Developing your own effective style for visual aids in teaching

Bok Center Faculty Lunch on Learning

April 1 2019

Visual aids in teaching incorporates many components

- Today I plan to touch three main aspects of visual aids in teaching:
  - How I construct my slide decks for teaching
  - How I construct illustrations
  - How I teach students to make illustrations

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My goals for teaching slides – multiple purposes

- Slides are useful to me:
  - Organize my thoughts
  - Prompts as I lecture
  - Visual aids to convey the concepts to students
  - Prompts to initiate discussions to assess students' understanding

- Slides are useful to the students:
  - Medium on which students can take notes during class
  - Study aids for students when they review
  - Reference for future use by the students

I use my own PowerPoint template and keep a consistent lecture outline

Lecture 23

Ligand interactions

Reading for Today: Chapter 12 Section B

Reading for Friday : Chapter 13 Section B

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Title slide includes course logistics

Today's Goals

- Use concepts of equilibrium and thermodynamics to investigate ligand-receptor interactions
- Explain features of the interaction that contributed to specificity vs. affinity
- We will use as examples drugs that target:
  - kinases – anti-cancer drugs
  - HMG-CoA reductase – cholesterol-lowering drugs
    - Structural properties
    - Thermodynamic properties
    - Use of ITC
- Case study (*time permitting*): selecting drug targets

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Goals slide outlines lecture and learning goals

Quick refresher from Friday

$$R{\bullet}L \leftrightarrows R + L$$

$$K_D = \frac{[R][L]}{[R \cdot L]} = \frac{1}{K_A}$$

- K_D and K_A are simply equilibrium constants – and therefore unitless
- Dissociation constant, K_D, is equal in magnitude to the concentration of ligand at which half the receptor is occupied, at equilibrium
  - Althoug… …pressed in molar u…

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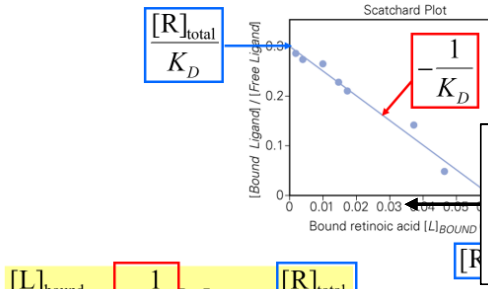
Often start with refresher of prior relevant material

Scatchard plot analysis



$$\frac{[L]_{bound}}{[L]} = -\frac{1}{K_D}[L]_{bound} + \frac{[R]_{total}}{K_D}$$

Figure from The Molecules of Life (© Garland Science 2008)

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Continue with general lecture materials

• • •

End with a slide summarizing the key concepts

Some concepts to remember

- Specificity depends on the relative affinity for cognate and non-cognate targets
- IC_{50} depends on K_i, K_D and ligand concentration and is important in determining inhibitor effectiveness
- …ophobic effect drives much of the affinity of ligands/drugs, …drogen bonds ensure specificity
- …enthalpy and entropy change of ligand binding are a …between the interactions made with water and with the …
- ITC can be used to determine binding affinity, enthalpy, and entropy

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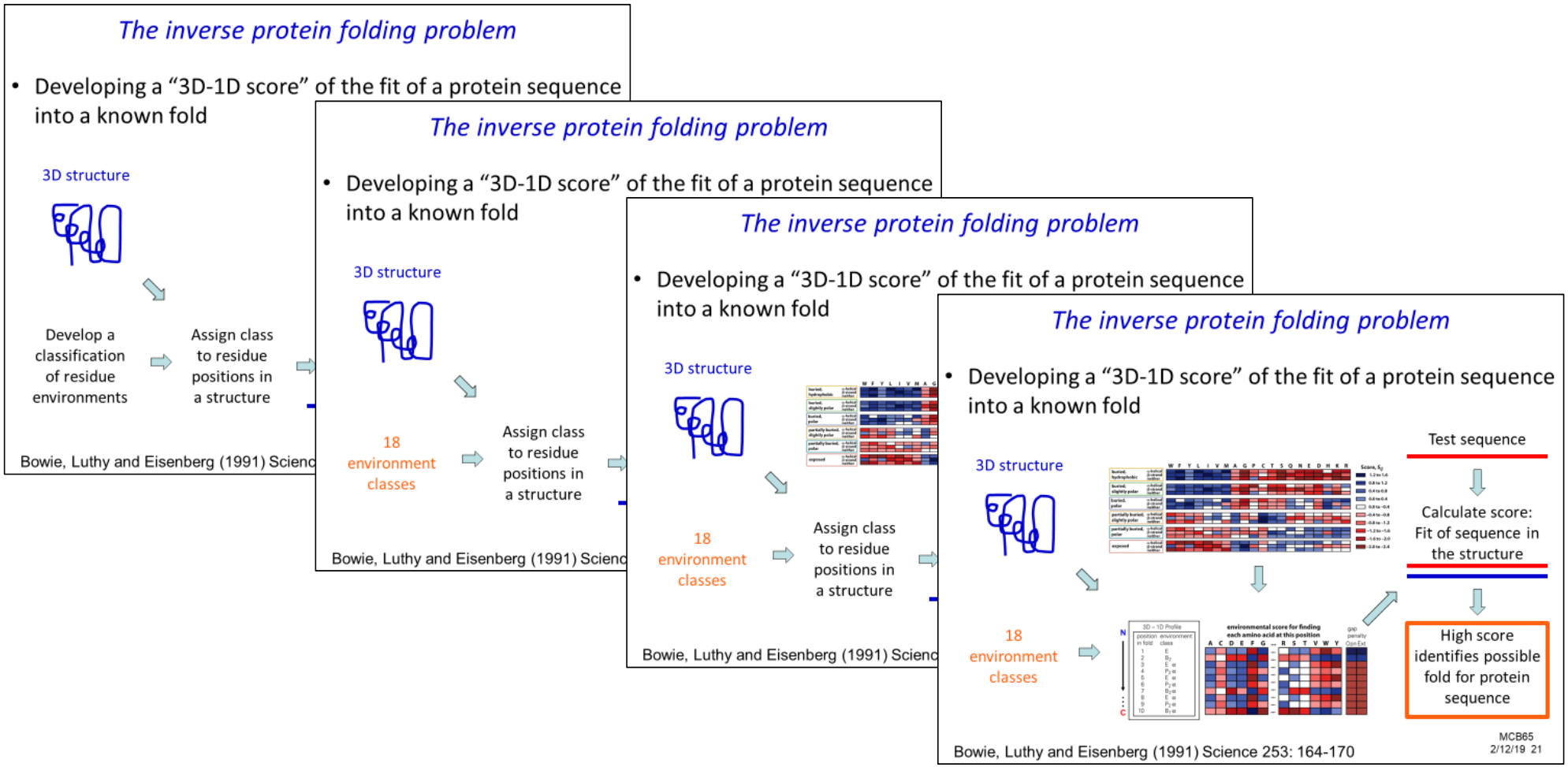
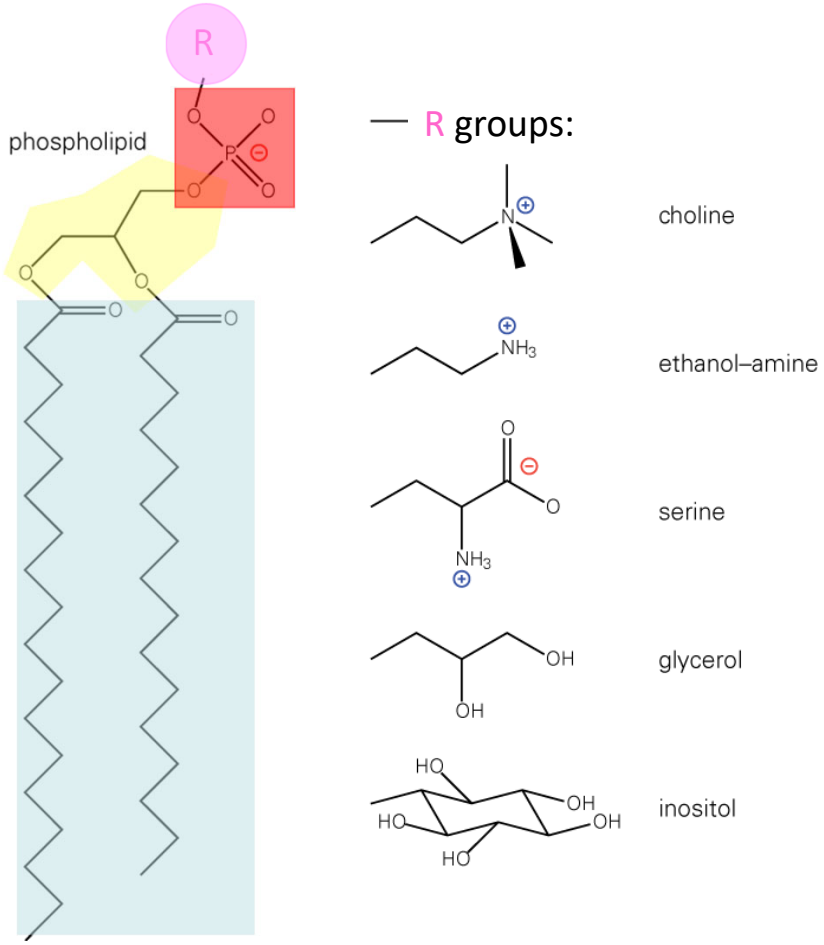
For complex topics spread on many slides I use a *recurring* outline slide



Diacylglycerol phospholipids

Slide as provided as a PDF to students

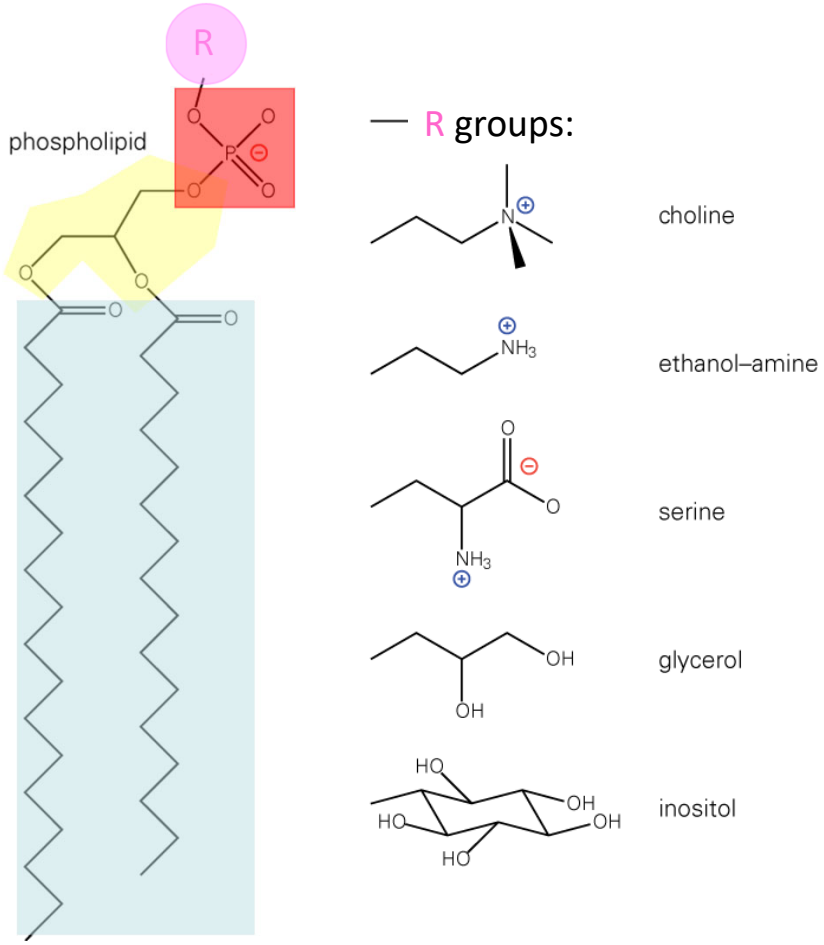


- Two fatty acid tails attached as esters to two glycerol hydroxyls
- One phosphate attached to the last glycerol hydroxyl
- Variable "R" head group attached to the phosphate

Figure from The Molecules of Life (© Garland Science 2008)

Diacylglycerol phospholipids

Slide as animated in PowerPoint



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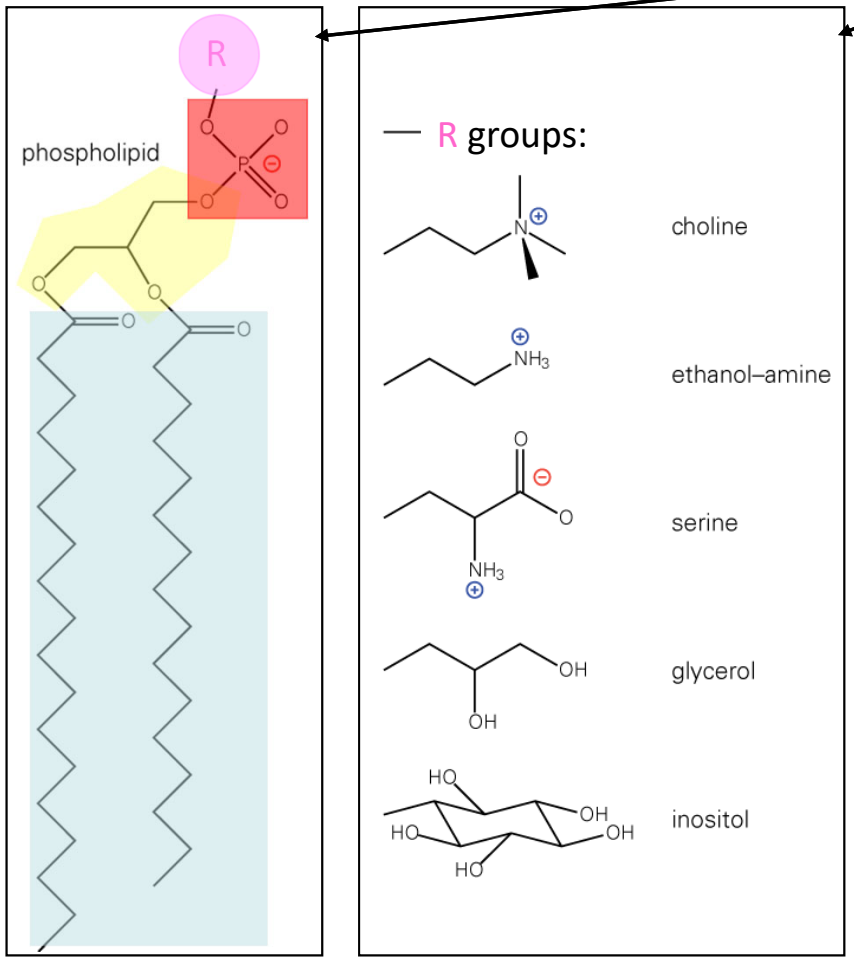
Diacylglycerol phospholipids

Split figure for animation



- Two fatty acid tails attached as esters to two glycerol hydroxyls

Color-coding for emphasis and clarity

- One phosphate attached to the last glycerol hydroxyl

White spaces help with readability

- Variable "R" head group attached to the phosphate

Date and slide number allow for referencing

Model proper citation

Some suggestions on citations

- To make the citations less obtrusive, use small font and grey color
  - It is important that the information is available
  - It is not important that it be immediately readable or catch the attention of the students

- I like to put references directly on individual slides
  - Advantage: easier to find
  - Advantage: easier to edit and update as needed

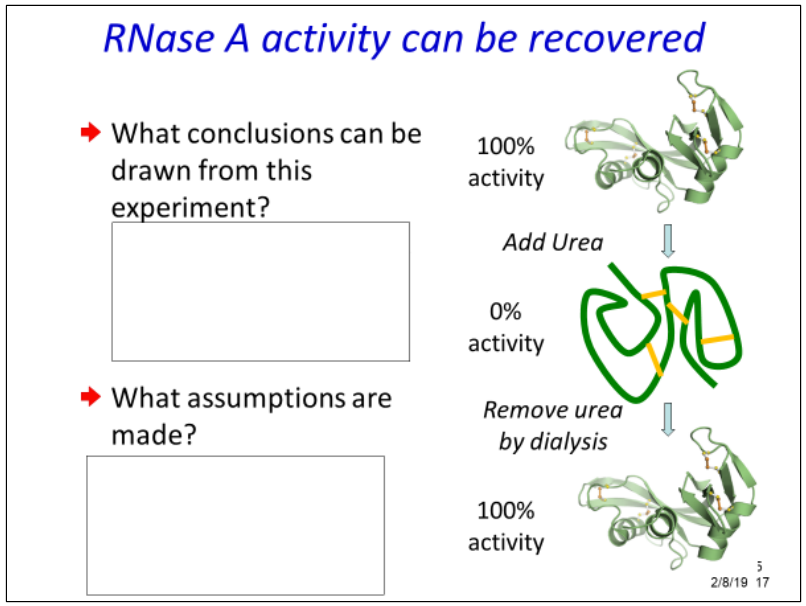
- An alternative is to provide a slide with bibliography/reference at the end
  - Advantage: slides are less cluttered

Figure from The Molecules of Life (© Garland Science 2008)

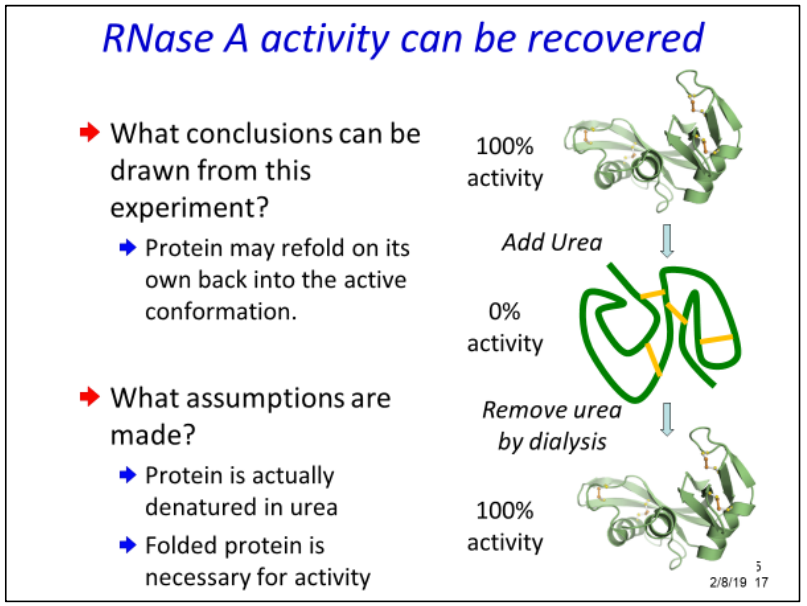
Model proper citation

I use white boxes to hide material in pre-lecture PDF files

Pre-lecture slide:



Post-lecture slide:



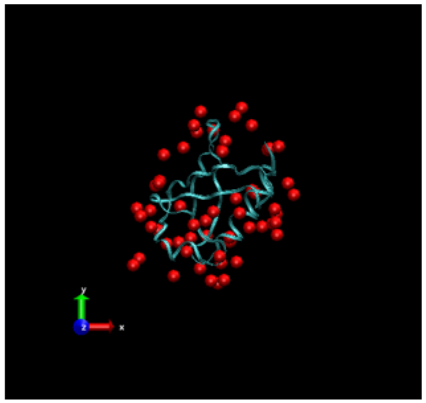
- I move these white boxes to the front before making the pre-lecture PDF, and move them to the back for post-lecture PDF notes.
- I use the notes section of each slide to prepare my narrative and put reminders for myself from year to year

I avoid overlapping visuals on my slides

- If an item is replaced, I duplicate the slide so both visuals are available in the lecture notes

Building the system

- Start with a crystal structure (~600 atoms)
- We need some solvent too
- The crystal structure has some solvent
  - These water molecules are bound to the protein, form a solvent shell



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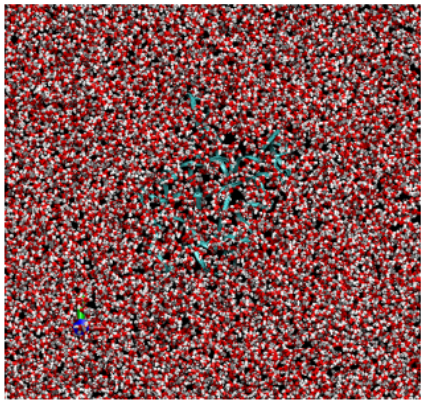
Building the system

- Start with a crystal structure (~600 atoms)
- We need some solvent too
- The crystal structure has some solvent
  - These water molecules are bound to the protein, form a solvent shell
- Add more solvent with hydrogens (~26,000 atoms)



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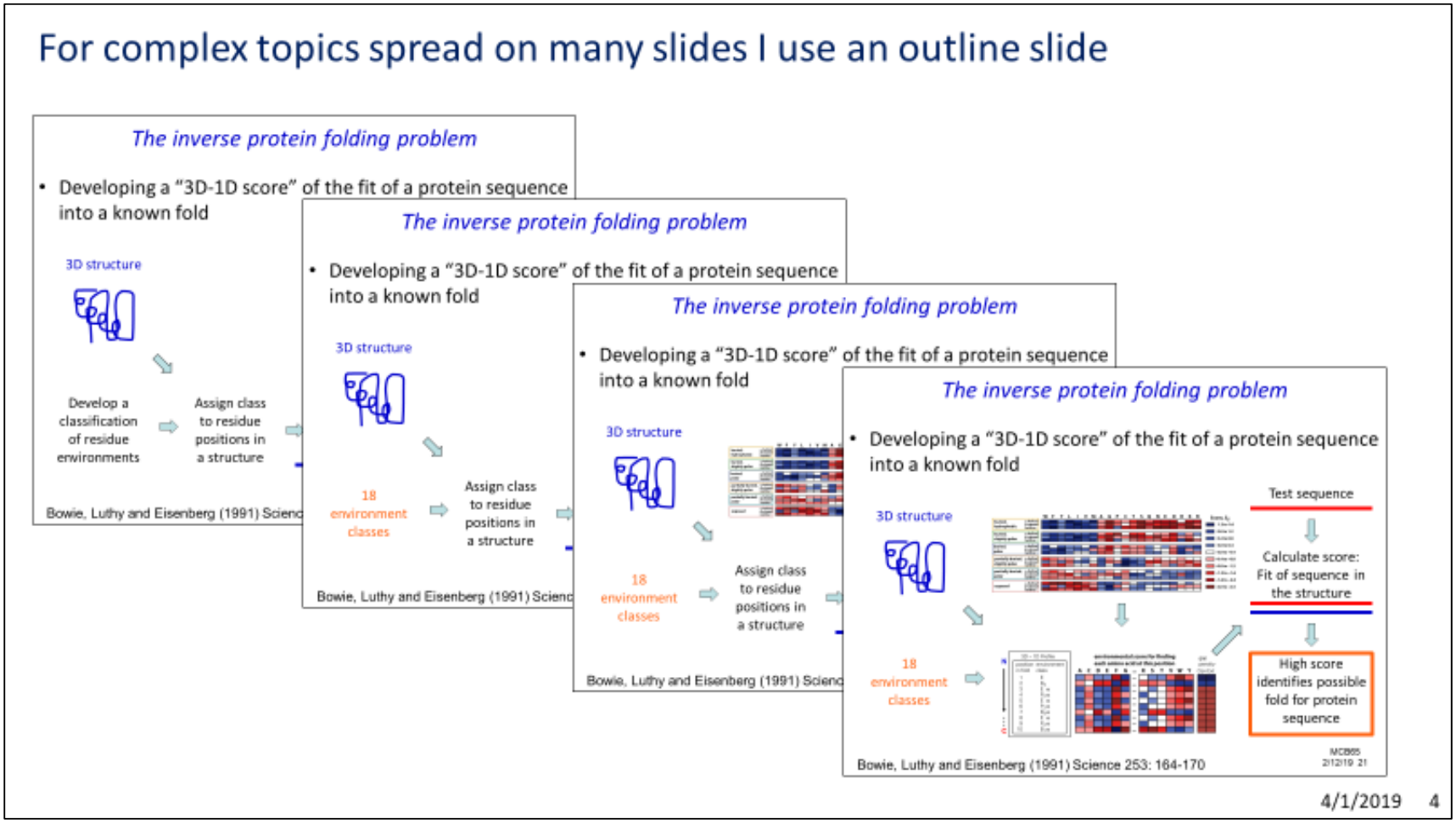
Slides that will not be distributed to students may have overlapping visuals



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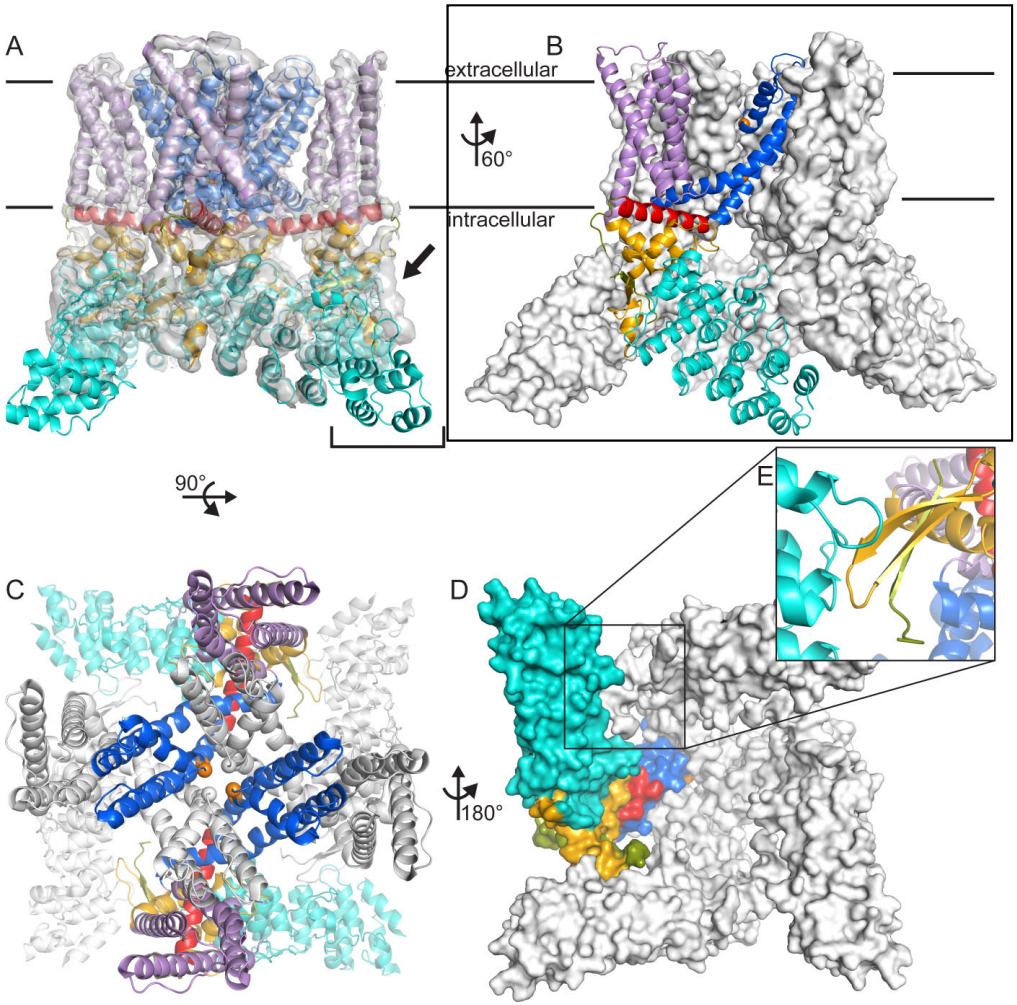
Generating slides and illustrations is an iterative process

- Important goals for my illustrations:
  - Highlight important features
  - Maintain accuracy as much as possible
  - Keep the images appealing

Let's see an example from an illustration for a publication

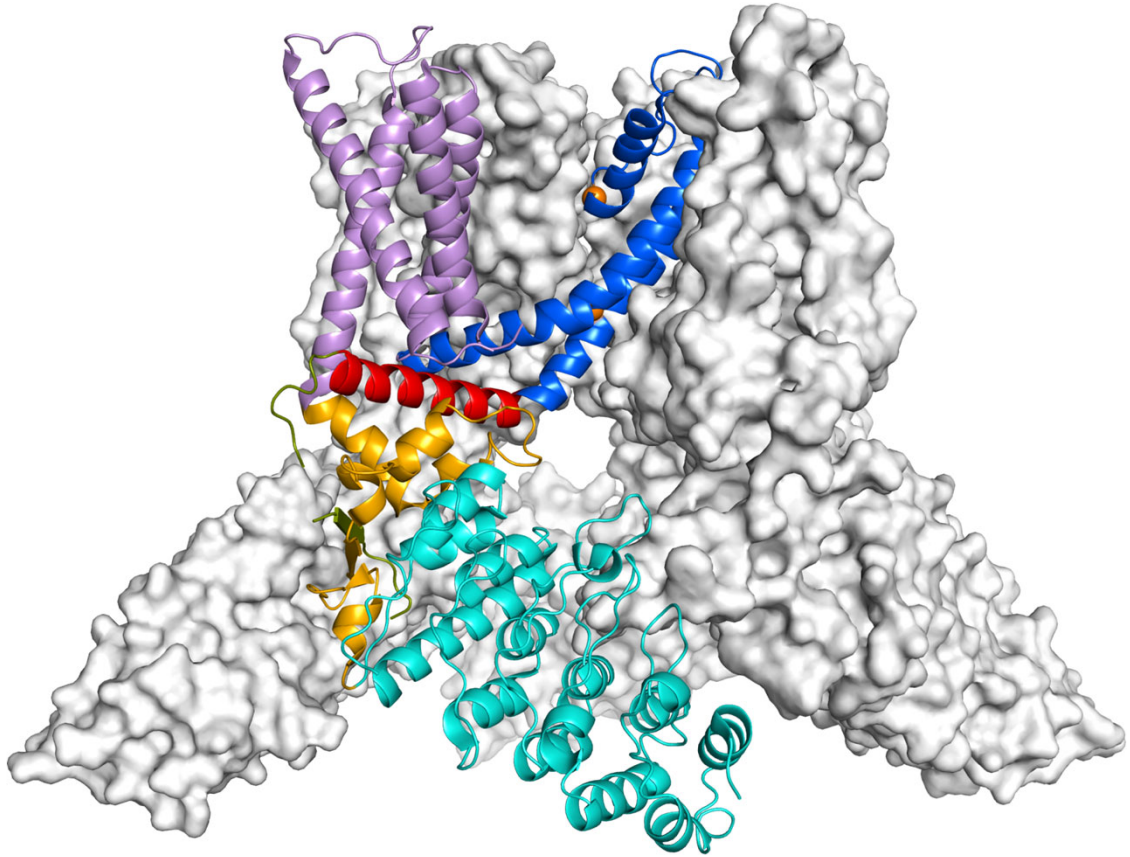
- These goals are often achieved through iteration
- Iteration also means slides evolve through the years – they are always a work in progress!
- I use "Post-mortem" notes to debrief after a lecture and help me prep for the next iteraction

Generating representations for publication is an iterative process



Hellmich and Gaudet (2014) Handb Exp Pharmacol.

Generating representations for publication is an iterative process



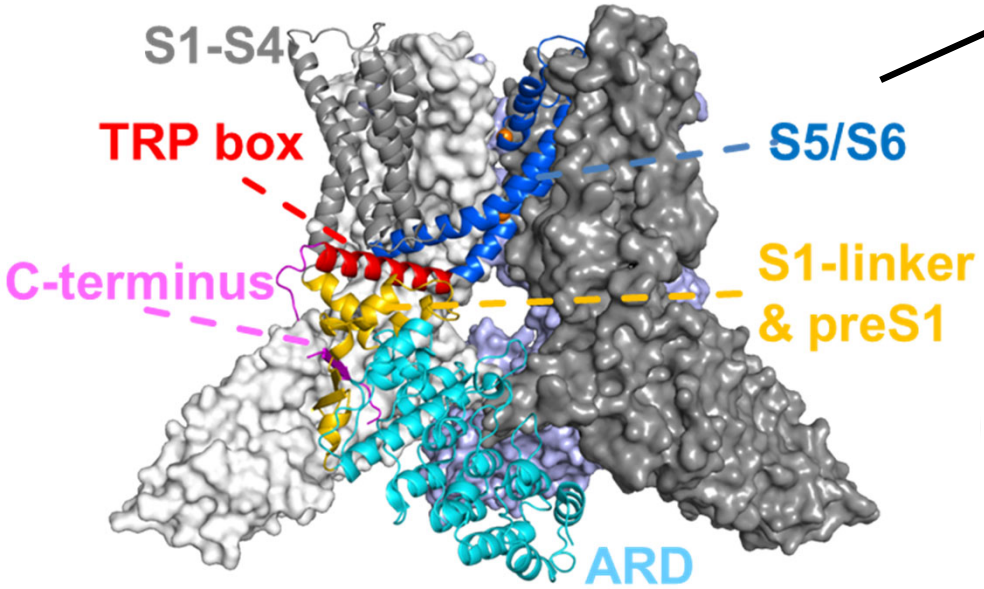
Result:

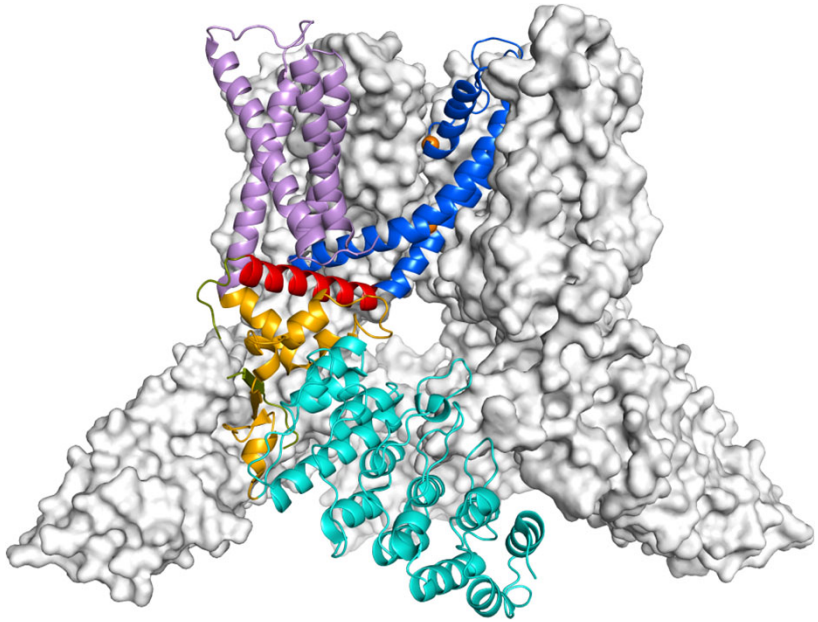
- Focus is on one of the four molecules
- Information on the other three subunits is lost

Generating representations for publication is an iterative process

Changes include:

- Remove unnecessary labels
- Increase depth-cueing
- Reduce the number of colors
- Avoid mixing greys





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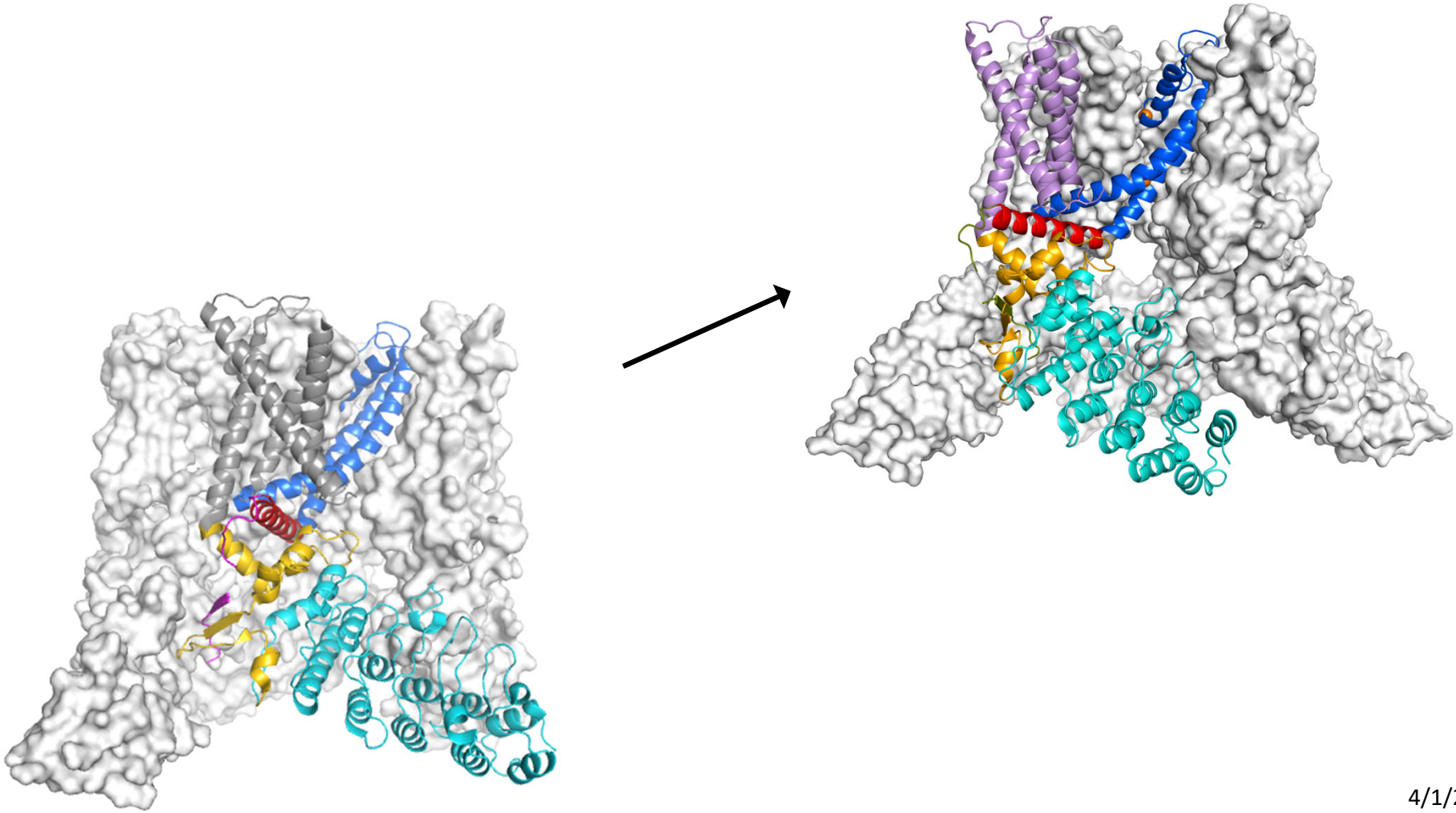
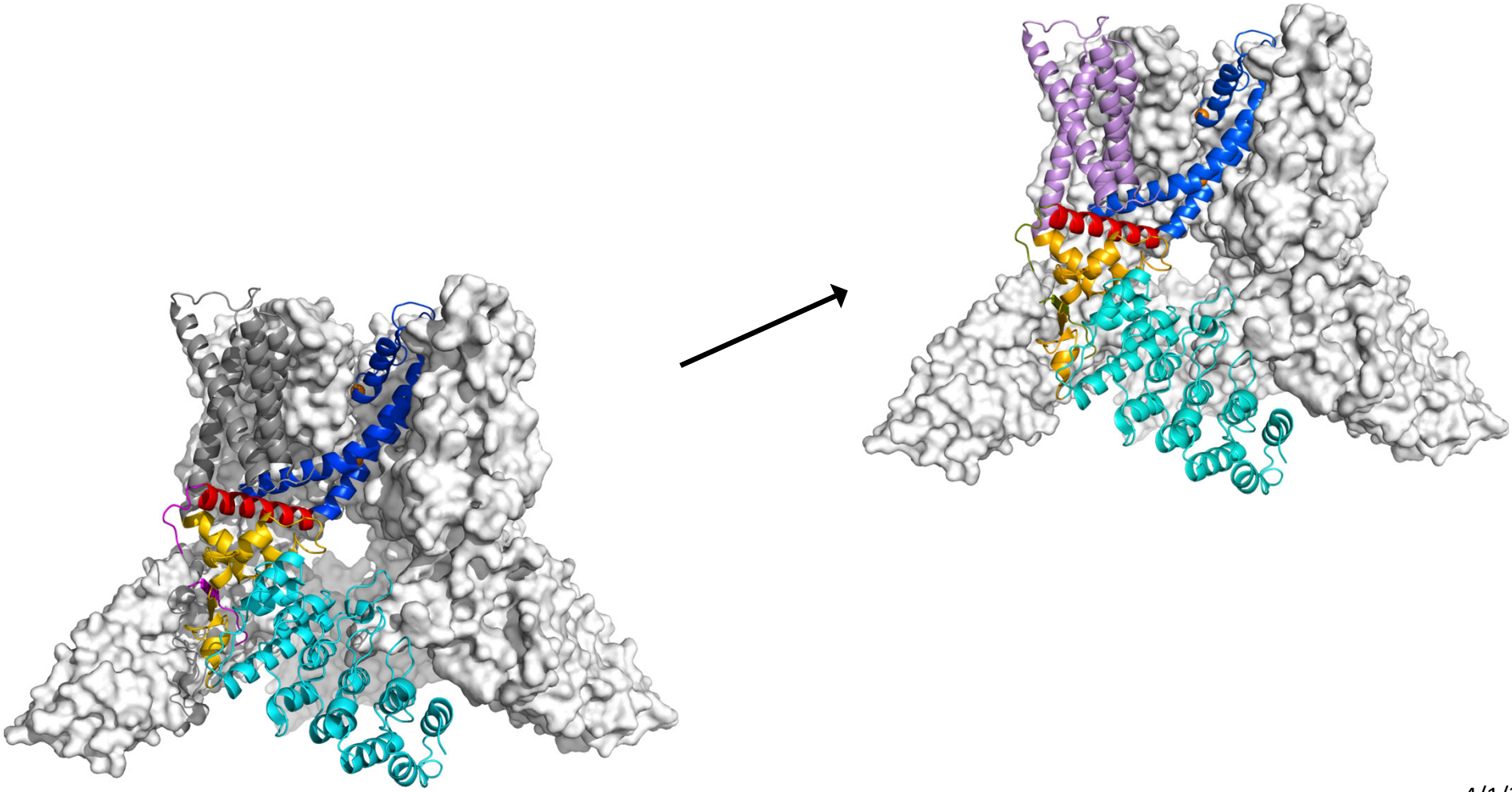
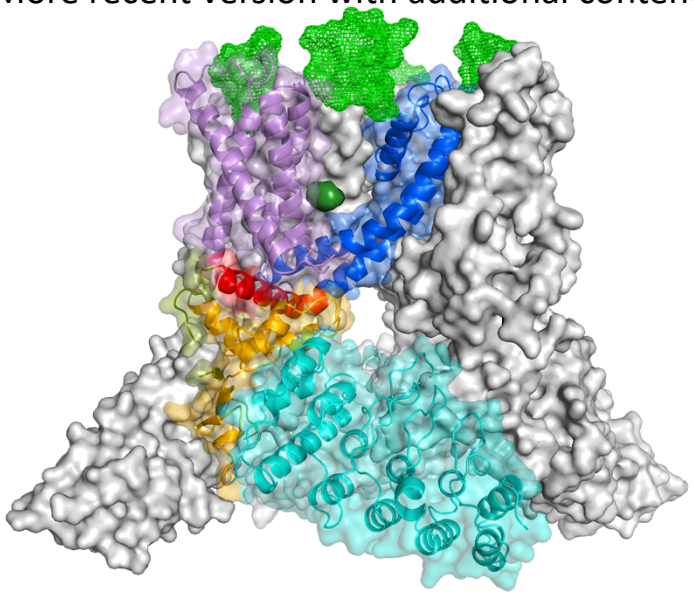


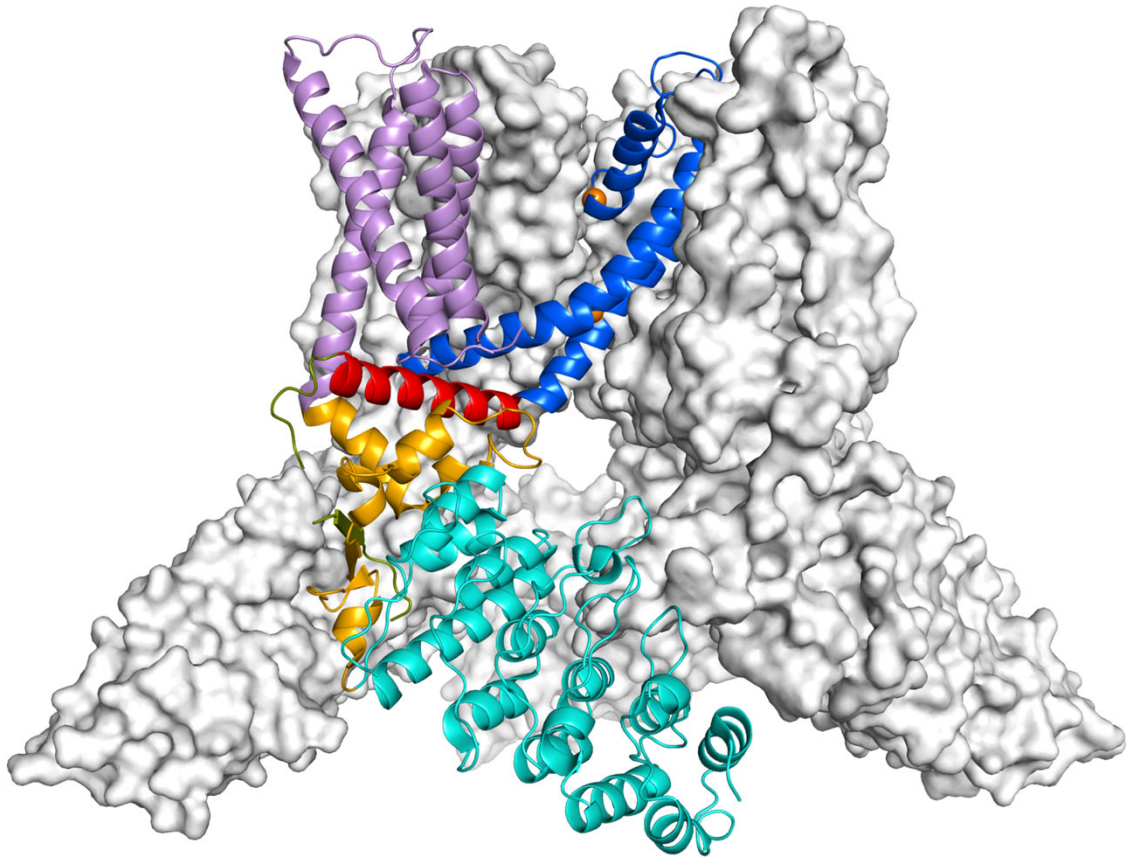
Generating representations for publication is an iterative process



Generating representations for publication is an iterative process

More recent version with additional content





Result:

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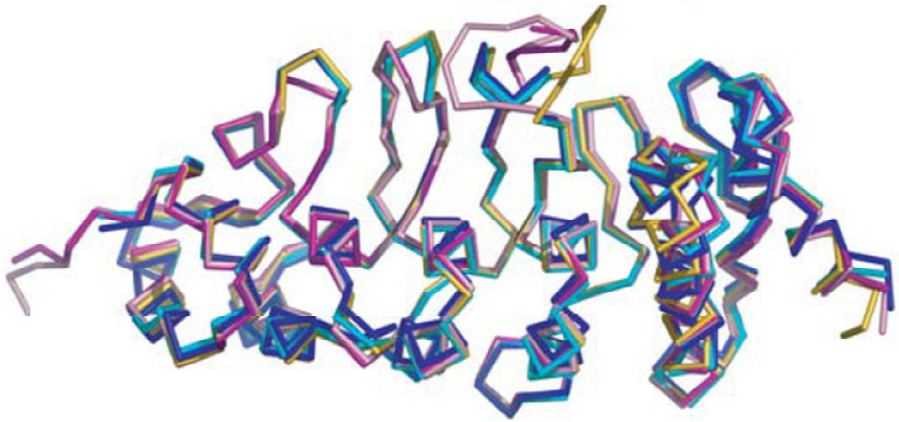
PyMOL example

Another example of using color judiciously for emphasis

Original draft



Final figure as published

Jin et al (2006) JBC 281(35):25006-10

Some tips for visuals

- Accommodate color-blind students
  - https://www.color-blindness.com/coblis-color-blindness-simulator/
  - https://blog.datawrapper.de/colors/
- I try to keep a consistent format / color-coding
- I use colors to highlight, and greys to deemphasize while providing context
- Minimize text, maximize font, but leave enough white space
- It's always a work-in-progress! Develop and adjust your style as time allows