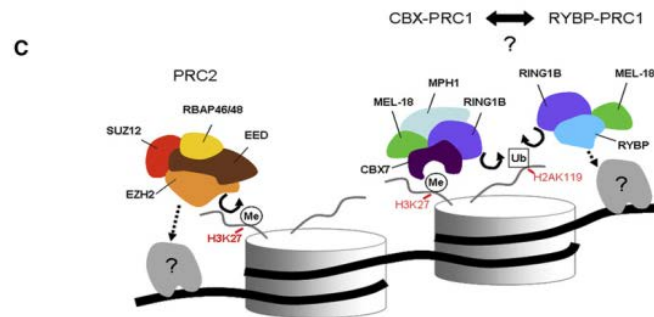
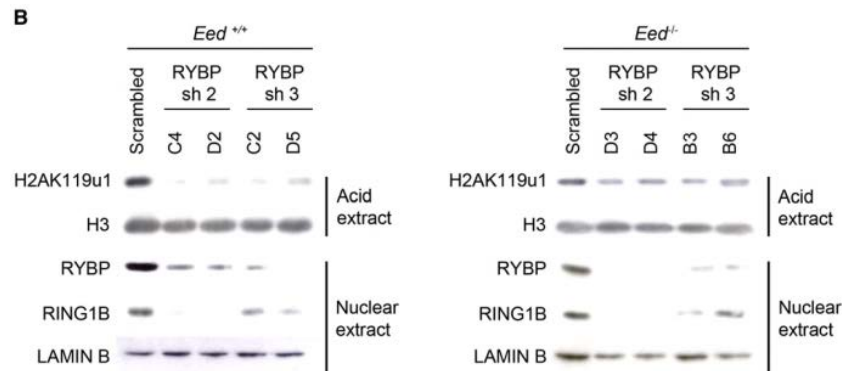
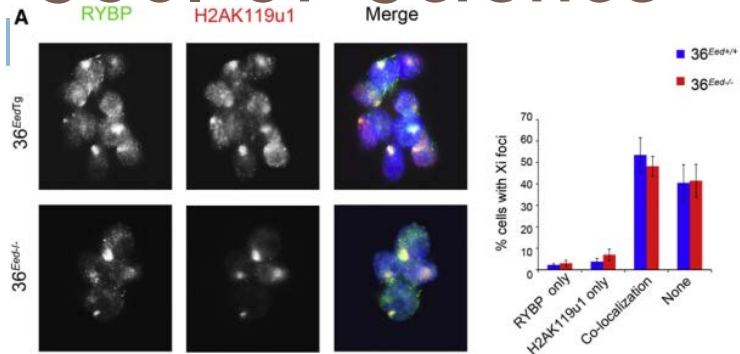


# Actively passive: The role of textbook figures in developing visual thinking skills

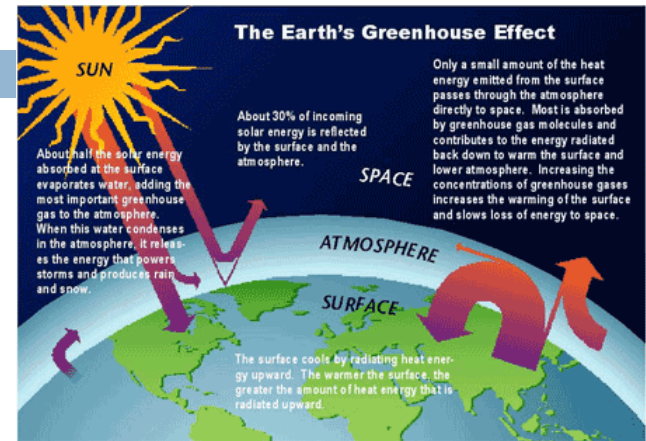
Erika Offerdahl

Department of Chemistry & Biochemistry

# Visual Representation: The Heart and Soul of Science

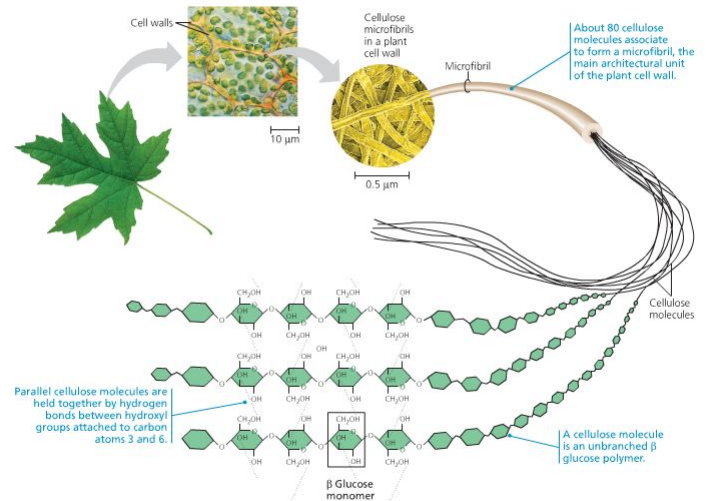


Tavares et al. 2011.



<http://science.howstuffworks.com>

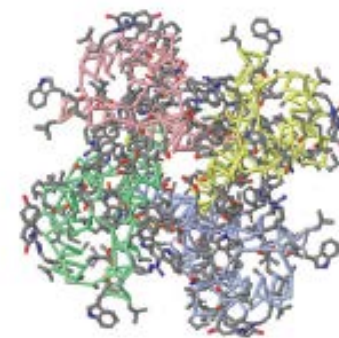
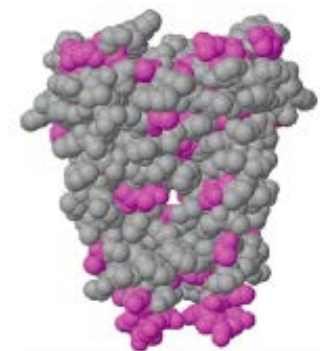
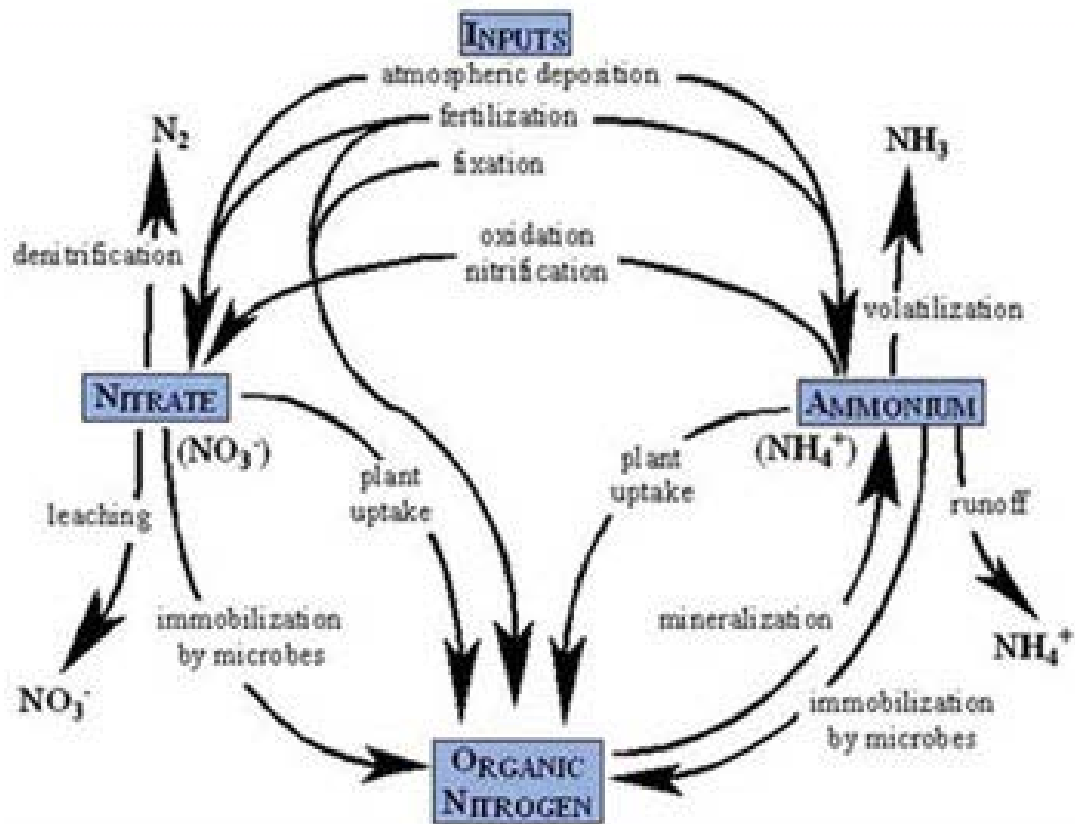
US Global Change Research Program



Campbell, *Biology* 8<sup>th</sup> Edition

# What is visual thinking?

- *Interpret, create, and use* representations

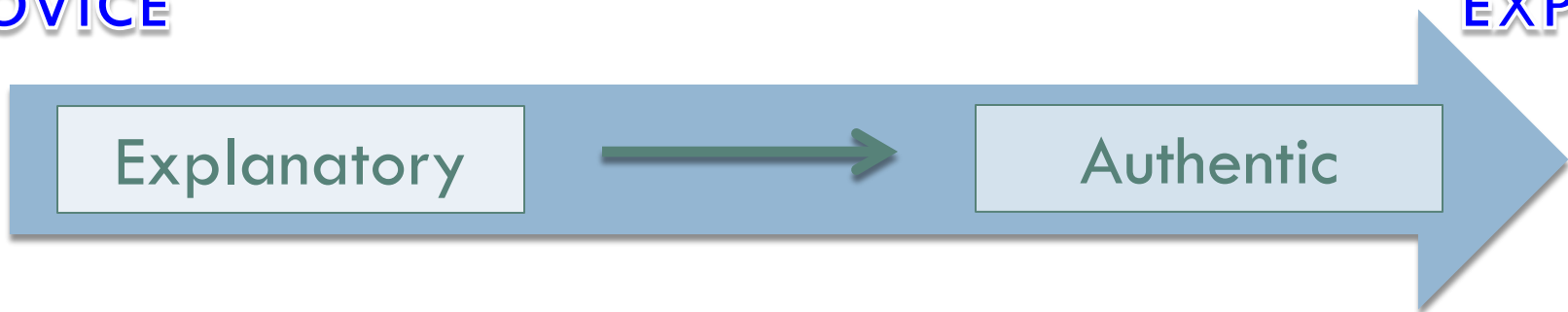


# How are visual thinking skills developed?

- Visual thinking is, at best, an implicit goal of undergraduate curricula.
- As such, visual thinking is constrained by the visualizations to which students are exposed.

NOVICE

EXPERT

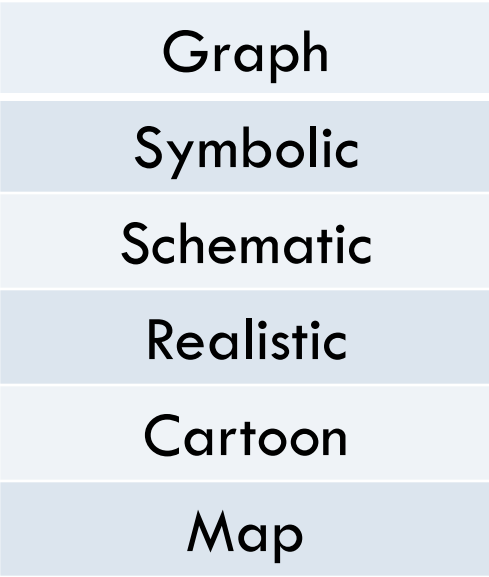


Instructional Visualizations

# Research Questions

To what degree do textbook visualizations provide a scaffold for the development of visual thinking?

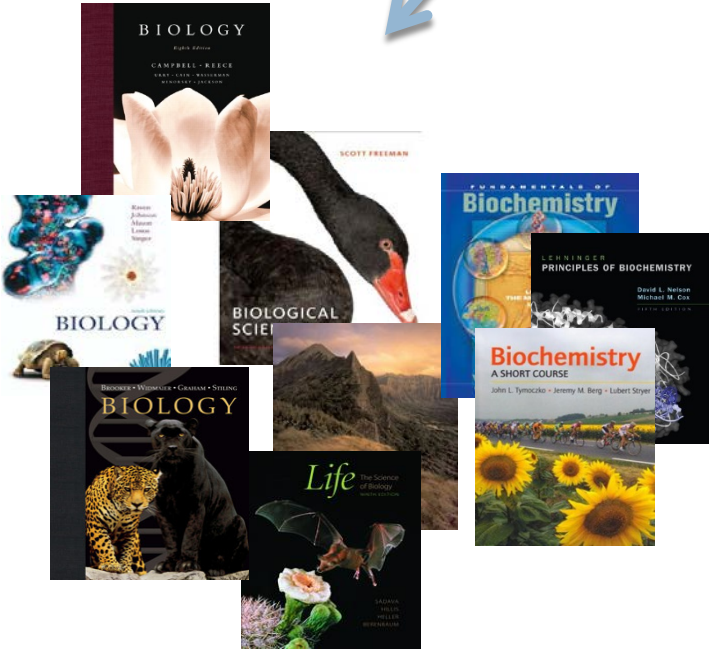
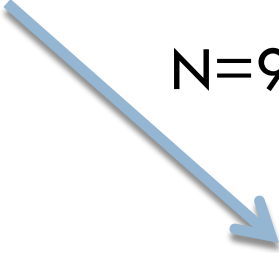
- ▣ What is the nature of textbook visualizations across the undergraduate curriculum?
- ▣ How do textbook visualizations compare to expert visualizations?



N=2332

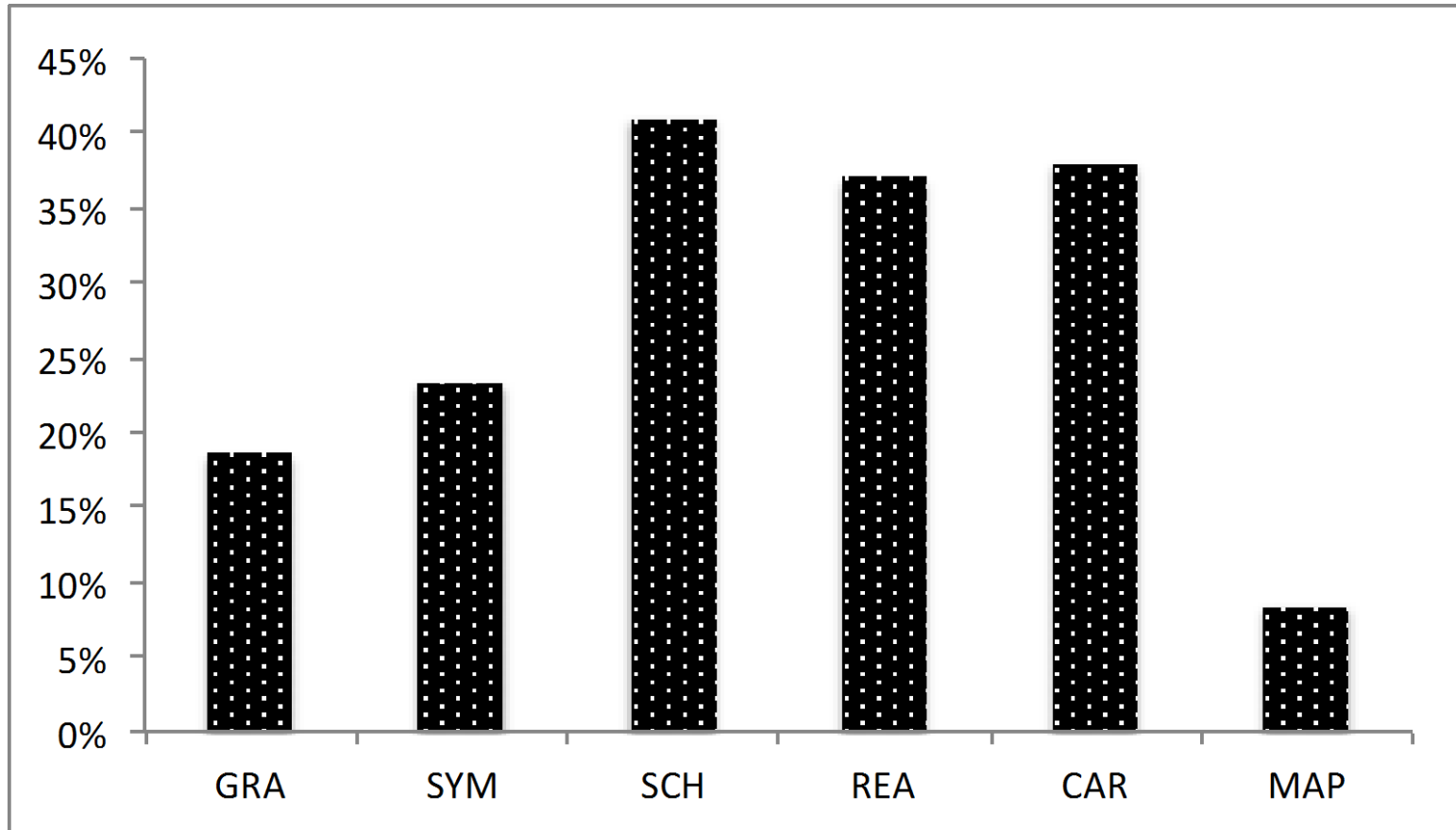


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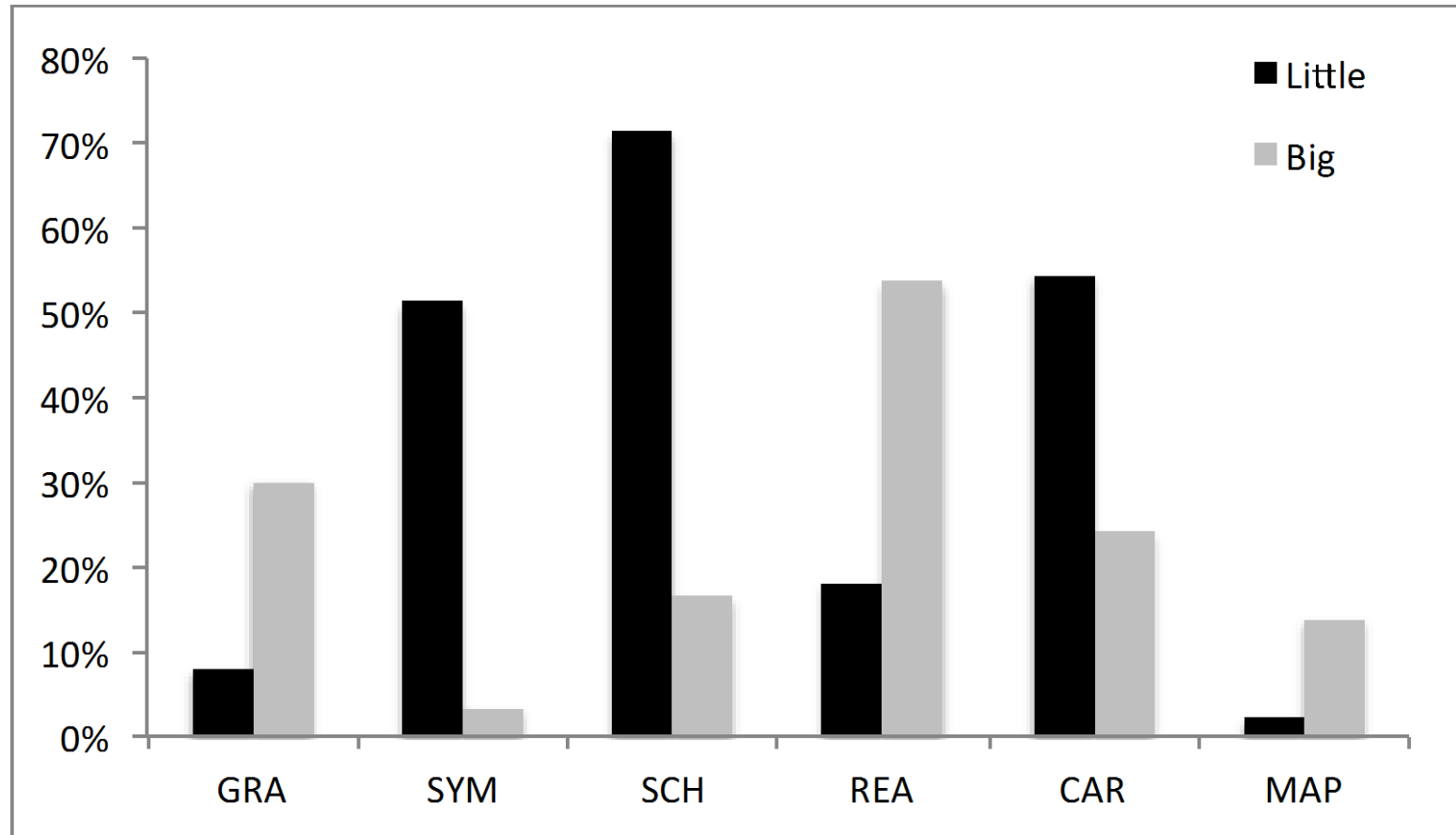


Duncan et al., 2011; Rybarczyk 2011

# Visualizations in Introductory Biology Sequence



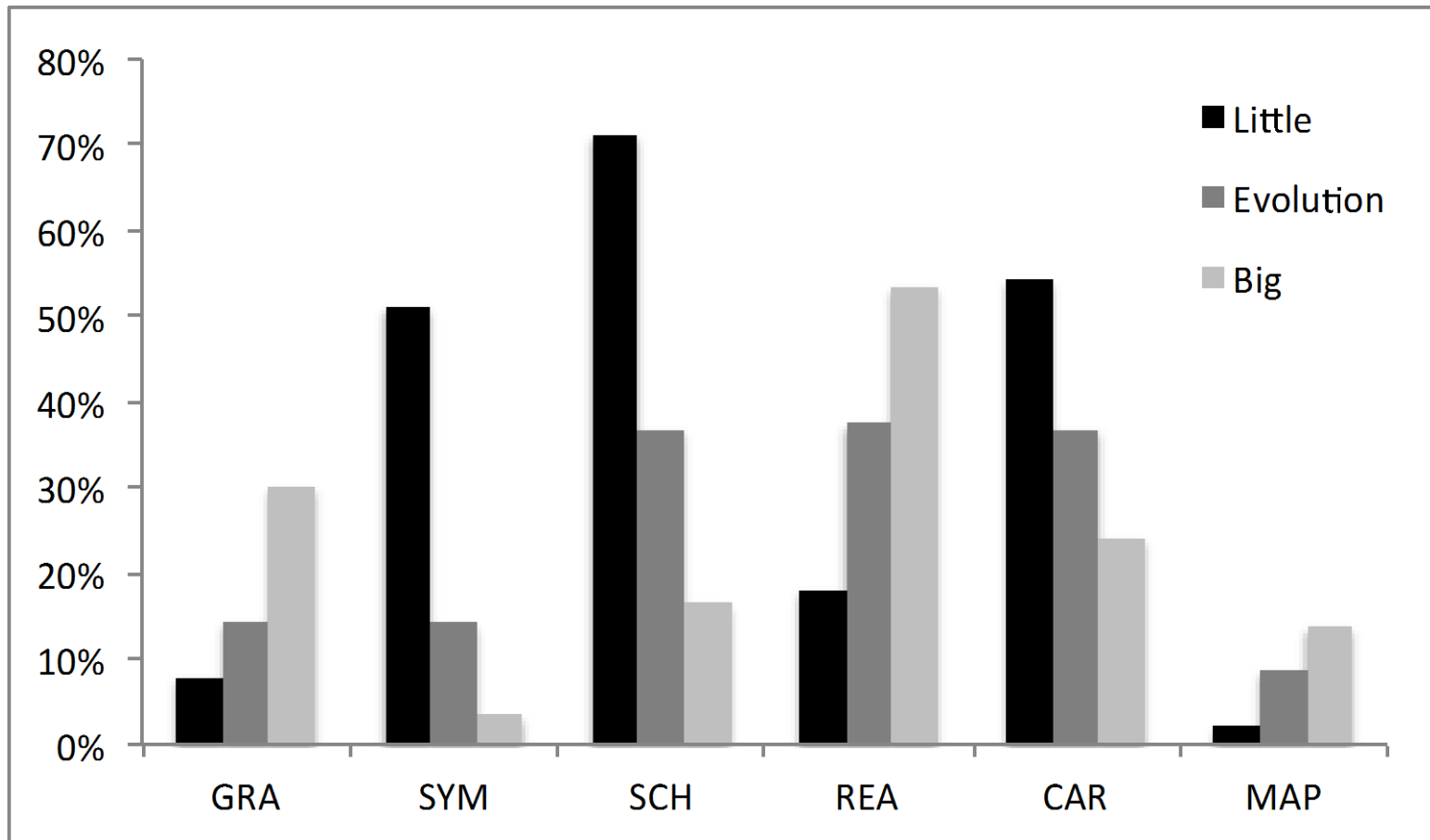
# Disconnect Between Semesters in Introductory Biology Sequence



13 July 2013

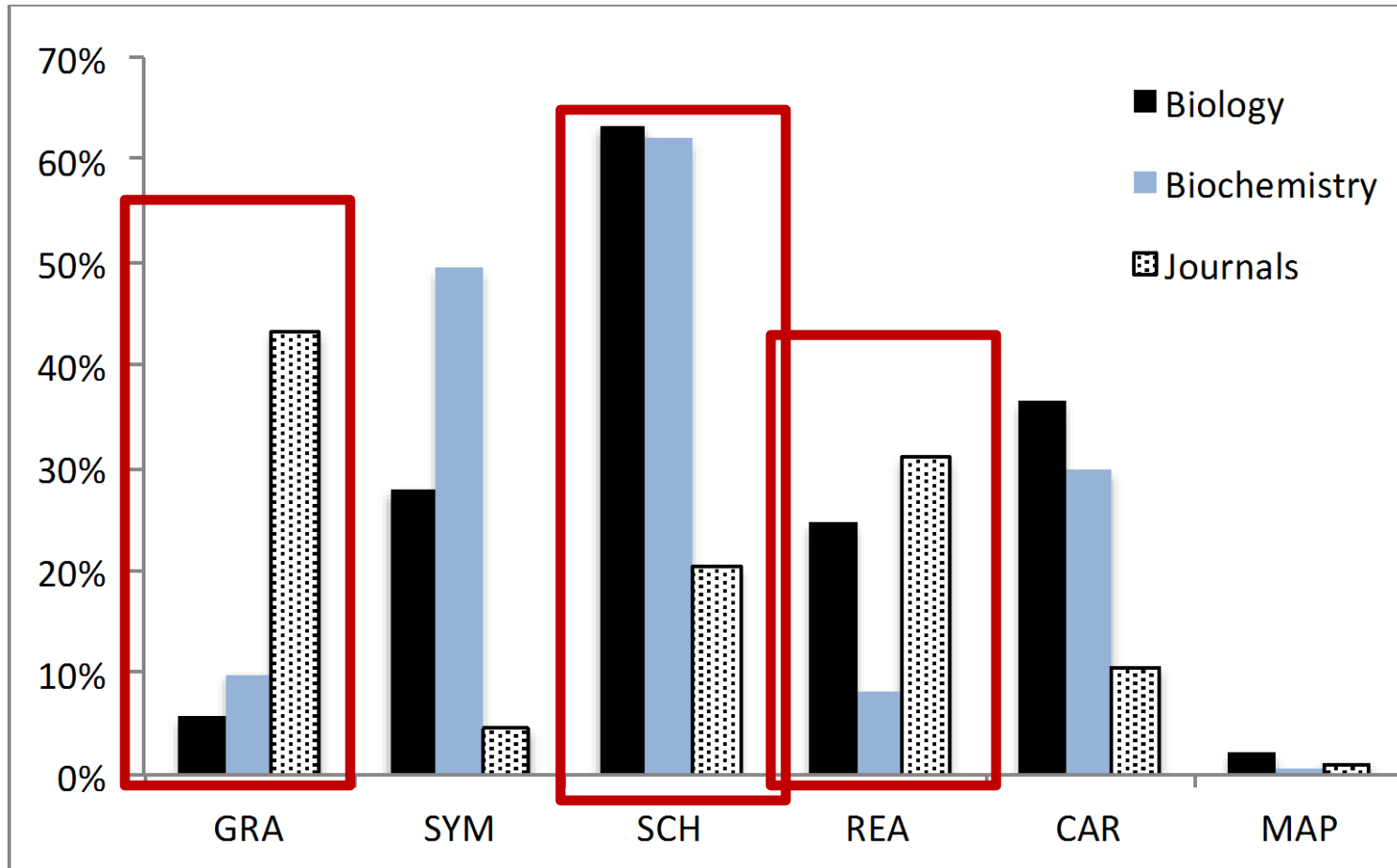


# Evolution: The Unifying Theme?



13 July 2013

# A transect across a curriculum



# Summary

- Lack of scaffolding across the undergraduate curriculum to support development of visual thinking .
- There is a disconnect between what students are routinely exposed to and what scientists use.
- Paucity of graphs may reinforce perceptions of life science as non-quantitative.
- Photographs and other real images are decorative or explanatory rather than representing data.
- Schematics seldom used to model or hypothesize.

# Implications and Future Work

- Learning environments should be augmented to better scaffold the development of visual thinking – including how we assess our students.
- Students need more opportunities to **see** and **interpret** authentic visualizations as well as **practice** representing data visually.
  - Model-based instruction
  - Authentic laboratory experiences
  - Portfolios of student learning

# Acknowledgements

**CiDER (Collaboration in Discipline Based Education Research) and Biochemistry Education Research Group @ NDSU:**

**Dr. Jenni Momsen**

**Jessie Arneson**

**Mary Derting (REU)**

**Alisa Fairweather (undergrad)**

**Jordyn Hull (REU)**

**Amanda Kliora (REU)**

**Megan Meyer (undergrad)**

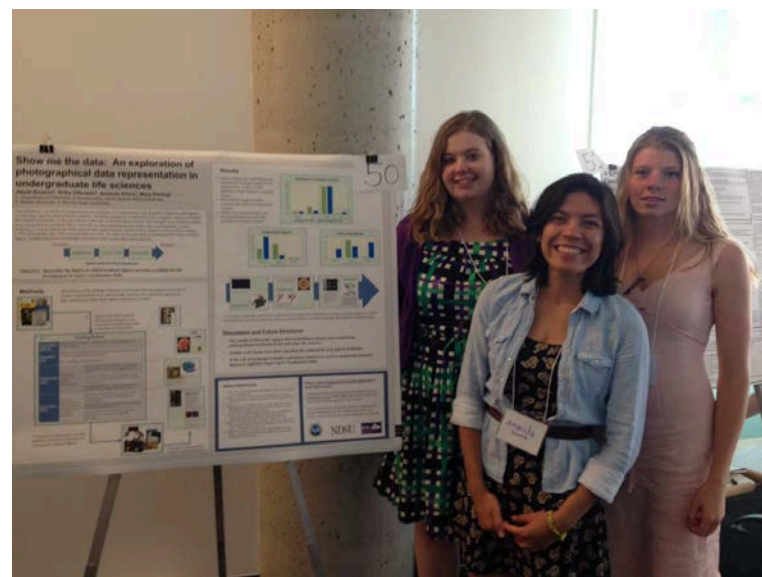
**Jan Ohm (high school student)**

**Amy Williams (undergrad)**

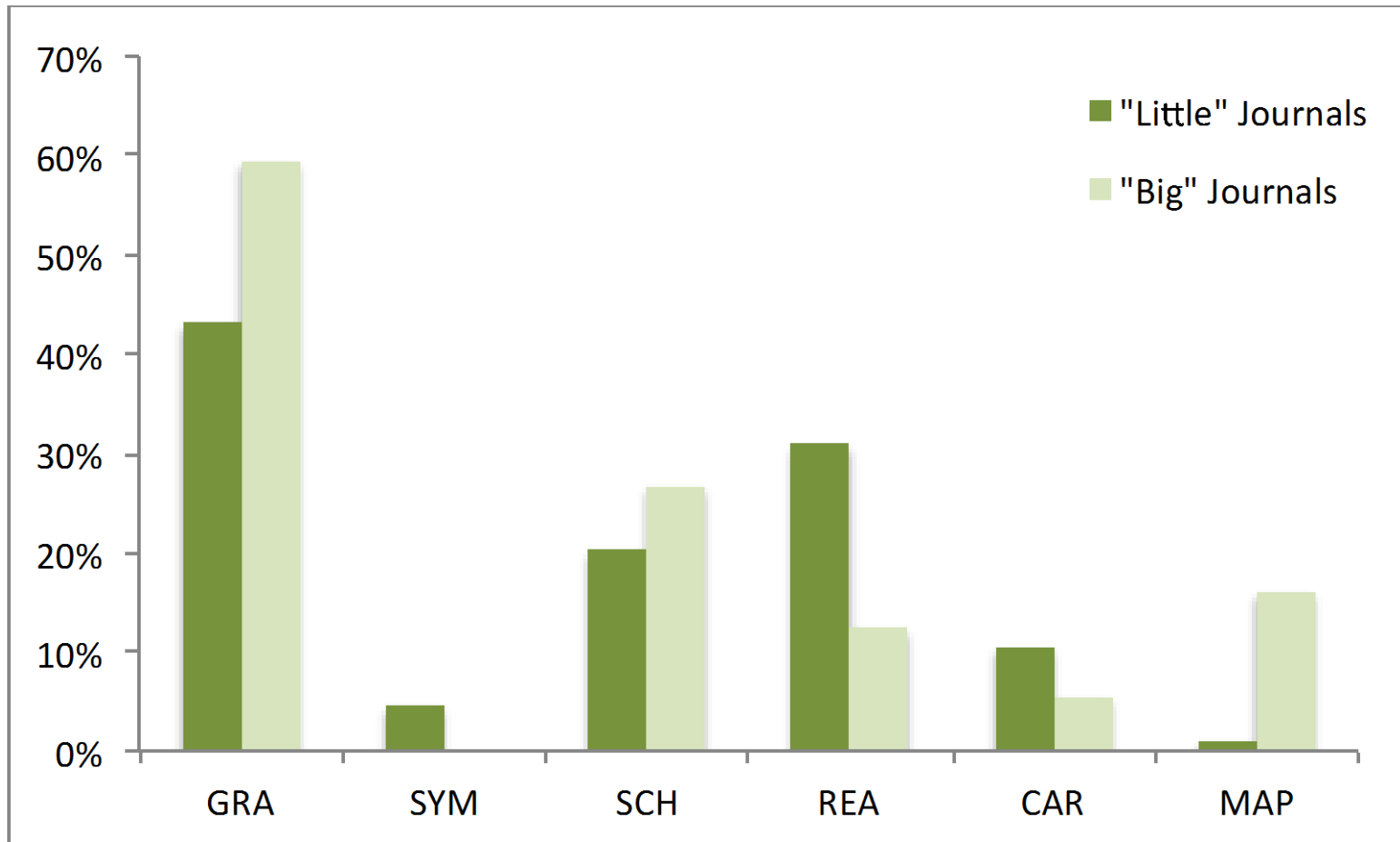
NSF-CHE #1062701

NSF-DUE #1156974

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# Differences due to disciplinary practices?



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