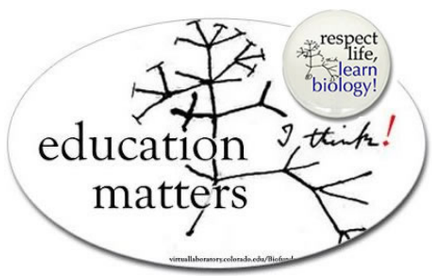
TaLB - Next Section (tonight) - Klymkowsky

- **Anything interesting happening (that you want to share)?**
- Dossier: track changes+extensions using different text colors.
  - I will review and provide feedback for all dossiers after next week's session
- Review from last time (comments / questions)
  - consider graphic assessment activities (models)
- **Then** : Evolutionary thinking
  - Origins, implications, and acceptance
  - Randomness in biological systems
  - Teaching genetics



Trujillo et al 2012: [Using graph–based assessments within socratic tutorials to reveal and refine students' analytical thinking about molecular networks]

Are Noncovalent Interactions an Achilles Heel in Chemistry Education? A Comparison of Instructional Approaches

Leah C. Williams,[†] Sonia M. Underwood,[†] Michael W. Klymkowsky,[‡] and Melanie M. Cooper[*,†]

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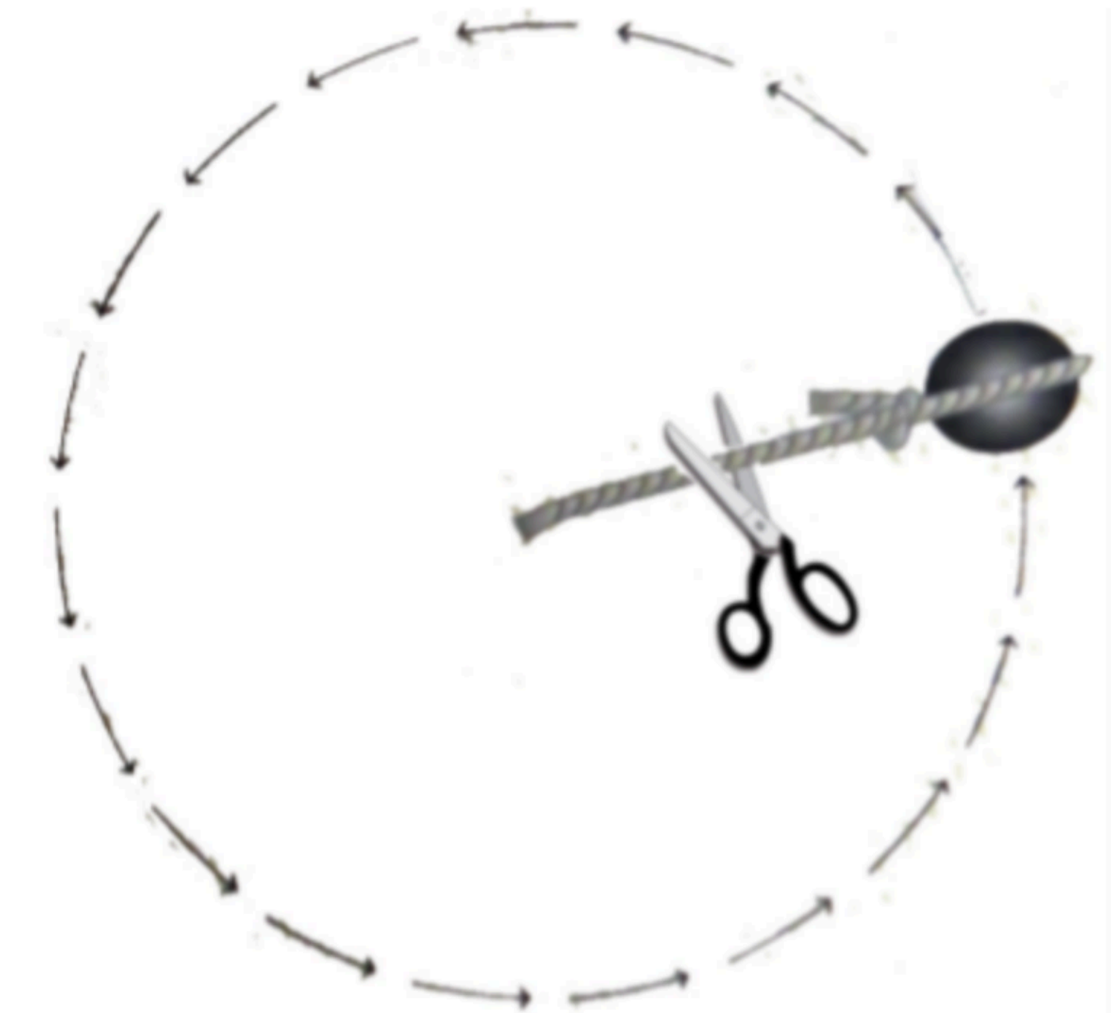
The diagram shows a rock attached by a rope to a person (at the center) who is spinning it around their head. Draw how you think the the rock will move if the person lets go of the rope



Draw | Erase | Reset

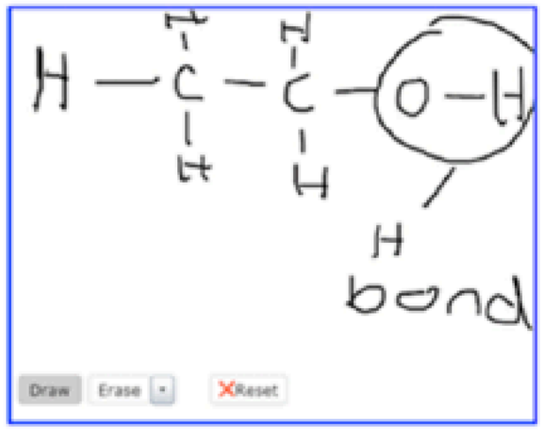
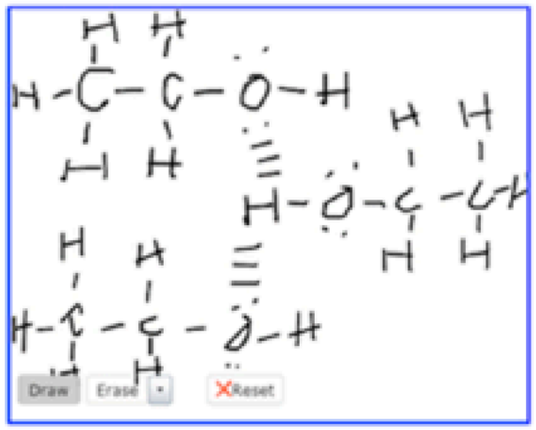
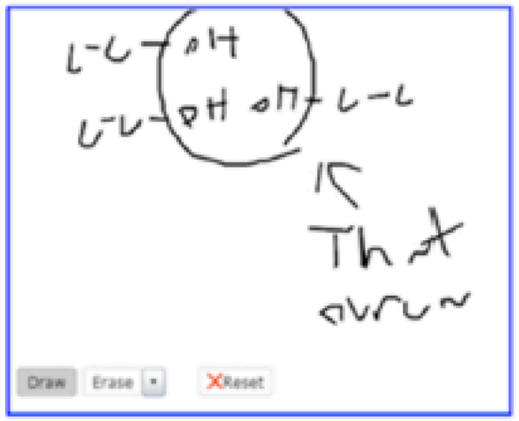
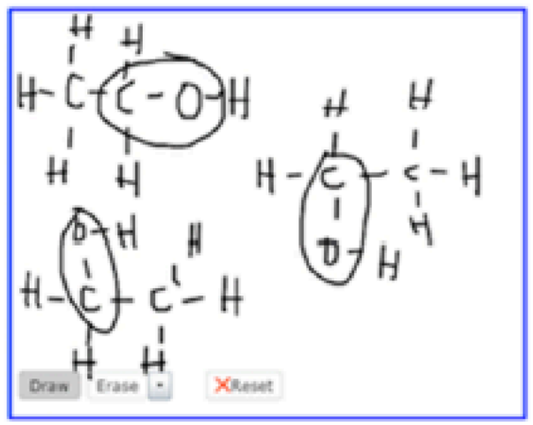
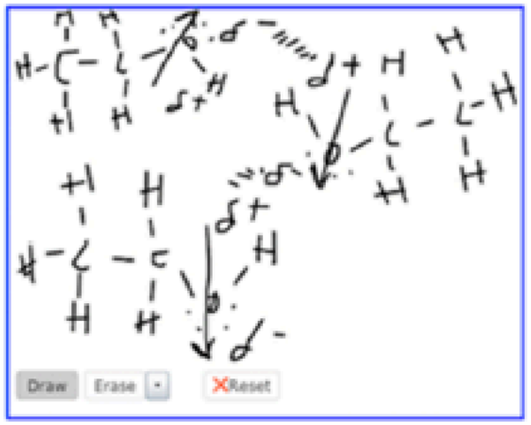
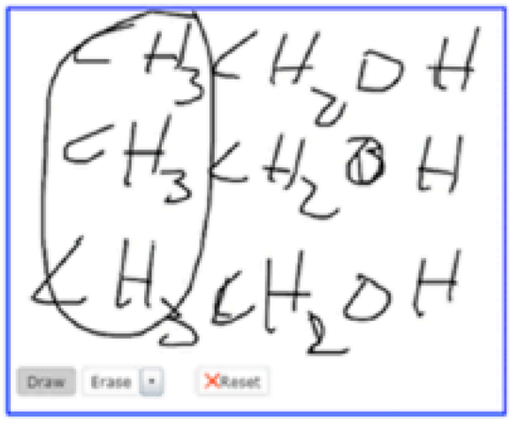
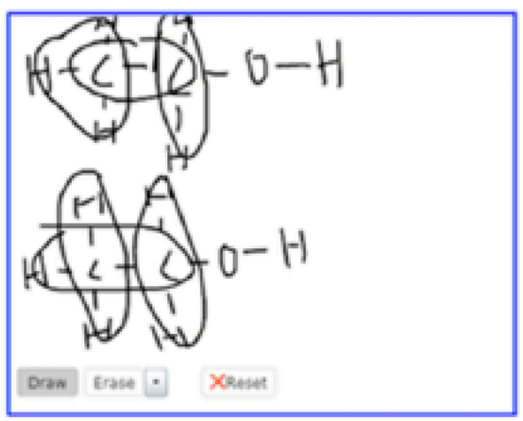
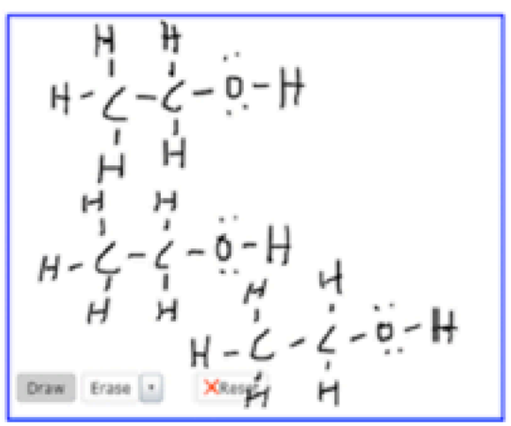
What ideas did you use in your answer?

The diagram shows a rock attached by a rope to a person (at the center) who is spinning it around their head. Draw how you think the the rock will move if the person lets go of the rope

Draw | Erase | Reset

What ideas did you use in your answer?

Table 1. Coding Examples for Student Drawings of Selected Types of Intermolecular Forces

IMF Type	Code for IMFA Response Drawings Characterizing IMF Locations		
	Within the Molecule	Between Molecules	Ambiguous
Hydrogen Bonding			
Dipole–Dipole Interactions			
London Dispersion Forces			

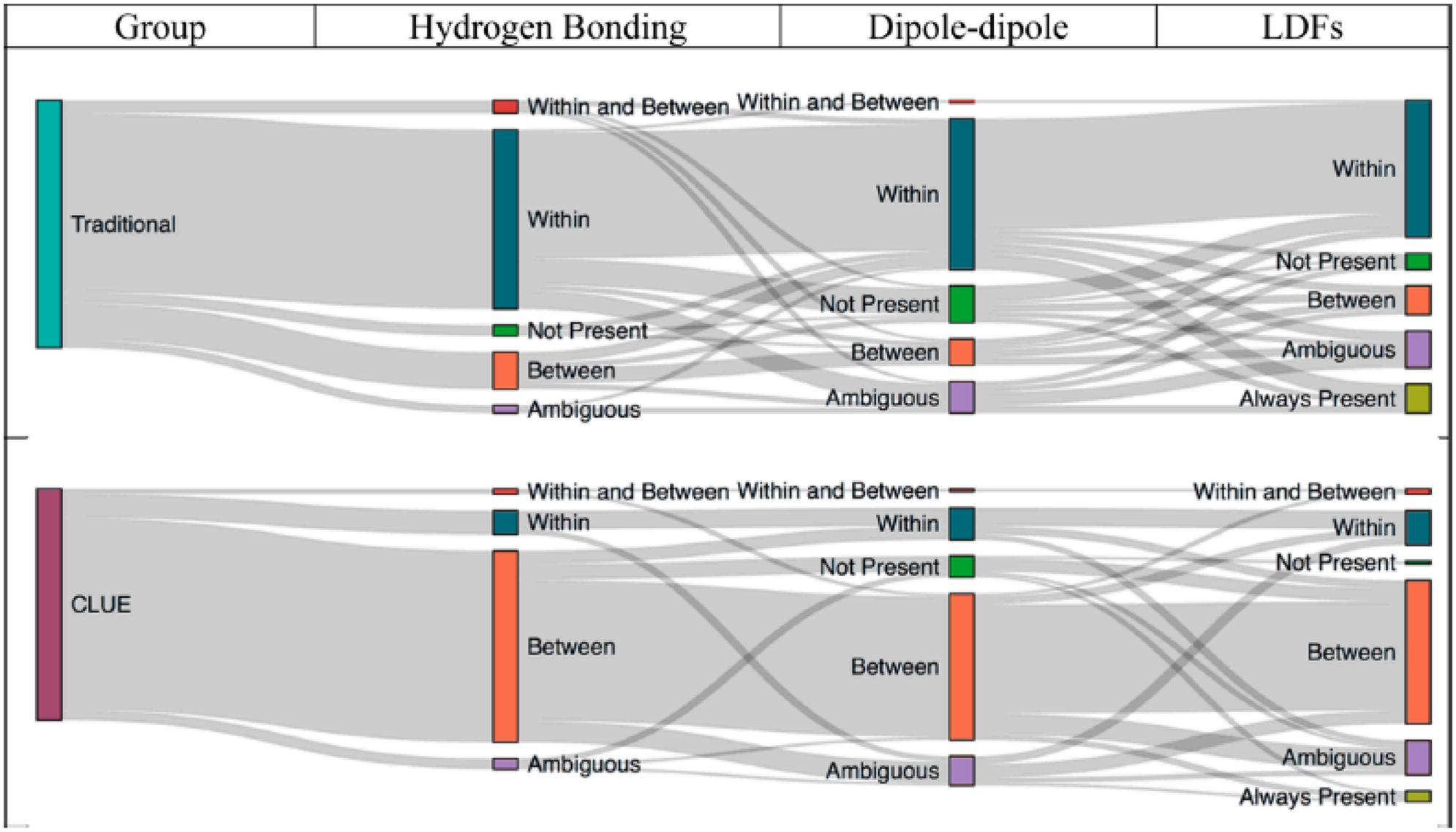


Figure 2. Flowchart showing how the code frequencies change for students in Cohort 1 across all three IMFs.

Trujillo et al 2012: [Using graph–based assessments within socratic tutorials to reveal and refine students' analytical thinking about molecular networks]

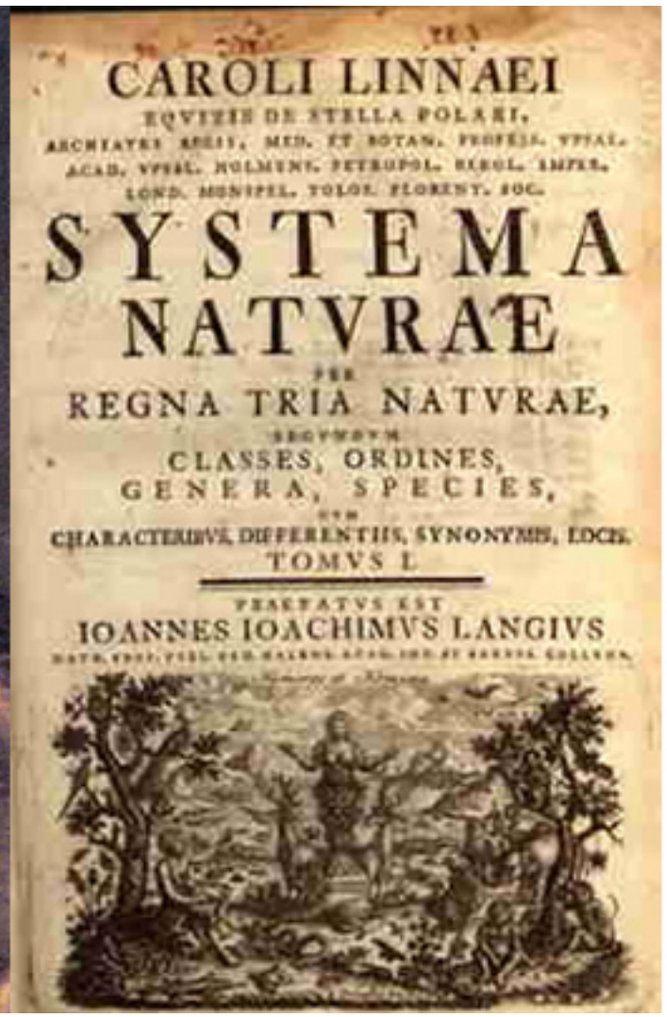
Consider in your dossier

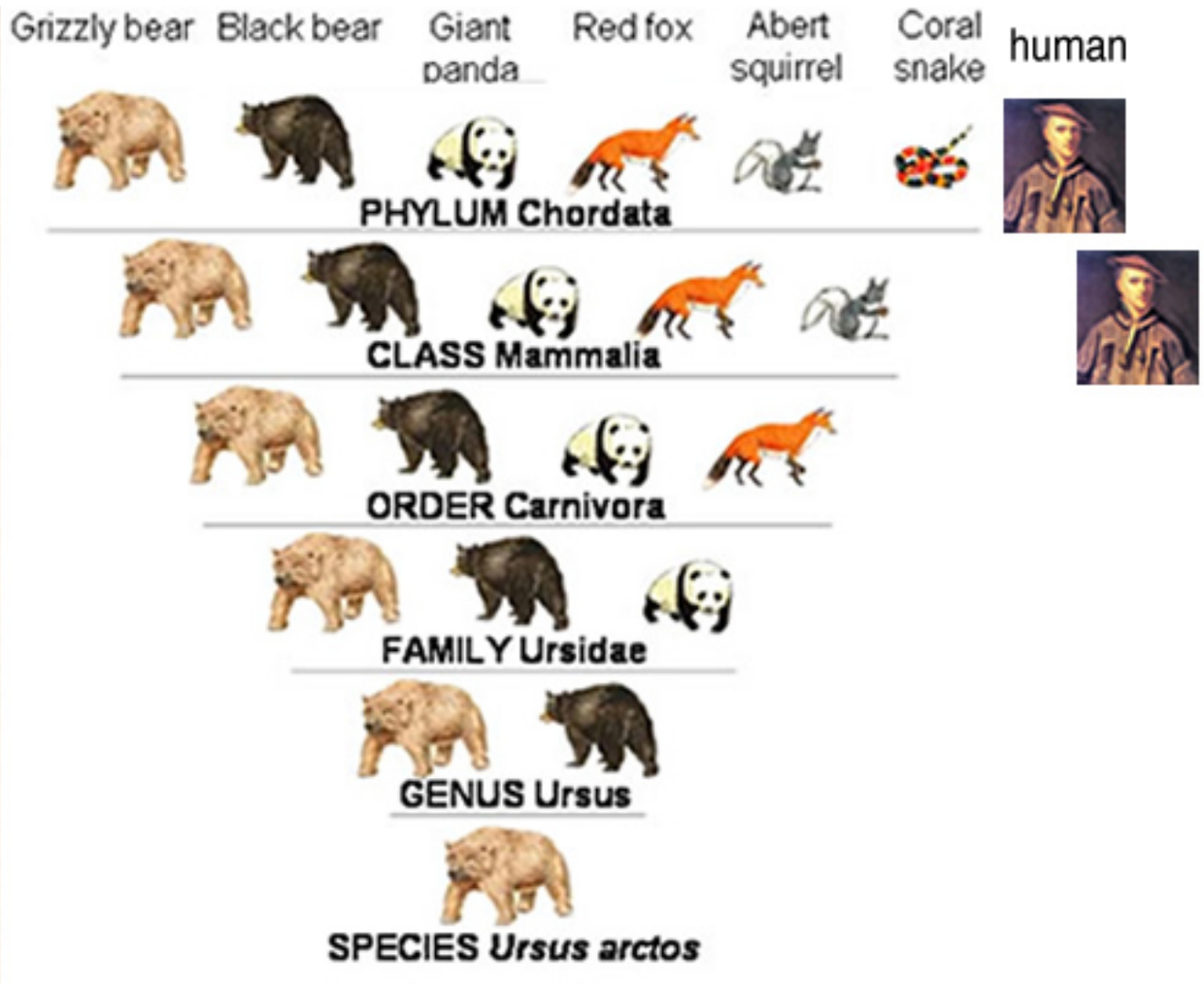
- Consider the types of learning situations in which drawings are useful.
- Try to develop present a simple graphic + text answered question.
- Goals and expectation of what students' graphs/ drawings might reveal that might be missed in a word-only response.

- **After reading** : Revisiting the eclipse of DarwinismLinks to an external site.
  & Why Don’t People Think Evolution Is True? Implications for Teaching, In and Out of the ClassroomLinks to an external site.

Where did the idea of evolution come from?
What did Darwin/Wallace add?

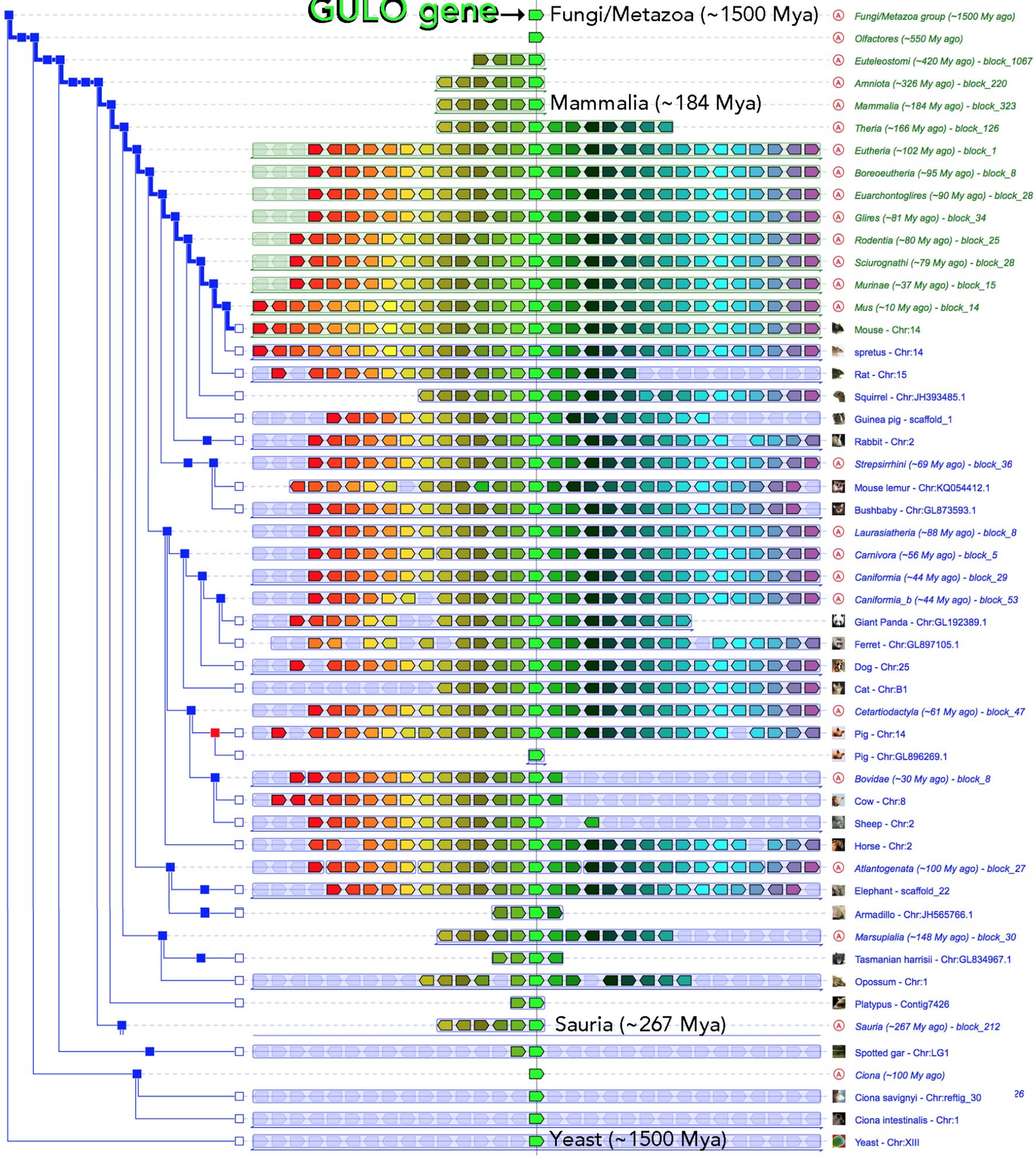
Week 4.1 Eclipsing and Rejecting Darwin



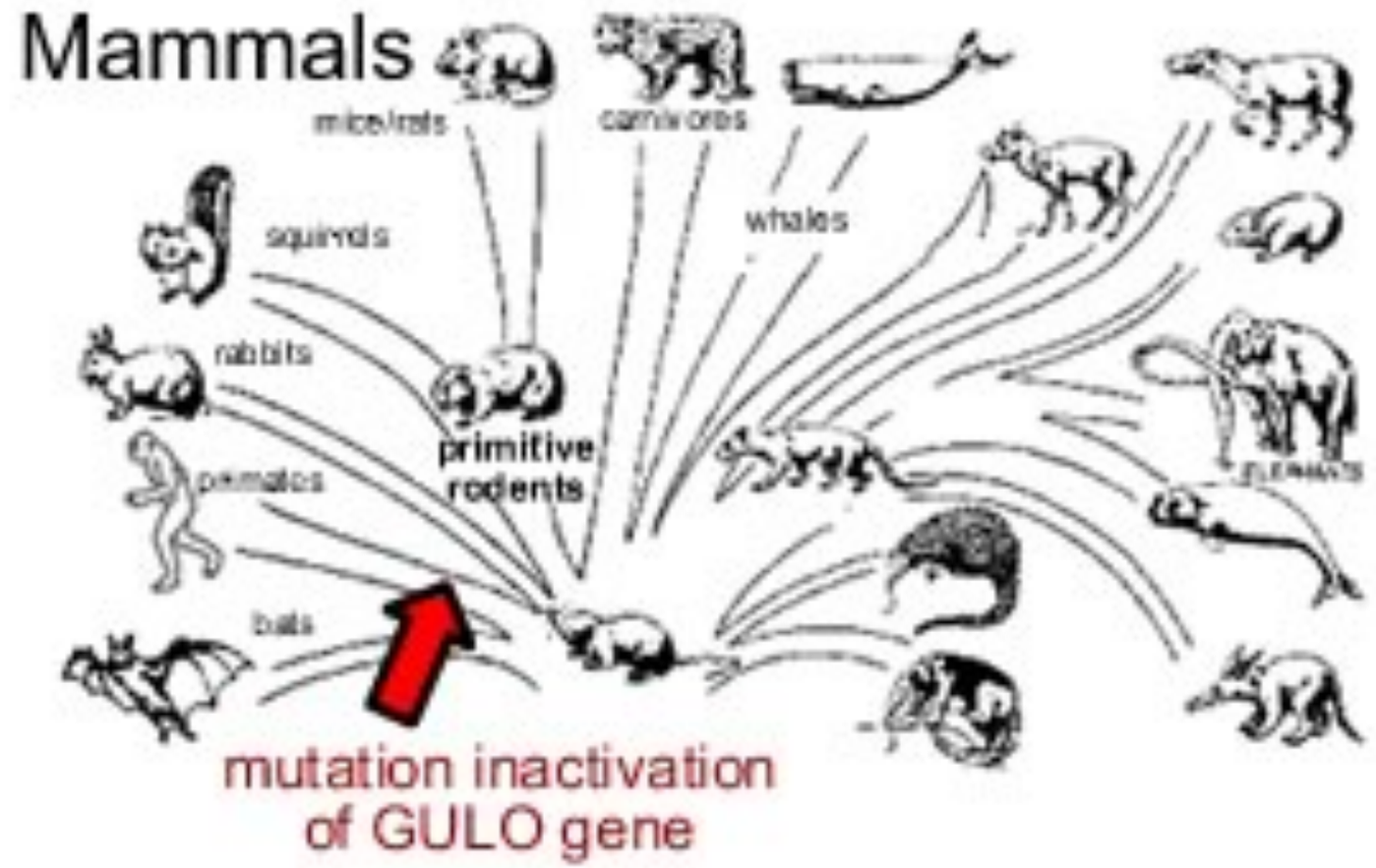


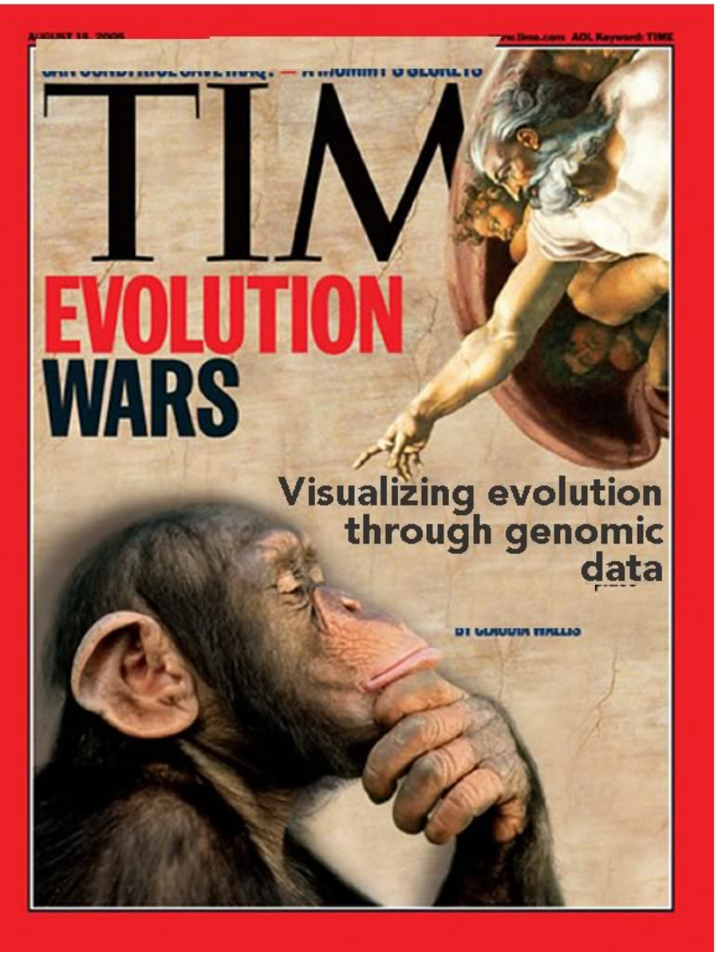
What are the (scientific + philosophical) implications of a Linnaean classification sheme?

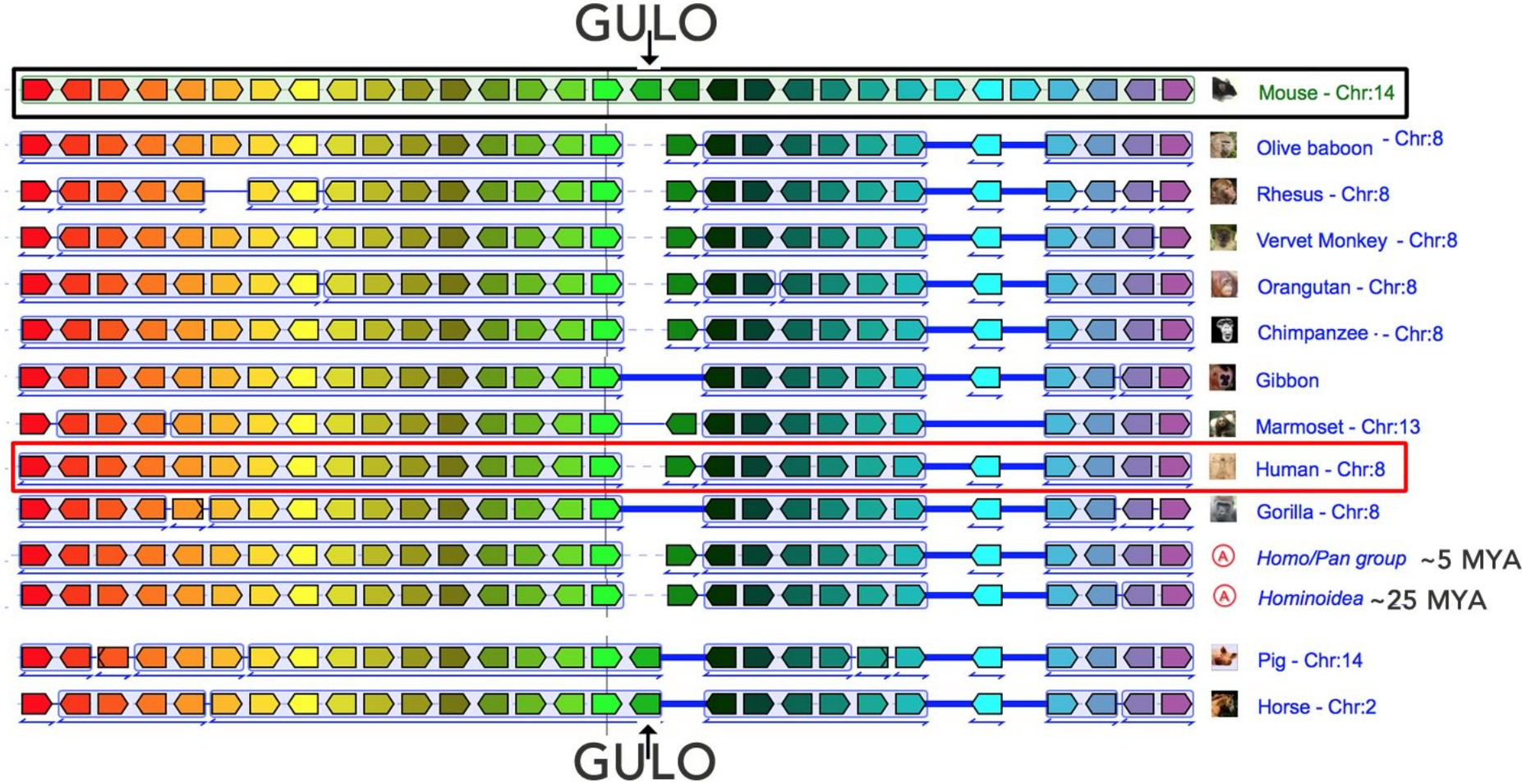
The impact of genomic data (synteny)



The impact of genomic data







- **After reading** : Revisiting the eclipse of Darwinism.
  & Why Don't People Think Evolution Is True? Implications for Teaching, In and Out of the Classroom.

  - What parts of Darwin's Theory of Evolution were readily accepted (and acceptable), which were not, and why?
    - consider both scientific and non-scientific reasons
  - What types of obstacles keep more "modern" people from accepting the reality of evolution?
    - Are they the same as those of the original scientific "rejectors"?
    - Consider both the positive and negative social implications of "evolutionary thinking".

Group discussion: how might considering these questions alter your presentation of evolutionary ideas?

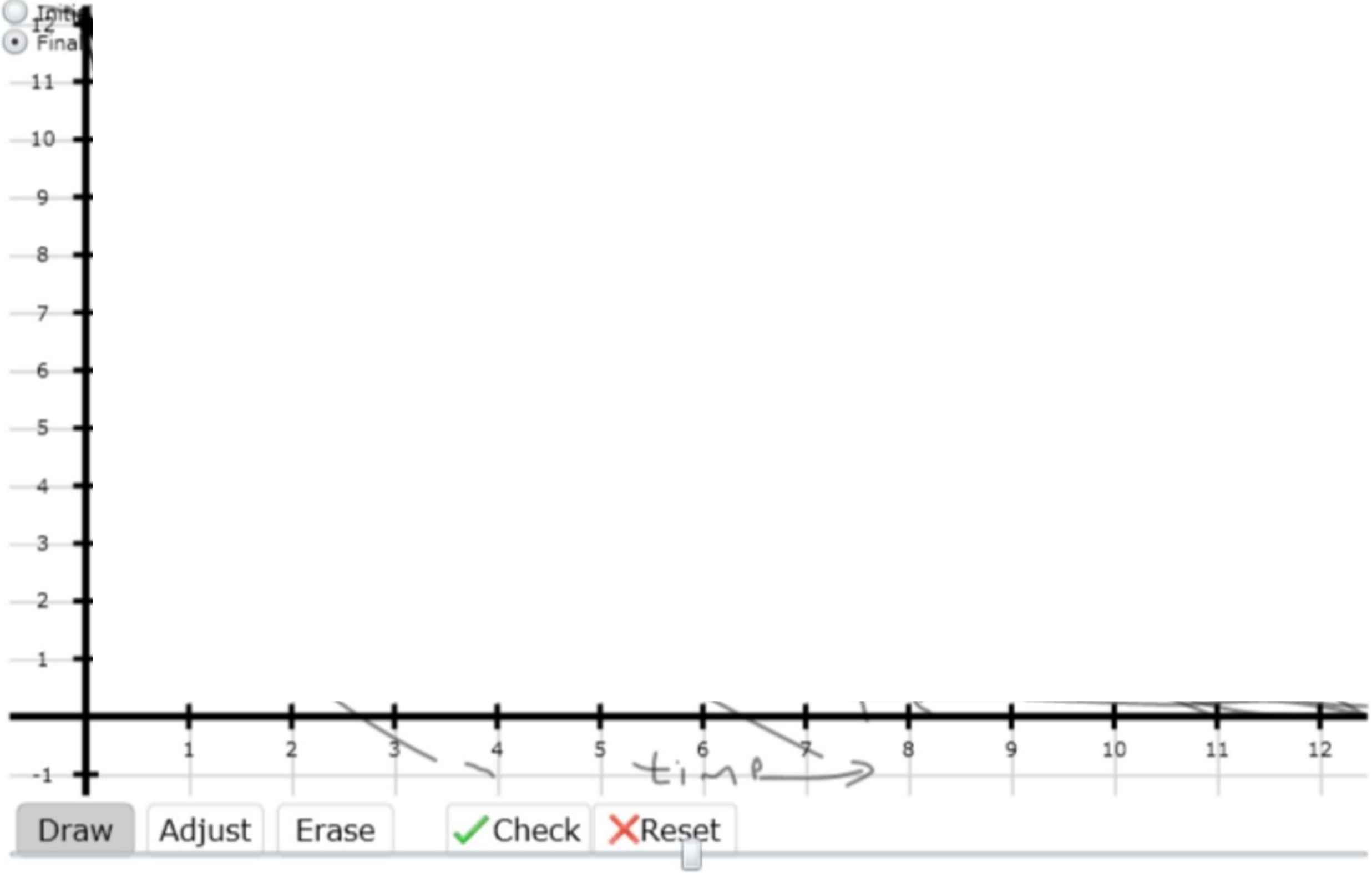
- It the primary goal of science teaching to change students beliefs.
- Does understanding the “eclipse of darwinism” provide insights into more effective teaching.

Week 4.2 Embracing randomness

- **Read**: Garvin-Doxas & Klymkowsky, 2008 Understanding Randomness and its Impact on Student Learning
- Small numbers of big molecules & Nature Versus Nurture? Add 'Noise' to the Debate

- What, in your words are the differences between truly random and stochastic (noisy) processes? Can you give an example of a truly random process?

2.2: Now draw the half-life relationship graphically. The half-life of this isotope is 4 time units and you begin with 12,000,000,000 isotope atoms



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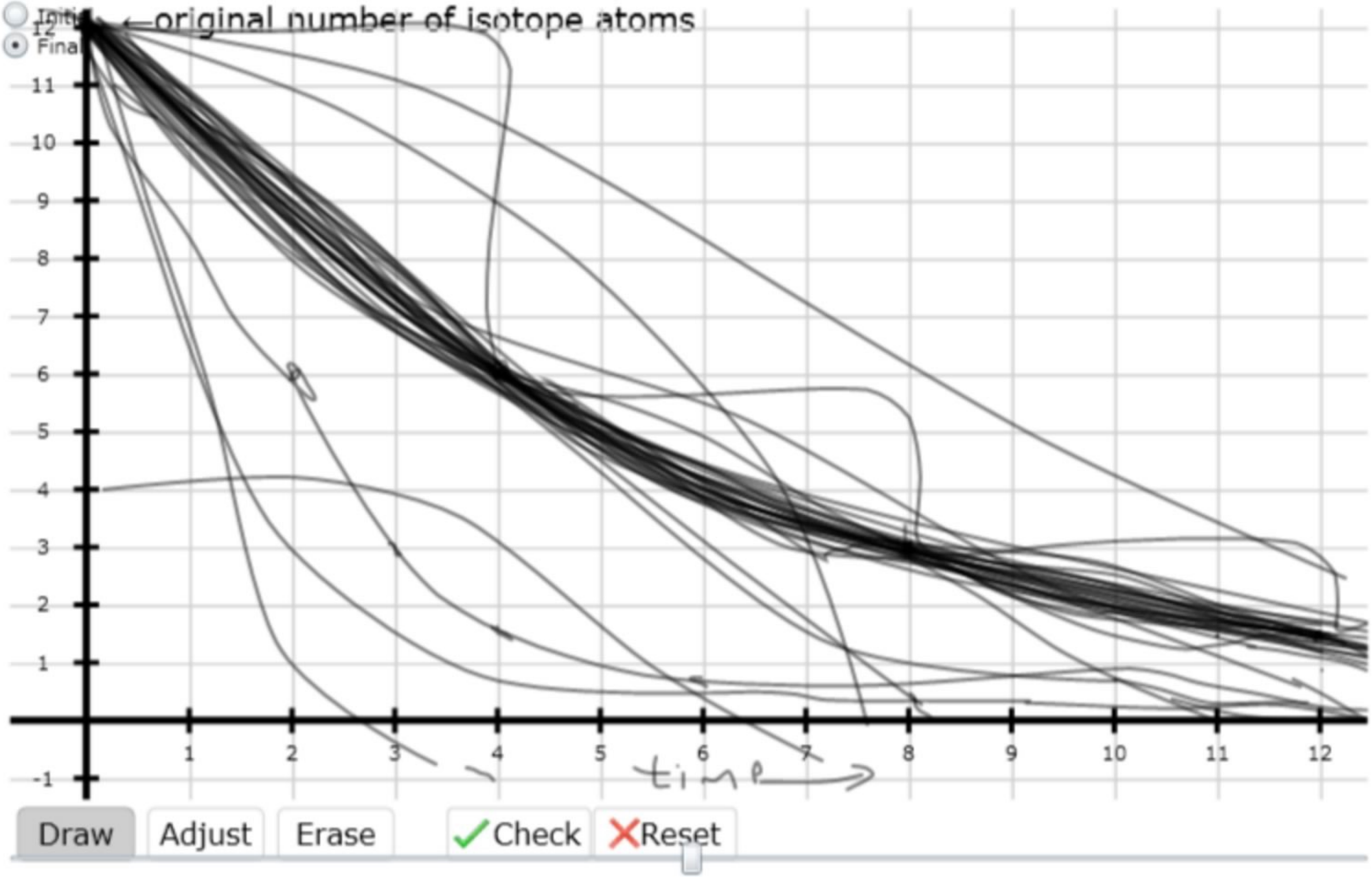
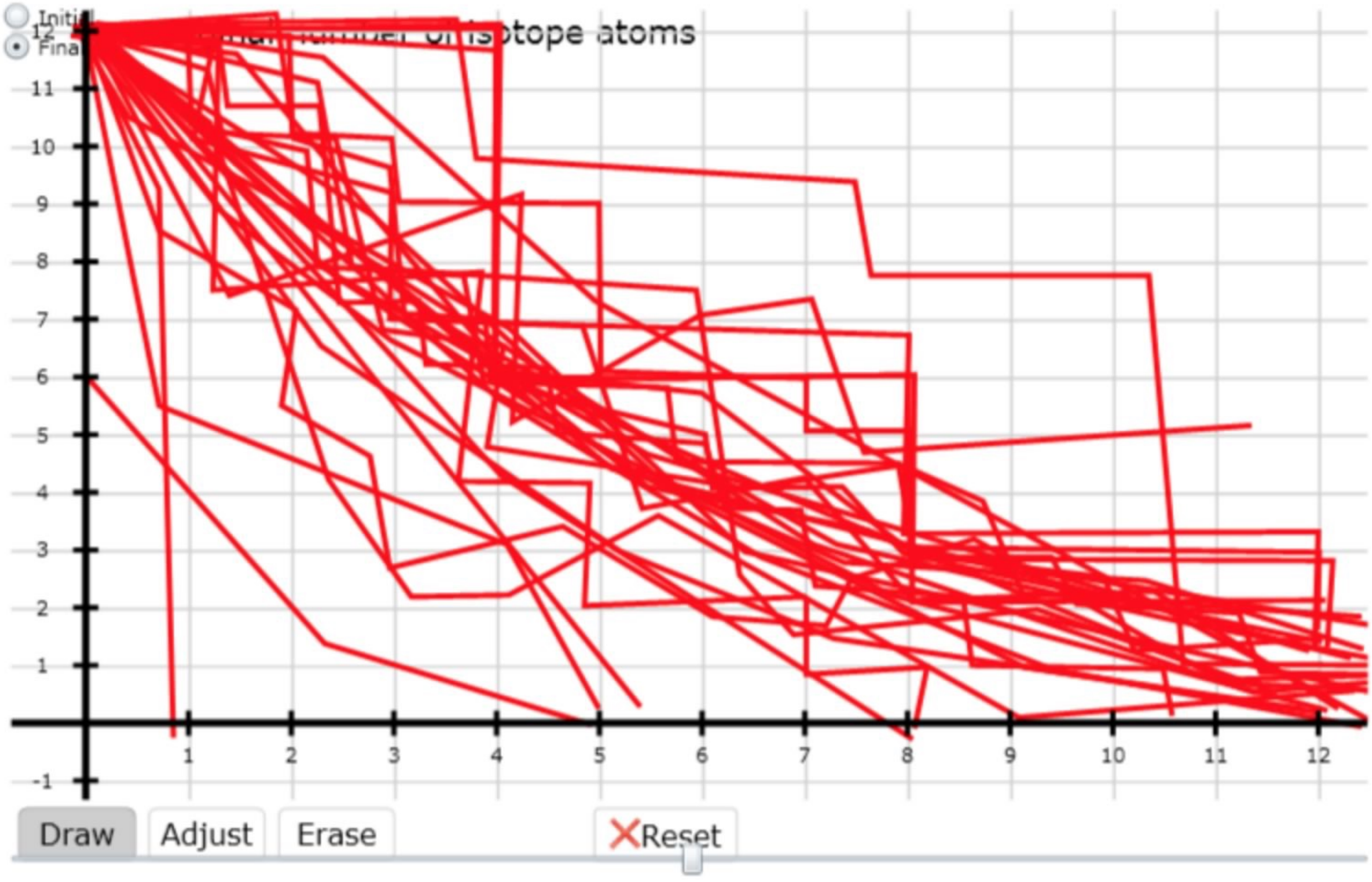


2.3: Now consider how your graph will change if you started with only 12 atoms? Draw a plausible graph of the behavior of 12 isotope atoms.

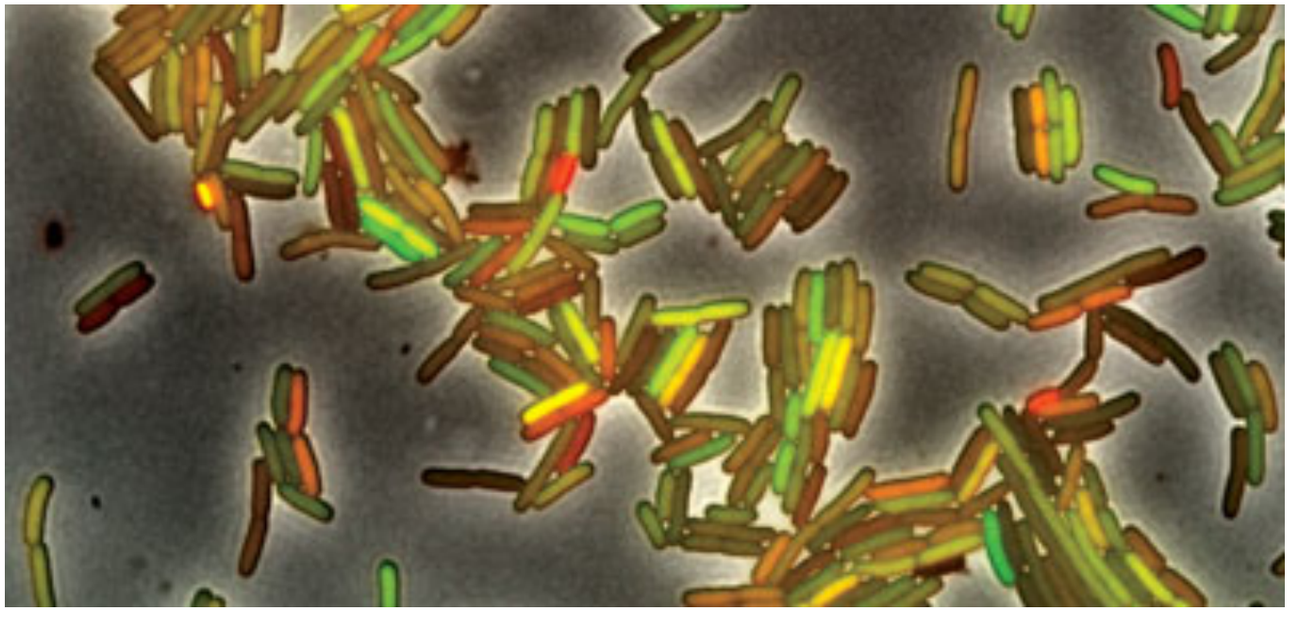


Week 4.2 Embracing randomness

Group discussion and report back:

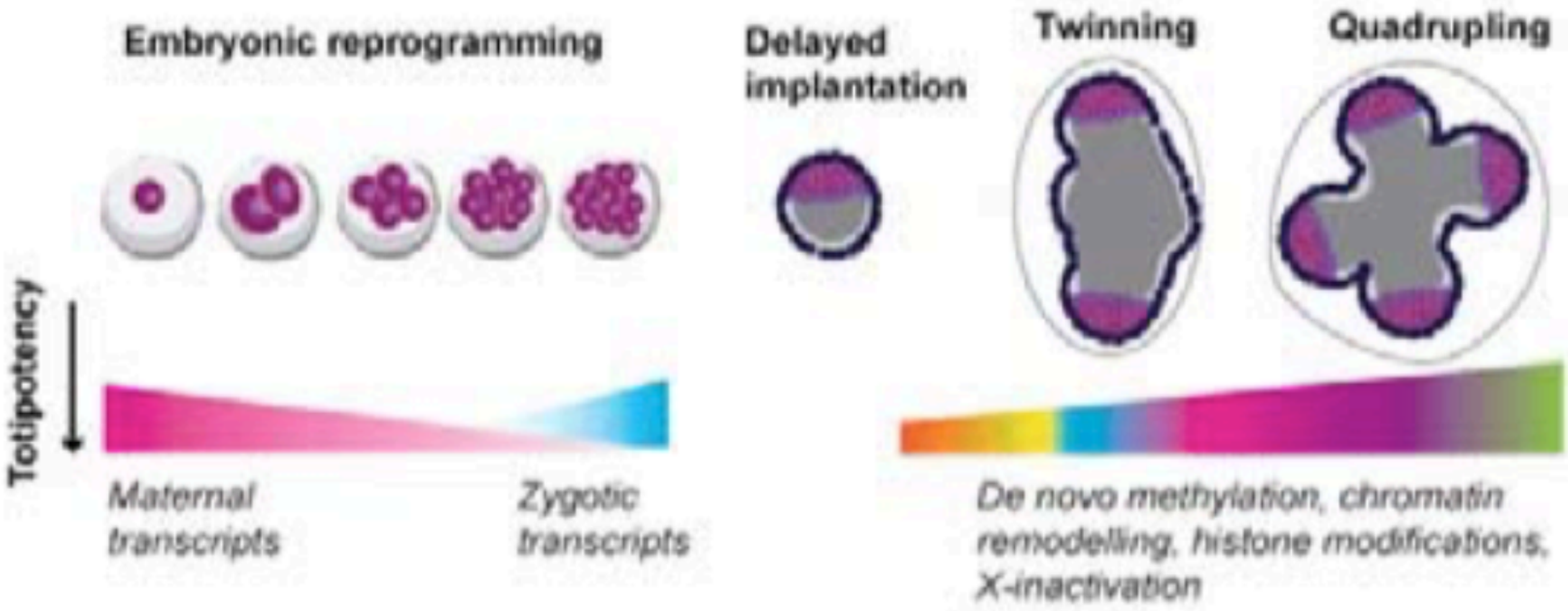
- What, in your words are the differences between truly random and stochastic (noisy) processes? Can you give an example of a truly random process?
- What are the obstacles that keep people from understanding stochastic processes?
- Is belief in magic or religion a way to control (make sense of) stochasticity?
- Are there advantages associated with using stochastic processes in biological systems?

How does the ubiquity of stochastic processes in biology impact instruction - what problems does it pose.



B

How does developmental robustness and noise create individuality?



Week 4.3 Teaching and its impact: race, populations, genetics and hidden implications

- **Read:** Avoiding unrecognized racist implications arising from teaching genetics (Links to an external site.)
  &
- Donovan et al (2019) Toward a more humane genetics education: Learning about the social and quantitative complexities of human genetic variation research could reduce racial bias in adolescent and adult populations (Links to an external site.)

- **In preparation for group discussion and report back**:
  - How would you present the genetic bases of phenotypic variation between human populations?
  - Speculate on the pros and cons of using the terms genes or alleles when comparing people or populations of people. Is it "better" to say that people have different genes or different alleles?

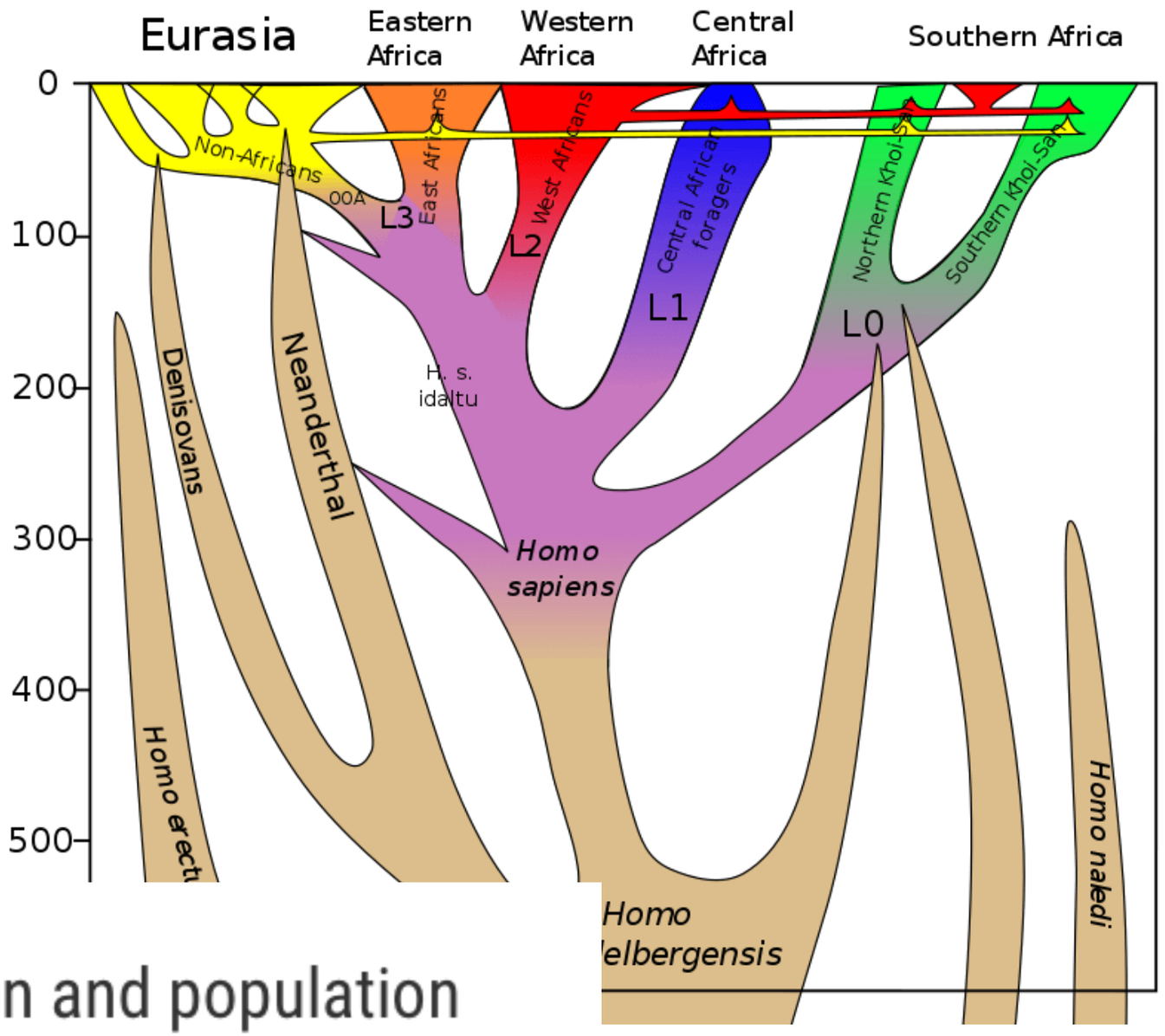
Week 4.3 Teaching and its impact: race, populations, genetics and hidden implications

Group discussion and report back:

- Explain where the idea of races came from and whether you consider races real or not?
- Speculate on the extra-scientific implications of assuming races a real (typological thinking
- How might teaching human genetic variation influence racist ideologies or presumptions?

Week 4.3 Teaching and its impact: race, populations, genetics and hidden implications

- Is any depiction of human populations variation likely to enhance racist or racialist (there a difference) thinking?
- What are the alternatives?



RESEARCH ARTICLE

Insights into human genetic variation and population history from 929 diverse genomes

Anders Bergström[1,2,*], Shane A. McCarthy[1,3,†], Ruoyun Hui[3,4,†], Mohamed A. Almarri[1,†], Qasim Ayub[1,5,6], ...

+ See all authors and affiliations

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