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Interactive Visualization of Evolutionary Trees and Gene Sequences

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UBC CS Discovery Forum

Computer Graphics

- create or manipulate images with computer
  - movies, games, photorealistic simulation

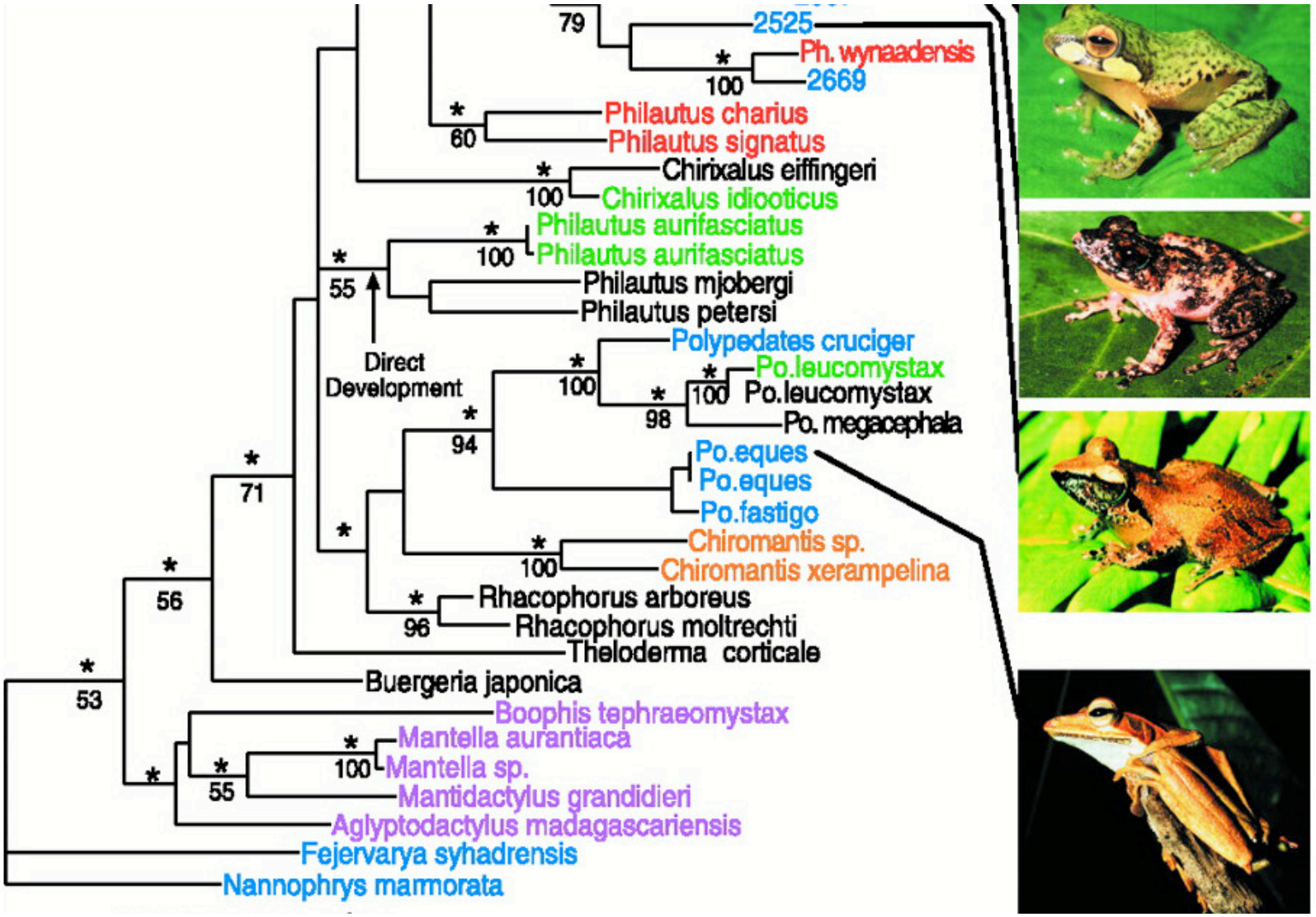
Computer Graphics

- create or manipulate images with computer
  - movies, games, photorealistic simulation
  - but wait, there's more!

Visualization

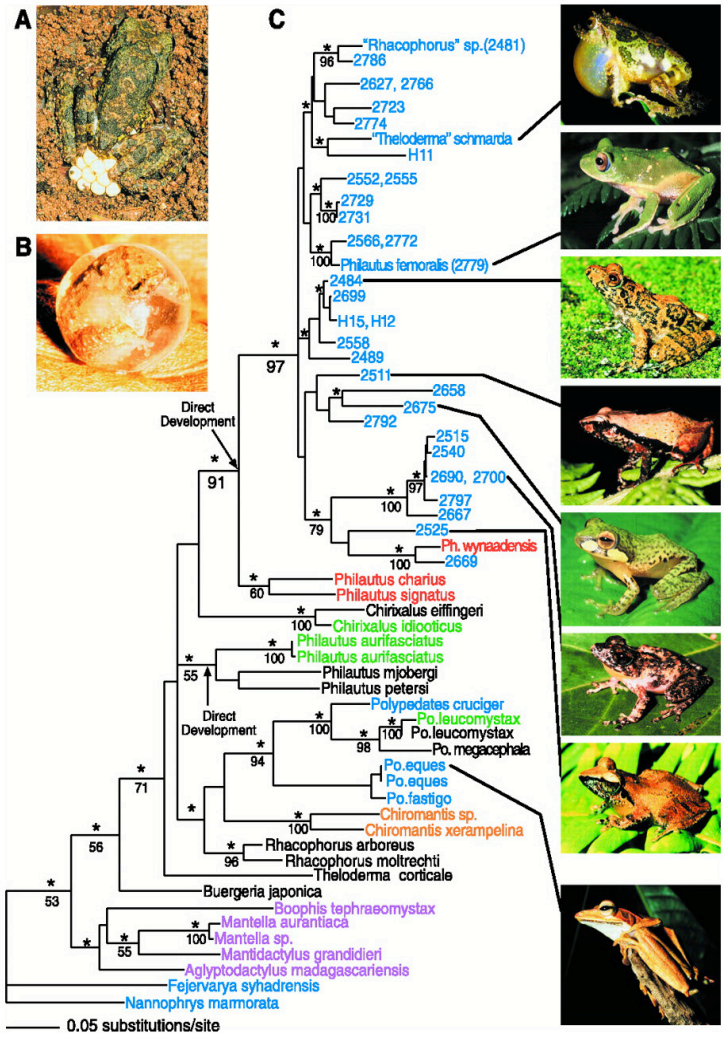
- using interactive computer graphics to help people understand information better
  - biological data:
    evolutionary trees and gene sequences

Evolutionary Tree



M Meegaskumbura et al., Science 298:379 (2002)

Common Dataset Size Today



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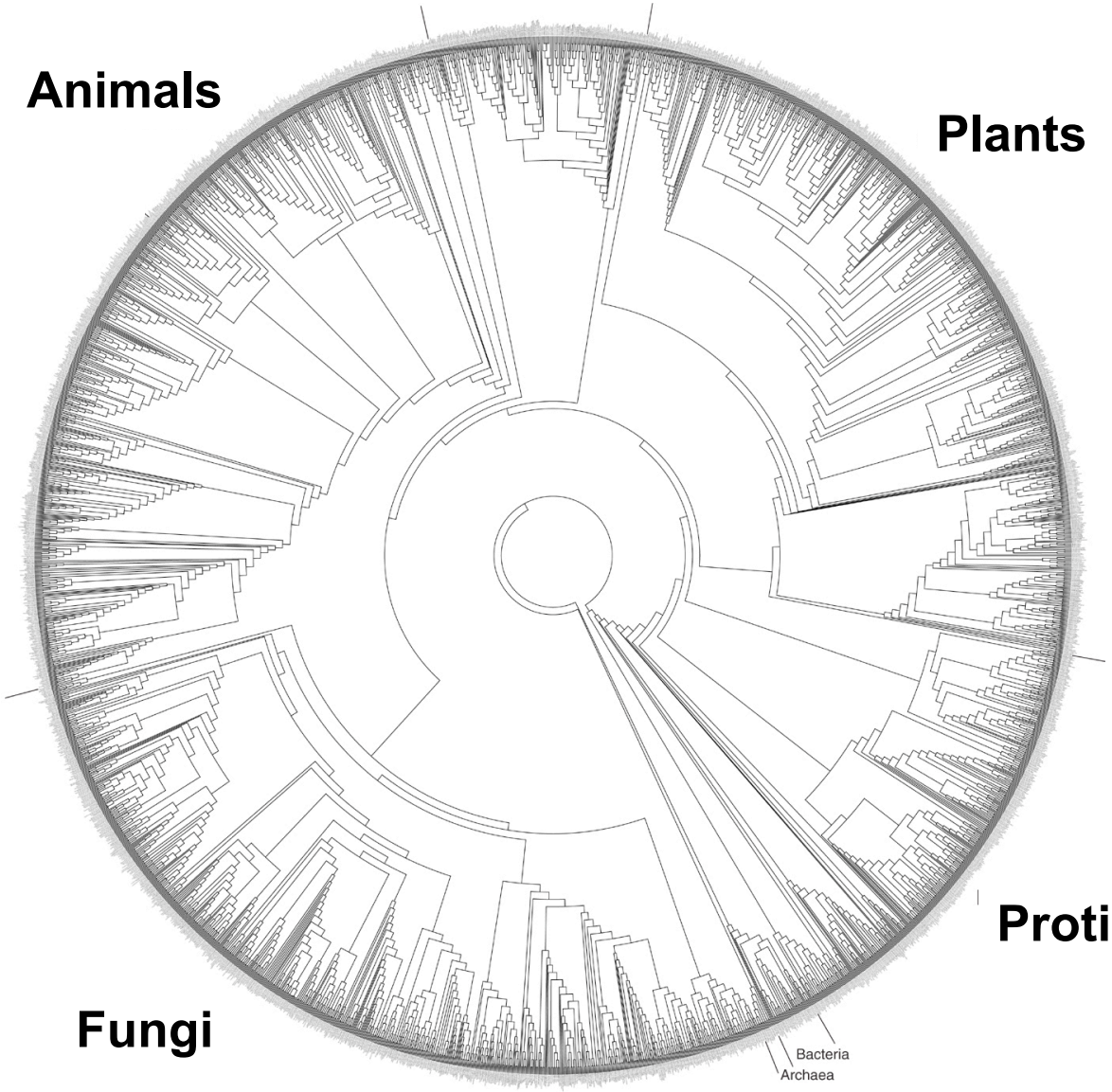
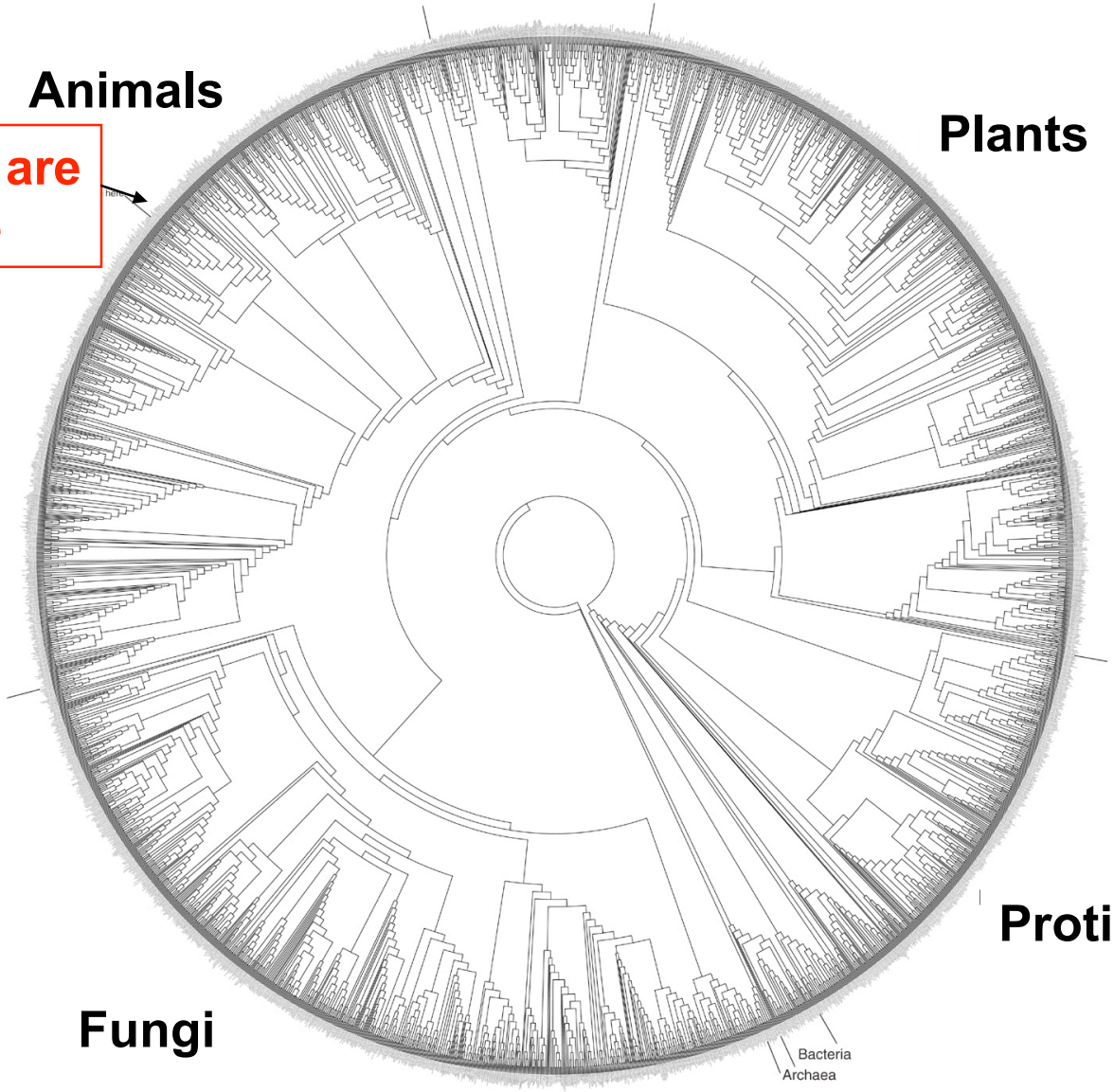
Future Goal: 10M Node Tree of Life



David Hillis, Science 300:1687 (2003)

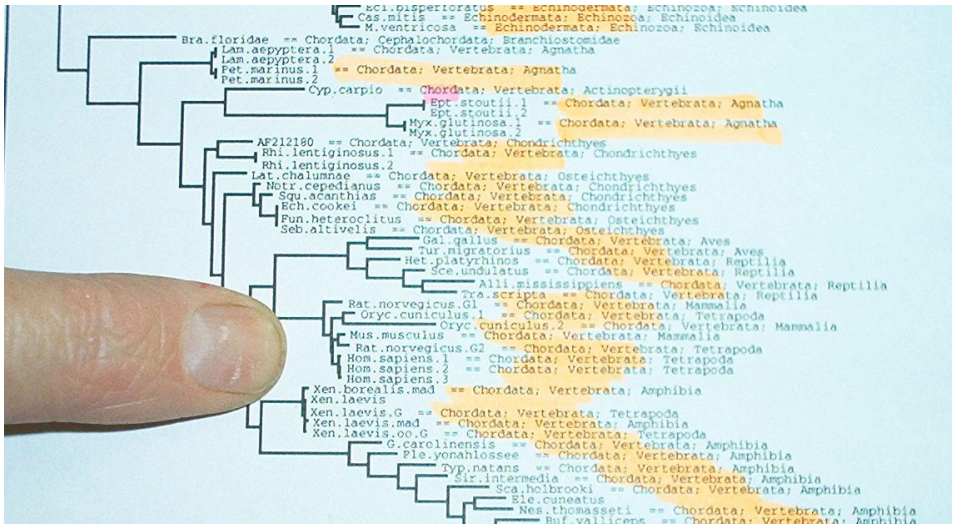
Future Goal: 10M Node Tree of Life



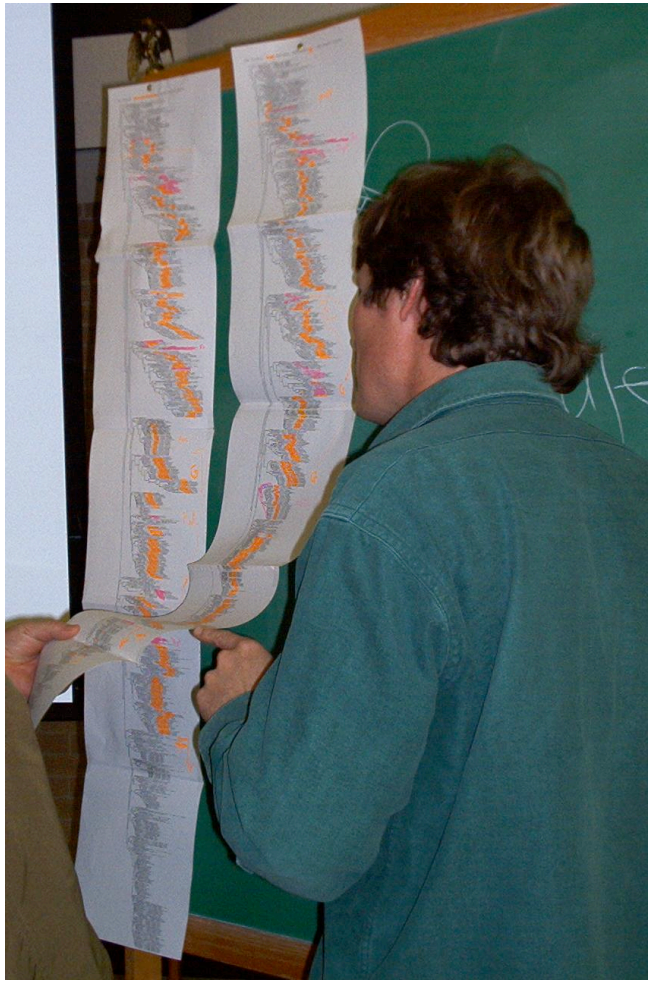
David Hillis, Science 300:1687 (2003)

Paper Comparison: Multiple Trees

focus

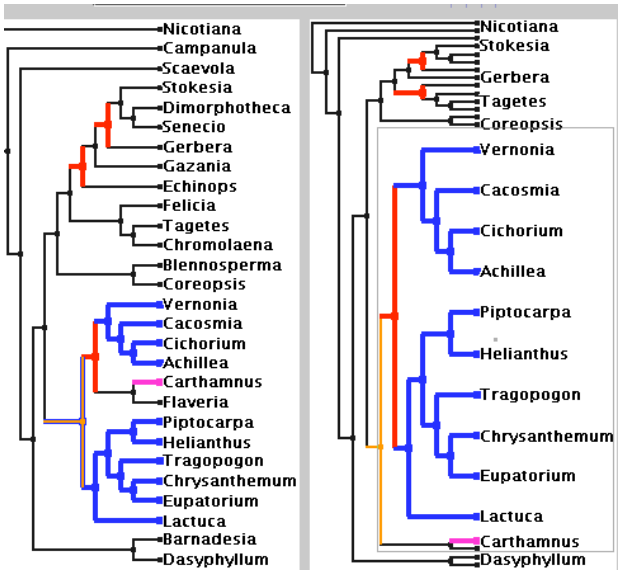


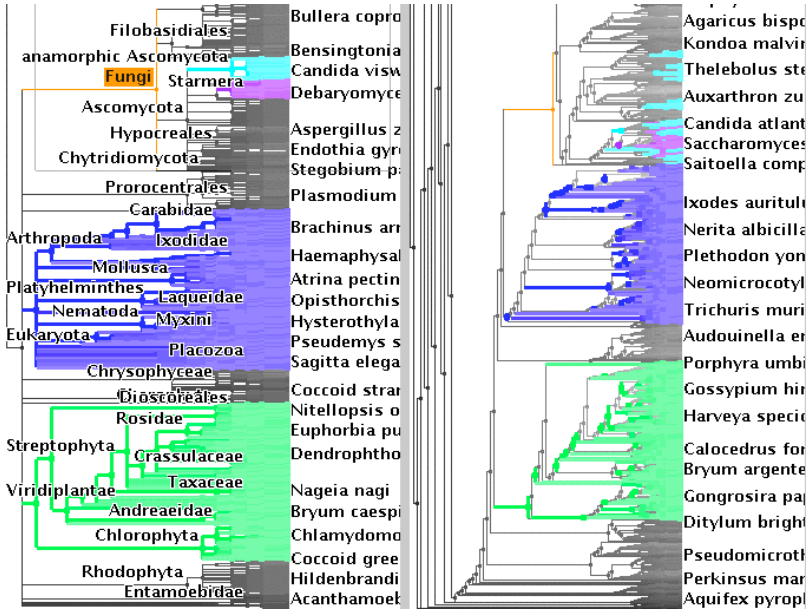
context



TreeJuxtaposer

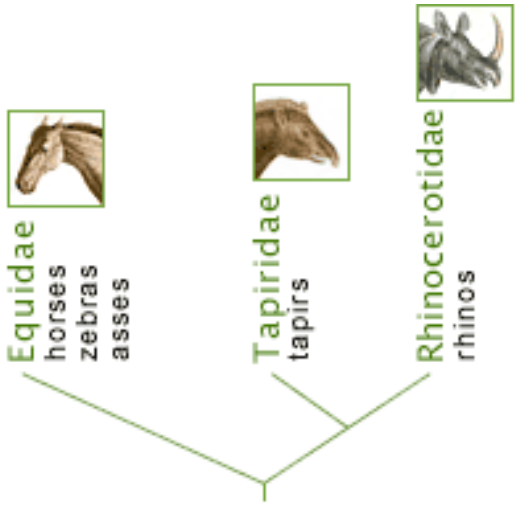
- side by side comparison of evolutionary trees
  - both focus and context with stretchable surface
- demo - downloadable from http://olduvai.sf.net/tj





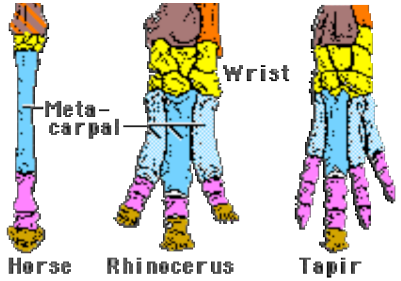
Reconstructing Trees from Genes

- know leaves, infer interior nodes
  - similarity: parallel evolution or common ancestor?



[research.amnh.org/programs/genomelab]

- old: morphology
  - observable similarities



[gwis2.circ.gwu.edu/~atkins]

- new: molecular
  - DNA sequences - nucleotides
  - protein sequences - amino acids

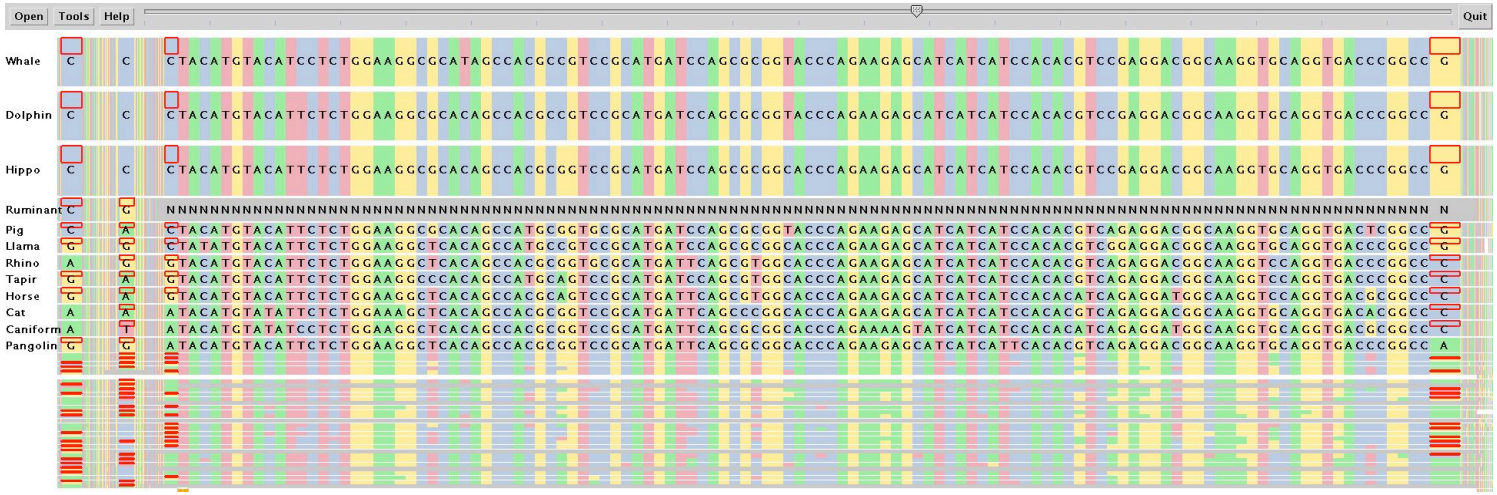
horse: ...CCTGAACCG...

tapir: ...ACTCTACCG...

rhino: ...GCTCTACCG...

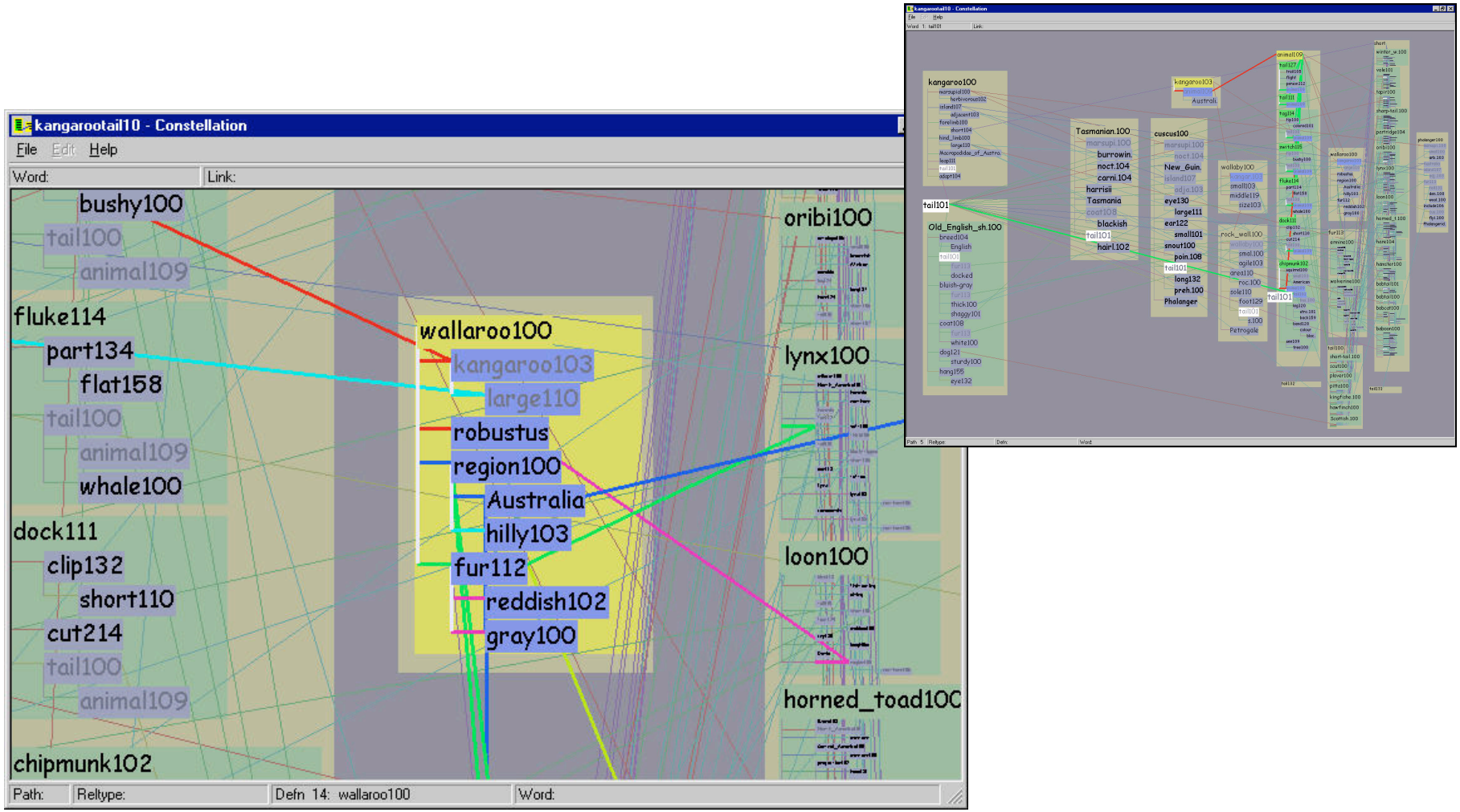
SequenceJuxtaposer

- comparison of aligned gene sequences
  - focus and context with stretchable surface
- demo - downloadable from http://olduvai.sf.net/sj



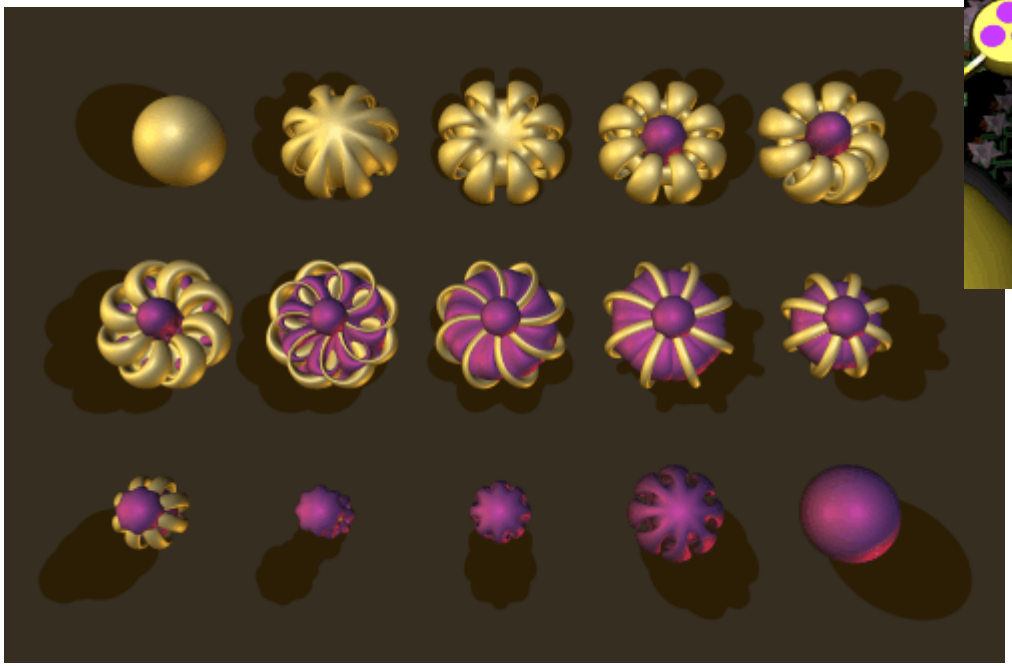
CS: Collaboration with Many Fields

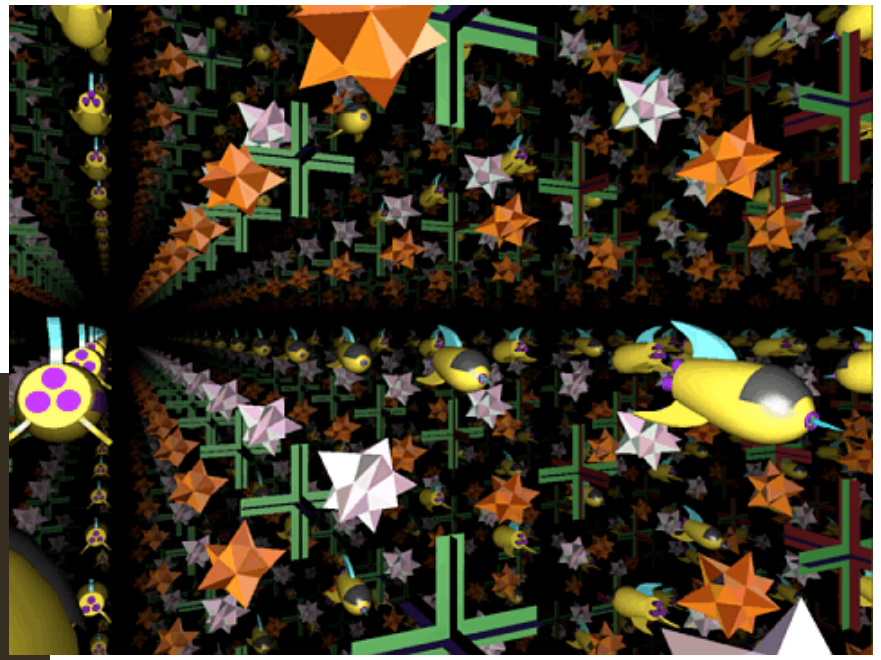
- computational linguistics



CS: Collaboration with Many Fields

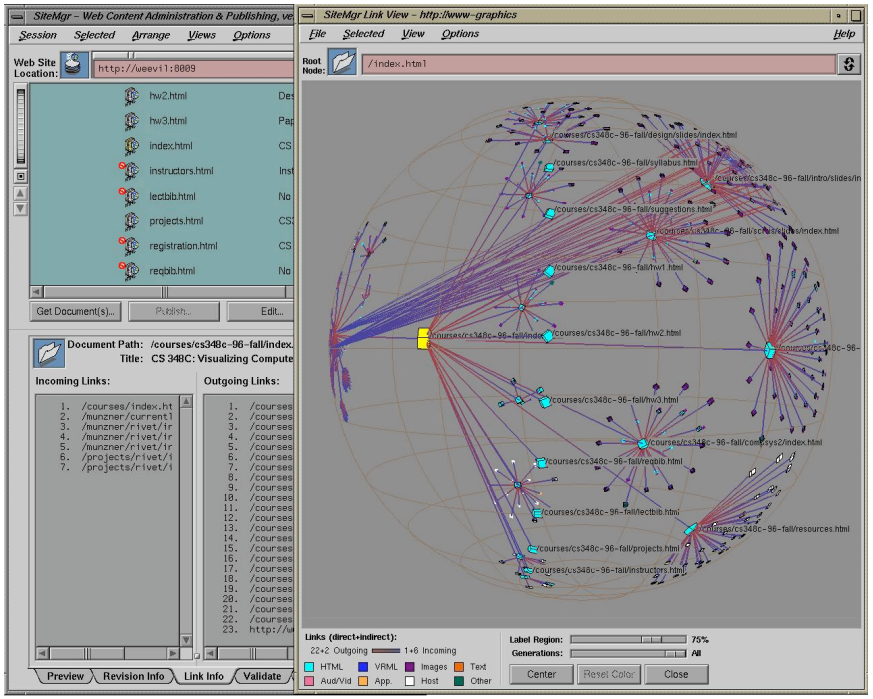
- mathematics: topology and geometry





CS: Collaboration with Many Fields

- software for web site designers
  - now also useful for biologists!
  - downloadable from graphics.stanford.edu/~munzner/h3



More Information

- http://www.cs.ubc.ca/~tmm