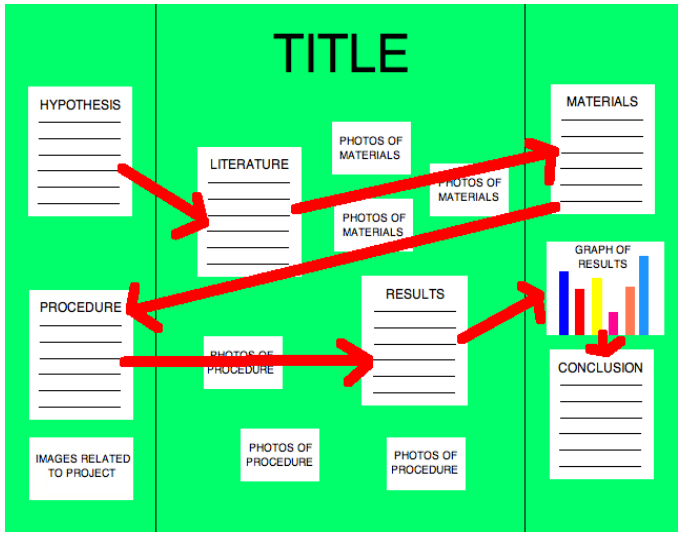
PowerPoint

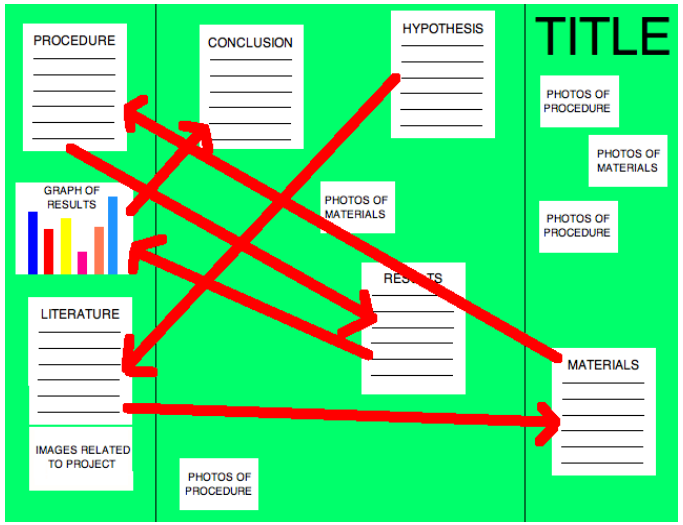
Poster – Anatomy

- **Title & List of authors & affiliations**
- **Introduction** (to the project or problem—why is it important?)
  - Remember your target audience and use general language, not “jargon”
- **Background information**
  - Put graphics or text for all the stuff that people usually ask about when you discuss your research—otherwise you will have to explain it 20 times to 20 different viewers
  - Use bullet points, not paragraphs
- **Results and discussion**
  - This section is often further subdivided according to the research done
  - Do not cram every experimental result onto the poster (that’s what papers are for)
  - Focus on telling a story and the critical **take away message**
- **Conclusions** (and outlook, if you like)
- **References** (a must!)
- **Acknowledgements** (funding agencies, etc.)

Poster – Layout

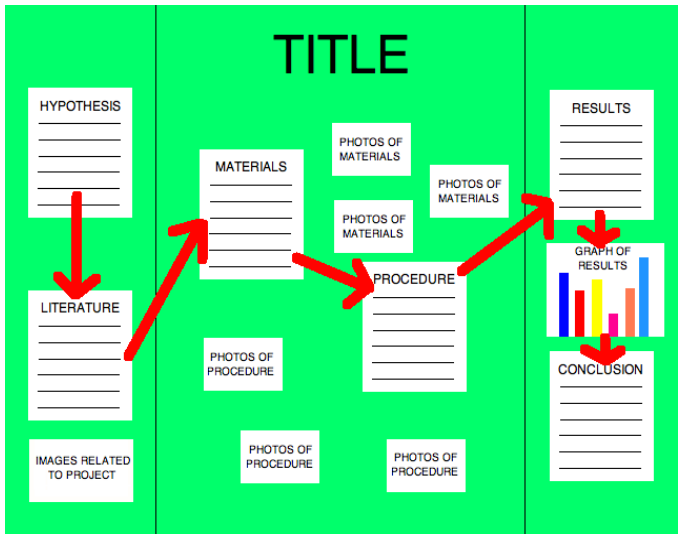
Bad Layouts





http://sciencefair.math.iit.edu/display/layoutflow/

A Good Layout



When sketching poster, ask "how will this figure, image, text, … **support my main story**"

(use those bullet points from your abstract)

The Process

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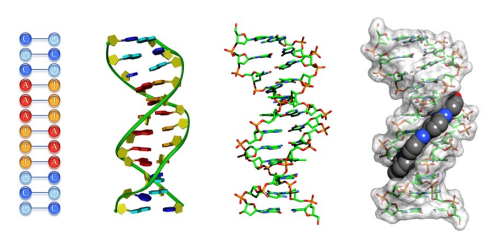
Visualizing Biomolecular Structure and Dynamics

Kristina E. Furse and Steven A. Corcelli
Department of Chemistry and Biochemistry, University of Notre Dame, IN 46556

UNIVERSITY OF NOTRE DAME
Center for Research Computing

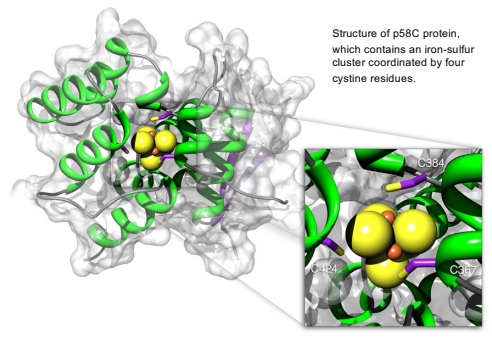
Visualization is a tremendously important tool for understanding the relationships between structure, dynamics and function in biological systems. It is especially crucial for data intensive computational studies, where good visualization can highlight important relationships hiding in pages of numbers. Challenges include accurately representing complex three dimensional objects in two dimensions, conveying movement, and compressing massive amounts of data into a small visual space in order to facilitate comparisons.



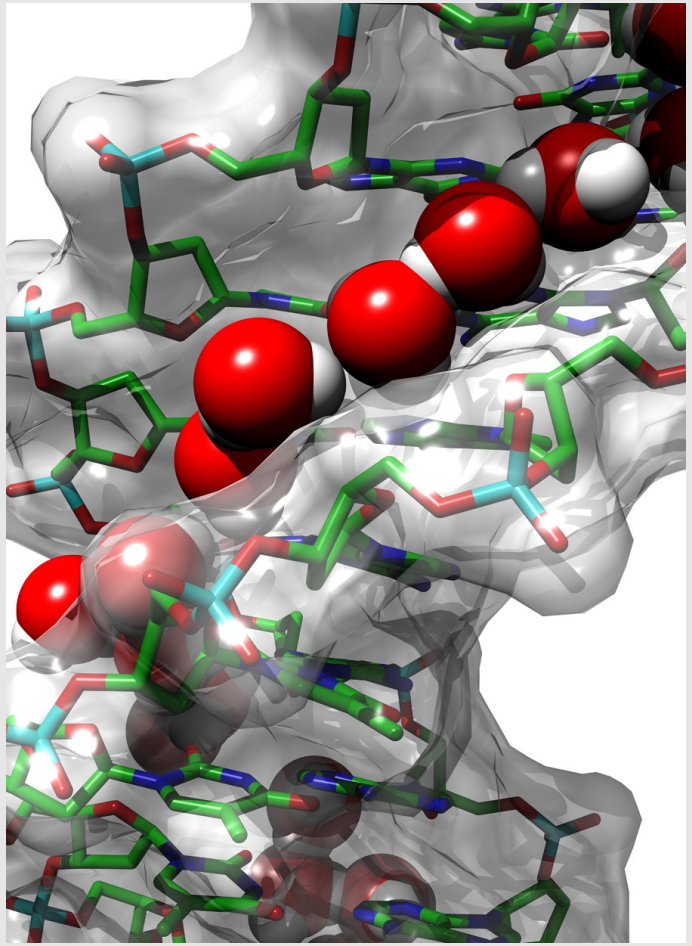
Different representations of a double-stranded DNA dodecamer highlighting sequence, base pairing, structure, volume, and interaction with a minor-groove binding drug .1 Molecules rendered with UCSF Chimera.[2]

structure and volume

The structure of a biological molecule is closely related to its function, so simply looking at structures can yield tremendous insight. A simple wireframe model with atoms connected by stick bonds is sufficient for 3D viewing on a stereo monitor, but quickly collapses into a haystack in 2D. Simplifications like “cartoon” ribbon representation and molecular surfaces, together with strategic use of color, clipping planes and transparency can help recapture 3D structure and volume in 2D.



Structure of p58C protein, which contains an iron-sulfur cluster coordinated by four cystine residues.



References

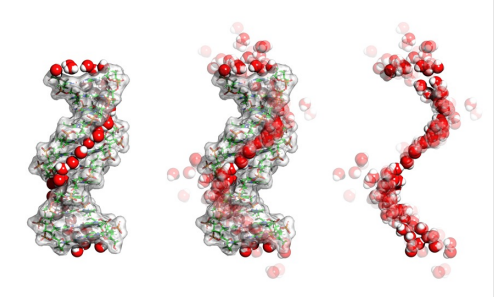
1. K. E. Furse and S. A. Corcelli JACS 2008, 130:13103.
2. E. F. Pettersen, et. al. J. Comp. Chem. 2004, 25:1605.
3. C. S. Miller, E. A. Ploetz, M. E. Cremeens and S. A. Corcelli. J. Chem. Phys. 2009, 130:125103.

Acknowledgements

This work was supported by National Science Foundation grant SMA-1560089: "REU Site: Computational Social Science"

portraying movement

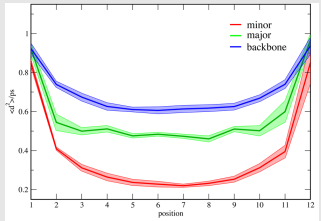
Conveying molecular dynamics on paper introduces another significant challenge: adding a fourth dimension, time. Here again, transparency is an incredibly useful tool. Movement can be conveyed by layering multiple transparent structures.

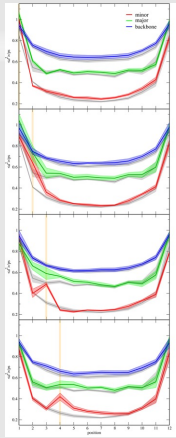


Movement of water in the minor groove of DNA is indicated by layering snapshots of future water positions after 20, 40, 60 and 80 ps, with transparency increasing proportional to time.

data compression

Beyond structure, effective visualization is needed to analyze a wide variety of data extracted from molecular dynamics simulations. Compressing large amounts of data into a small visual space can emphasize relationships and trends in a clear and powerful way.





Reducing the 2D data to a single number, the slope of the average mean-squared displacement, facilitates broad comparisons. Water movement in three solvation zones can be visualized for native DNA (above), as well as DNA with a fluorescent probe in place of a base pair to quantify perturbation of the solvent environment due to the probe (right).

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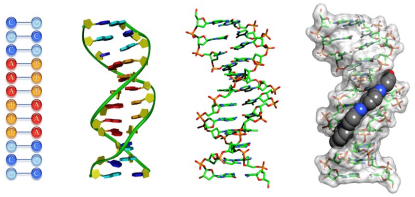

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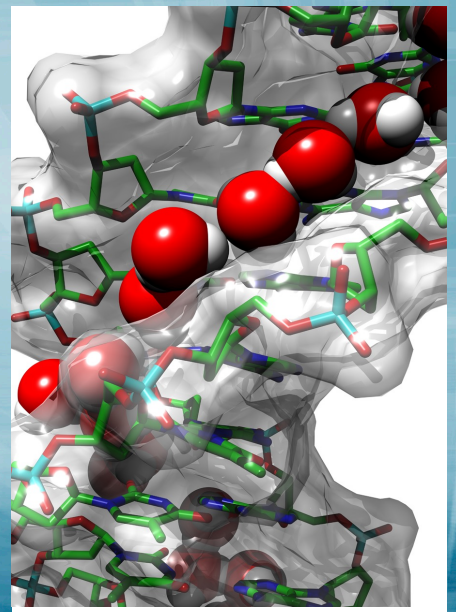
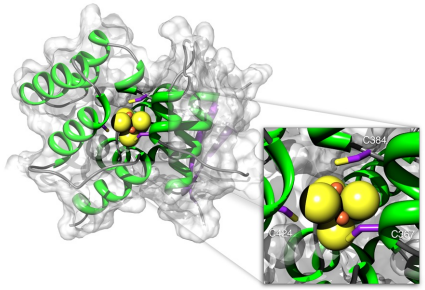


Above, multiple different atomic representations are used together to describe the structure of DNA and its first solvation shell. Red spheres are used to represent water molecules which form a "spine of hydration" along the unusually narrow minor groove of A-tract DNA. Below, a similar approach is used to show the structure of p58C protein, which contains an iron-sulfur cluster coordinated by four cystine residues. Ribbons clarify alpha-helical secondary structure, while the transparent surface shows the overall shape and volume.



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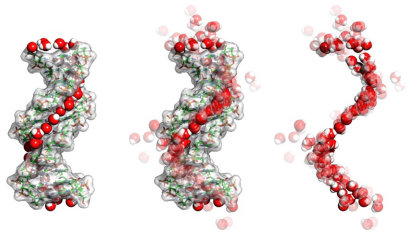
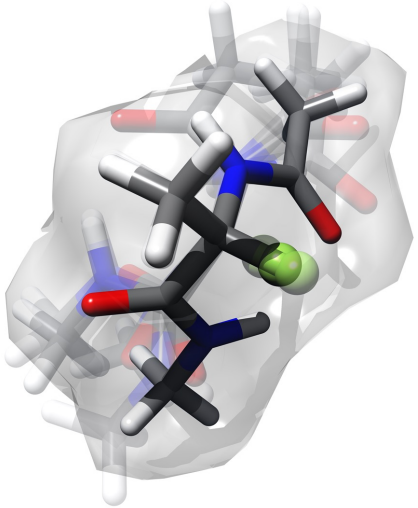
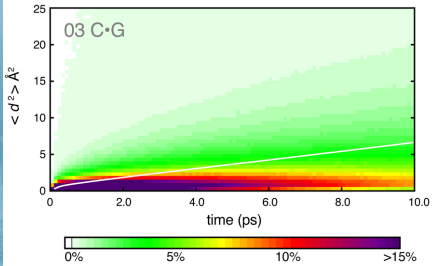


Above, movement of water in the minor groove of DNA is indicated by layering snapshots of future water positions after 20, 40, 60 and 80 picoseconds, with transparency increasing proportional to time.



Here, transparent layering indicates the relationship between bond vibration and conformation in alanine dipeptide with an alpha-carbon deuterium probe.



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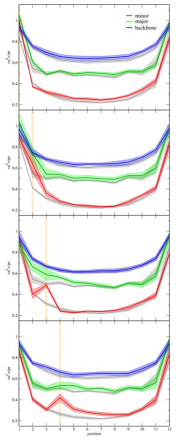

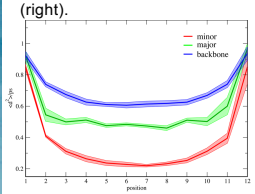

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Poster – Mechanics (for *in person* posters)

- Create the poster as a single slide in Powerpoint *at scale*
  - In the File:Page Setup dialog box, set your page dimensions to 36" x 48". The poster will now display at its actual size (you'll have to view it at 25% or smaller to see the whole thing)
- Poster should be legible from a distance of 4 feet
  - No font size smaller than **24 pt font anywhere** (including plots, figures, axes, etc.)
  - Giant fonts are appropriate for the title (>90 pt) and section headings (> 70 pt)
- Background & Colors
  - Avoid using dark colors, fancy patterns, or pictures in your background. Dark ink on light or white background are generally more legible.
  - Colors can be an effective way to make important information stand out on the poster, but must be used sparingly and rationally (have a scheme!)
    - do not use hard to see colors (*e.g.*, fluorescent green!)
    - do not use every color (*e.g.*, leave the rainbow for My Little Pony)
  - 4% of people are red-green color blind

Poster – Mechanics (cont.)

- Pictures and figures
  - Images draw the eyes in – photos of an experimental set-up or result, large, clear plots, and schematics can be effective (**put in the effort!**)
  - Figures and their captions should be self-explanatory. Add scale bars, units, labels, etc. in large font
  - Nice to include: logos of sponsors/universities, photo of poster presenter (so viewers can find you), envelope for exchanging business cards or notes or preprints of related papers

- Create a logical path through the poster
  - Use headers, numbering, color, boxes for text, even arrows

- Pay attention to details—columns of text should be the same width, use one font, emphasize text with one graphic trick (e.g., bold face).

The poster is a reflection of you and your research effort. If it is polished, well organized, neat, and professional, the audience has confidence in your findings. If it is not, then the audience does not.

Questions to Ask Yourself When Making a Poster

- The poster is meant to be **compelling** and **engaging** for the audience. This can be summarized by asking yourself: Is my poster visually attractive?

- The poster needs to **effectively communicate information** for the audience. This can be summarized by asking yourself: Would my friends understand this?

- The poster needs to be **polished and neat** in order to give the audience confidence in you and what you are presenting. This can be summarized by asking yourself: Are there any sloppy mistakes?

The Process

1. Write, revise, and submit an abstract

2. Outline your poster on paper or whiteboard, iterate!

3. Create a digital version of the poster and print it out

4. **Present the poster at a poster session**

“So, tell me about your poster”

- Have a **2 to 3-minute** narrative that tells a story
  - What is the big picture problem (picture from 30,000 feet)? Why do people care about this problem?
  - What is the problem you worked on? Are you testing a hypothesis? Are you developing a new method? Are you answering a specific question?
  - Overview the general methods and approach – don’t get lost in the details!
  - Highlight any specific challenges (picture from 500 feet) that show where the real science was happening.
  - Summarize the most important results and directly tie it to what you were working on. Was the hypothesis null? Did the method work? Did you answer the question?
  - If it’s a work in progress, say so! What needs to be done next and why?

How to Be the Best Speaker in the Room

- **Speak clearly and confidently**. You should address the *entire* audience, including those furthest from you. This goes for both the prepared presentation and anything during questions and answers (Q&A).

- **Have a narrative**. You should have a prepared talk timed correctly (~2 to 3 min for a poster presentation) that walks the audience through a clear story: motivation, hypothesis, how you test it, results and their interpretation, conclusions, and next steps.

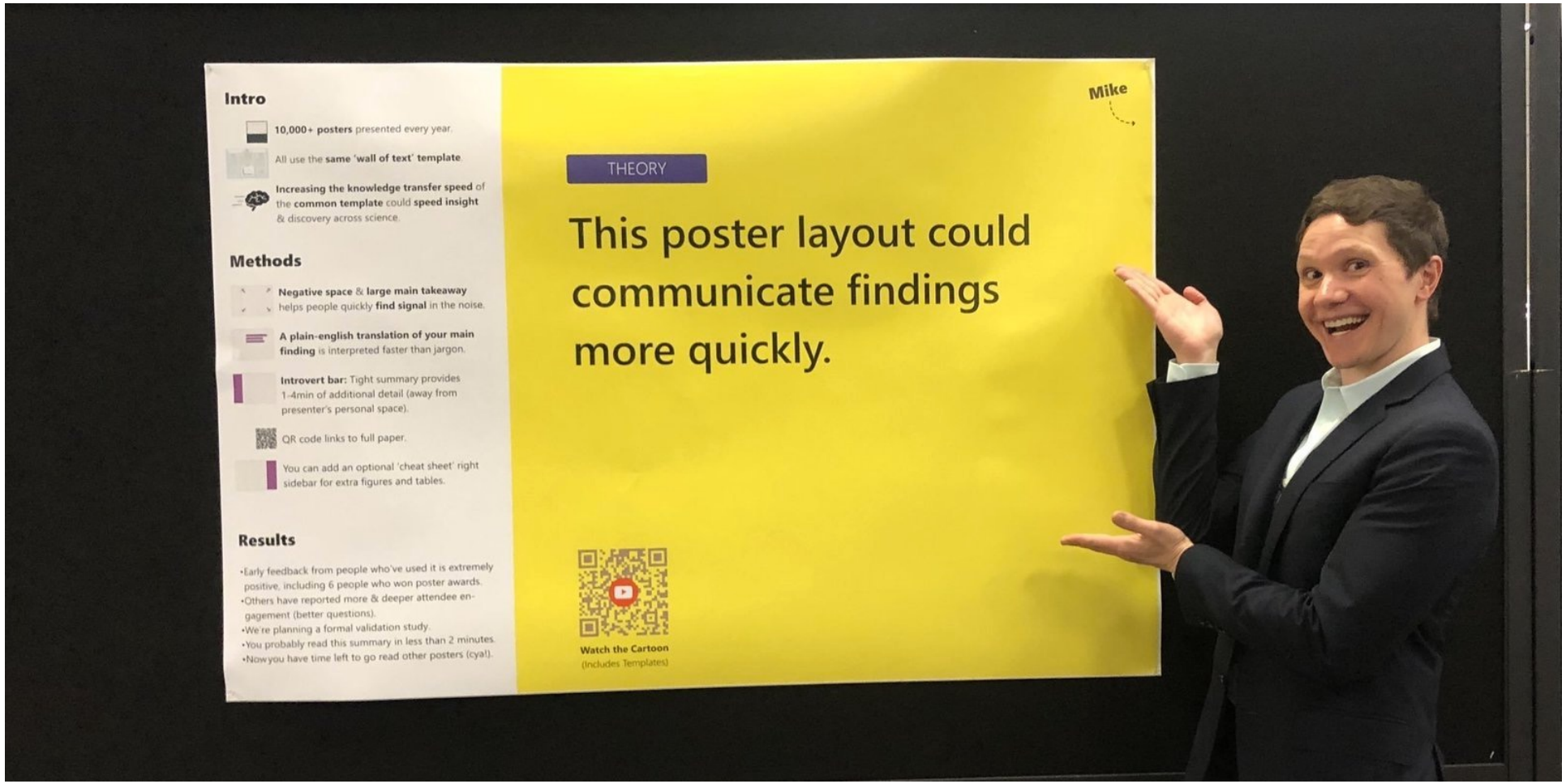
- Ask your audience if they have questions ~2 times during your narrative

How to Be the Best Speaker in the Room

- **Be precise in your language but general**. Your vocabulary should reflect your technical expertise and understanding.
  - Do not use vague phrasings such as ‘I got’, ‘I sort of did this’, ‘kind of’, and so forth
  - Use technically sound verbiage such as ‘I tested the hypothesis’, ‘I determined’, and ‘I drew a conclusion’, etc.
  - Avoid using jargon, abbreviations, or acronyms specific to your research field.

- **Answer the question that is asked or give a rational and reasoned explanation.**
  - When answering questions, be honest when you do not know the answer to a question. Offer a rational and logically-sound conjecture.
  - If a particular question is very challenging, use it as an opportunity to **engage the audience in a dialogue**; repeat questions for the entire audience or even to clarify them for yourself

Is There an Alternative? Poster 2.0



https://www.npr.org/sections/health-shots/2019/06/11/729314248/to-save-the-science-poster-researchers-want-to-kill-it-and-start-over

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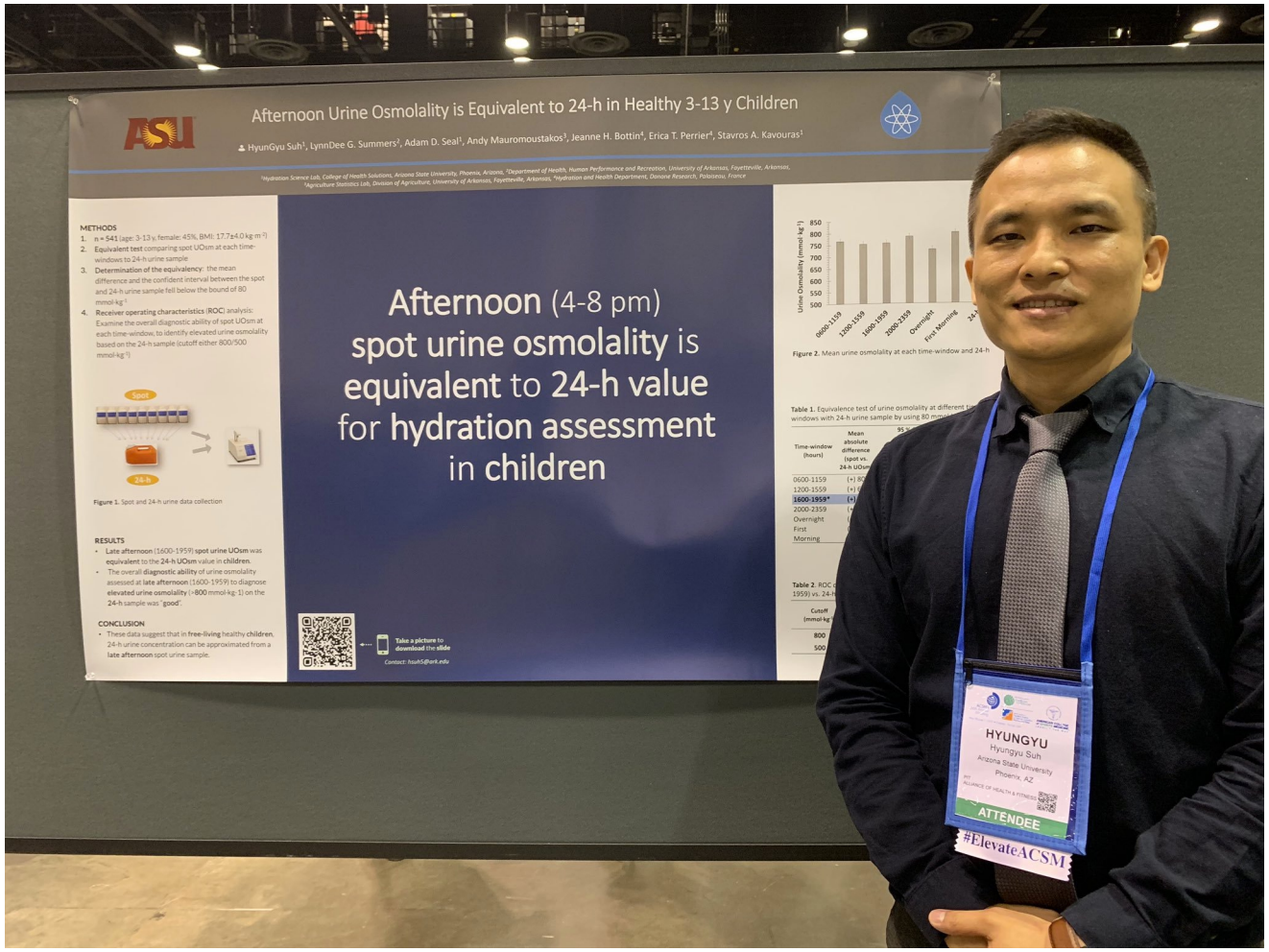


https://www.npr.org/sections/health-shots/2019/06/11/729314248/to-save-the-science-poster-researchers-want-to-kill-it-and-start-over

The Golden Mean? Poster 1.5

We Don't Have to Pick a Side: The Middle Is A Fine Place to Be

Appalachian STATE UNIVERSITY

Andrew R. Smith
Appalachian State University

INTRODUCTION

Mike Morrison created a template for a "Better Scientific Poster" (BSP) (https://osf.io/ef53g/)

The BSP format has been praised by many, yet disparaged by others.

The current project had 2 goals:

1. Create a template that I think could be useful.
2. Point out that we don't need to either love or hate the new format—the middle is just fine.

METHOD

To create a new template, I identified strengths of the BSP template and the traditional format.

BSP strengths: clear take-away message, minimal text, QR code

Traditional format strengths: room for figures, reasonable text size on sides, large title to make finding posters in poster session easy, web link and email for people who don't like QR codes

Why must we pick sides?

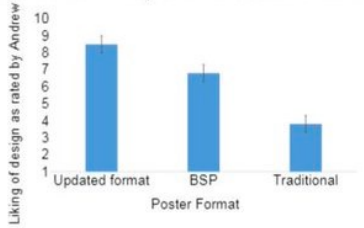
The new poster format is a revolution, or the new poster format is garbage!

Take the **good parts** of the new format, keep the **useful aspects** of the traditional format, add in your own ideas, and **create something better**.

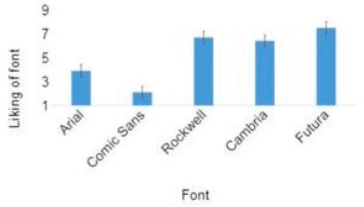
Poster template: https://osf.io/ayjzg/
smithar3@appstate.edu

RESULTS

Preregistered analysis: 78% increase in liking compared to traditional format and 24% increase compared to the BSP format.



Exploratory analysis: room for improvement in this template (Arial font, seriously?!?!).



DISCUSSION

Sometimes it makes sense to pick a side; this is not one of those times.

Praise what you like, make suggestions for improvement, and **then make something better**.

Take Mike's ideas, incorporate some of mine, **be creative**, and let's make posters more useful.

https://www3.beacon-center.org/blog/2019/09/01/the-evolution-of-academic-posters-from-poster-1-0-to-better-poster-2-0-to-hybrid-poster-1-5/

Some Final Tips

- **Proof-read your materials one, twice, three times**! Typos and simple mistakes appear sloppy and if the poster appears sloppy, do you think the audience will trust the actual science on it?

- **Start early** in preparing the poster. It takes time to iteratively make good figures, a good layout, and a strong title. It takes time to write your text in a concise and clear manner. But the bottom line is the poster should reflect the time and effort you put into doing the actual research!

- Get **early feedback** (before you open PowerPoint)!