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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• Today I plan to touch three main aspects of visual aids in teaching:
  
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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

**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

**Quick refresher from Friday**

$$R \cdot L \rightleftharpoons R + L$$

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

- $K_D$ and $K_A$ are simply equilibrium constants – and therefore unitless
- Dissociation constant, $K_D$, is equim in magnitude to the concentration of ligand at which half the receptor is occupied, at equilibrium
- Although expressed in molar units, $K_D$ is often expressed in micromolar or nanomolar units

**Scatchard plot analysis**

**Goals slide outlines lecture and learning goals**

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 $K_D$, $K_A$, and ligand concentration and is important in determining inhibitor effectiveness

Ligand-receptor interaction is driven by hydrophobic effect and hydrogen bonds ensure specificity

Describes the enthalpy and entropy change of ligand binding are a result of the interactions made with water and with the protein

- ITC can be used to determine binding affinity, enthalpy, and entropy

**Often start with refresher of prior relevant material**
For complex topics spread on many slides I use a *recurring* outline slide.
Diacylglycerol phospholipids

- 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

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

• 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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- 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)
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

- 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 iteration

Let’s see an example from an illustration for a publication
Generating representations for publication is an iterative process
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

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

PyMOL example

More recent version with additional content
Another example of using color judiciously for emphasis

Original draft

Final figure as published

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