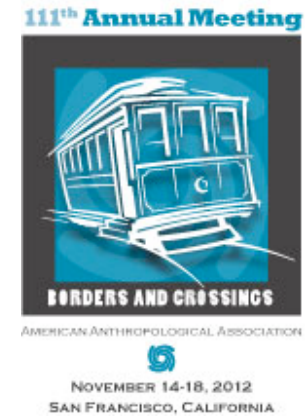


Session “Cultural transmission studies: tree and network models of micro- and macro-evolution”

At the 111th AAA meeting

November 15th, 2012



# The challenge of tree-thinking and network-thinking: conceptual issues across biological and cultural domains

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# Cultural evolution

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- **Advanced methods of biology (devised for species, individuals, genes, phenotypes...):**

- mathematical methods
- computer-aided analysis protocols
- massive public databases
- computer simulations

- **Data from:**

- linguistics
- anthropology
- archaeology
- sociology
- economics
- etc.

# Cultural evolution

BEHAVIORAL AND BRAIN SCIENCES (2006) 29, 329–383  
Printed in the United States of America

## Towards a unified science of cultural evolution

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*Existing approaches within anthropology and archaeology demonstrate a **good match with the macroevolutionary methods** of systematics, paleobiology, and biogeography, whereas **mathematical models derived** from population genetics have been successfully developed to study cultural microevolution. Much potential exists for experimental simulations and field studies of cultural microevolution, where there are **opportunities to borrow further methods and hypotheses** from biology. Potential also exists for **the cultural equivalent** of molecular genetics in ‘social cognitive neuroscience’, although many fundamental issues have yet to be resolved*

# Cultural evolution

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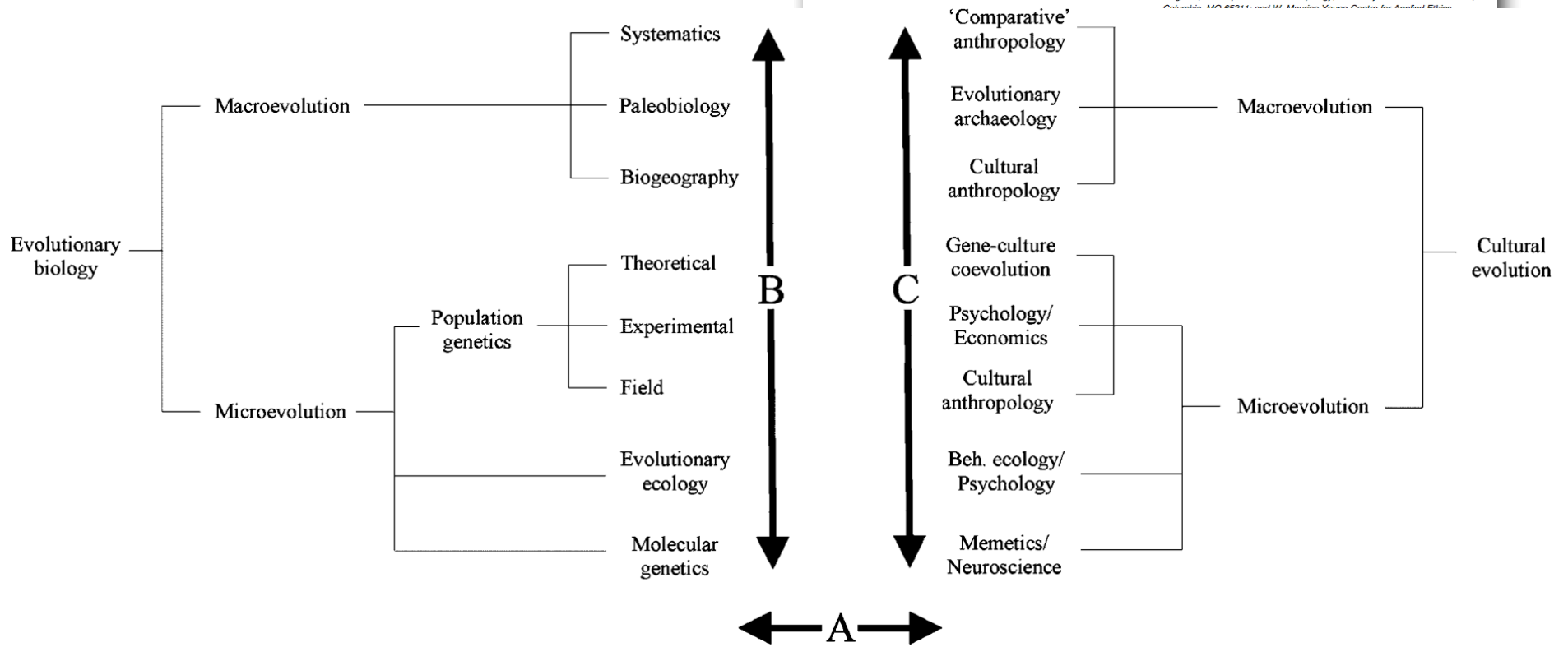
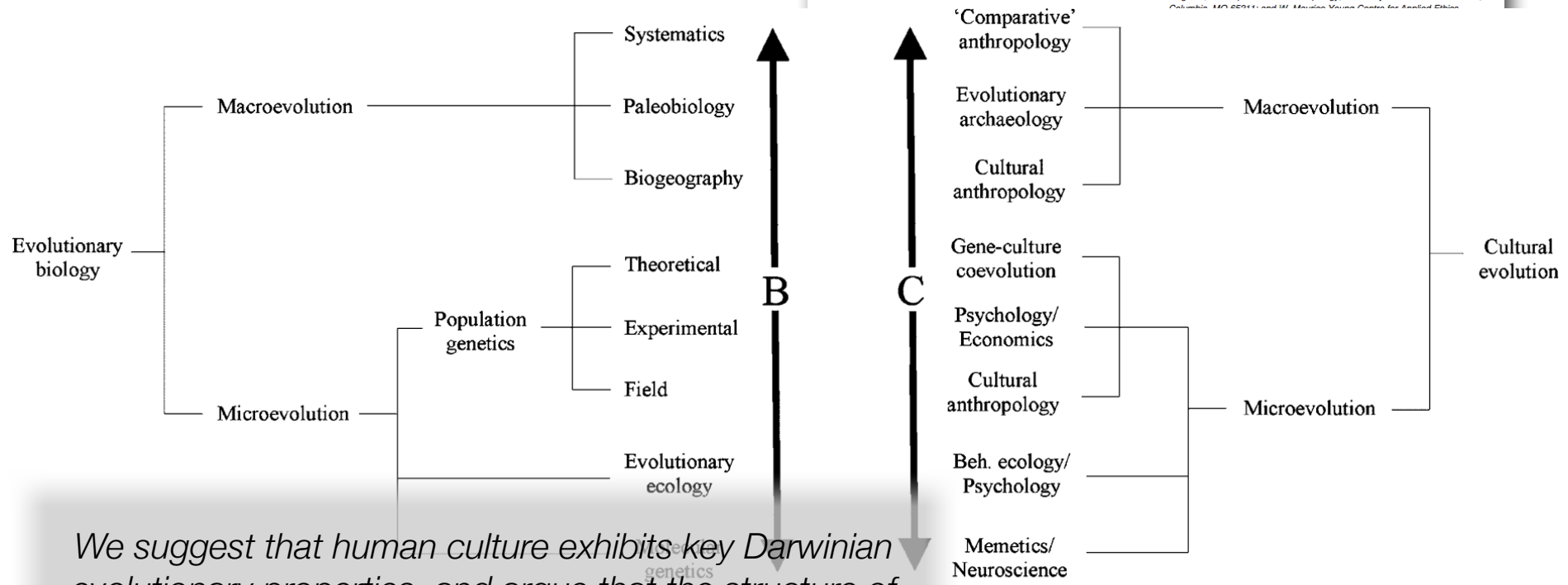


Fig. Mesoudi (2007), *A Darwinian Theory of Cultural Evolution*, p. 265, modified from Mesoudi, Whiten & Laland (2006), *Towards a unified science of cultural evolution*, p. 331

# Conclusion

## Towards a unified science of cultural evolution

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*We suggest that human culture exhibits key Darwinian evolutionary properties, and argue that the structure of a science of cultural evolution should share fundamental features with the structure of the science of biological evolution.*

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# Cultural evolution

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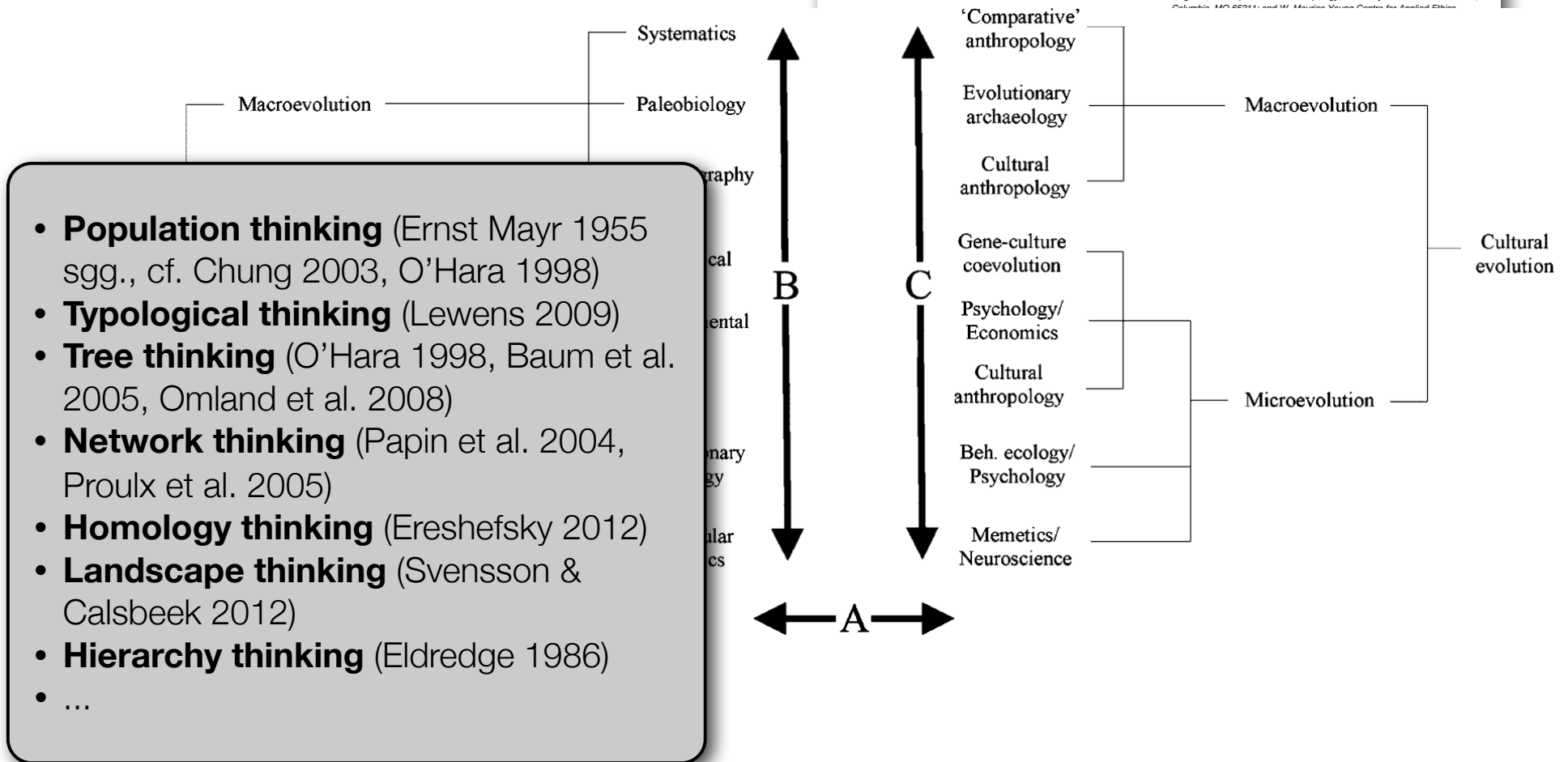
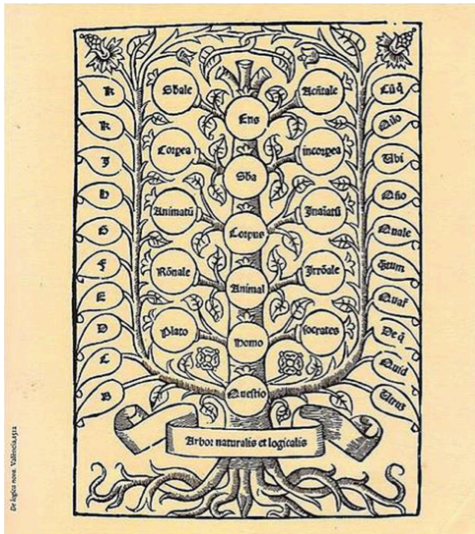
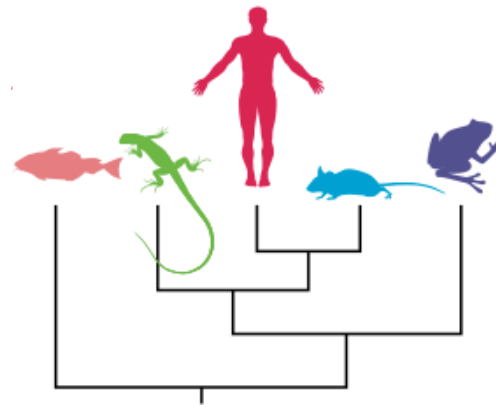


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# Tree thinking: epistemology

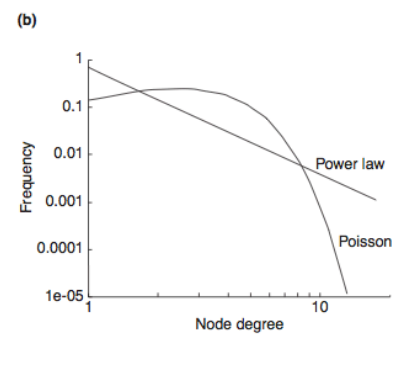
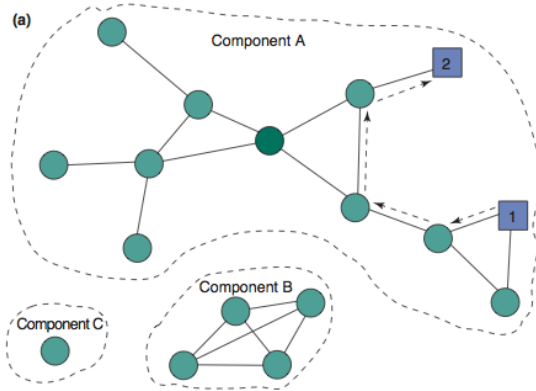


Alonso de Proaza, *De logica nova*, València edition (1512)



- Gontier (2011), “Depicting the Tree of Life”

- Baum, DeWitt Smith & Donovan (2005), *The Tree-Thinking Challenge*

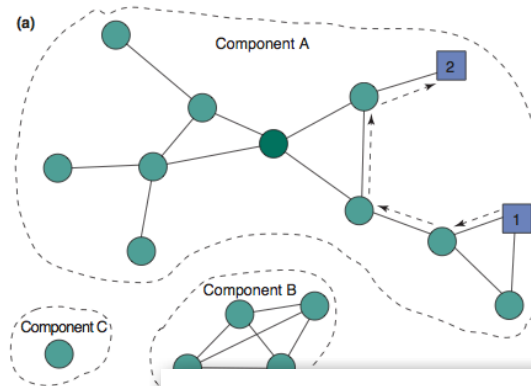
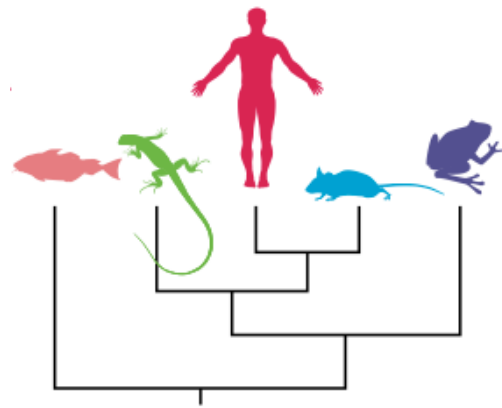


- Proulx, Promislow & Phillips (2005), *Network thinking in ecology and evolution*

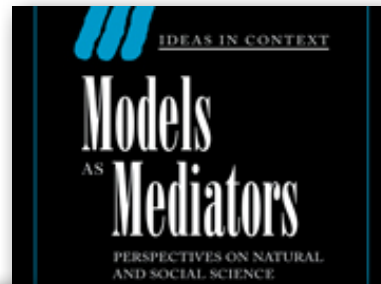
TRENDS in Ecology & Evolution



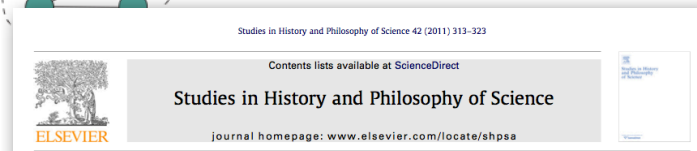
# Thinking: epistemology



- Beatty (1980), What's wrong with the received view of evolutionary theory?



- Morgan & Morrison eds. (1999), Models as Mediators



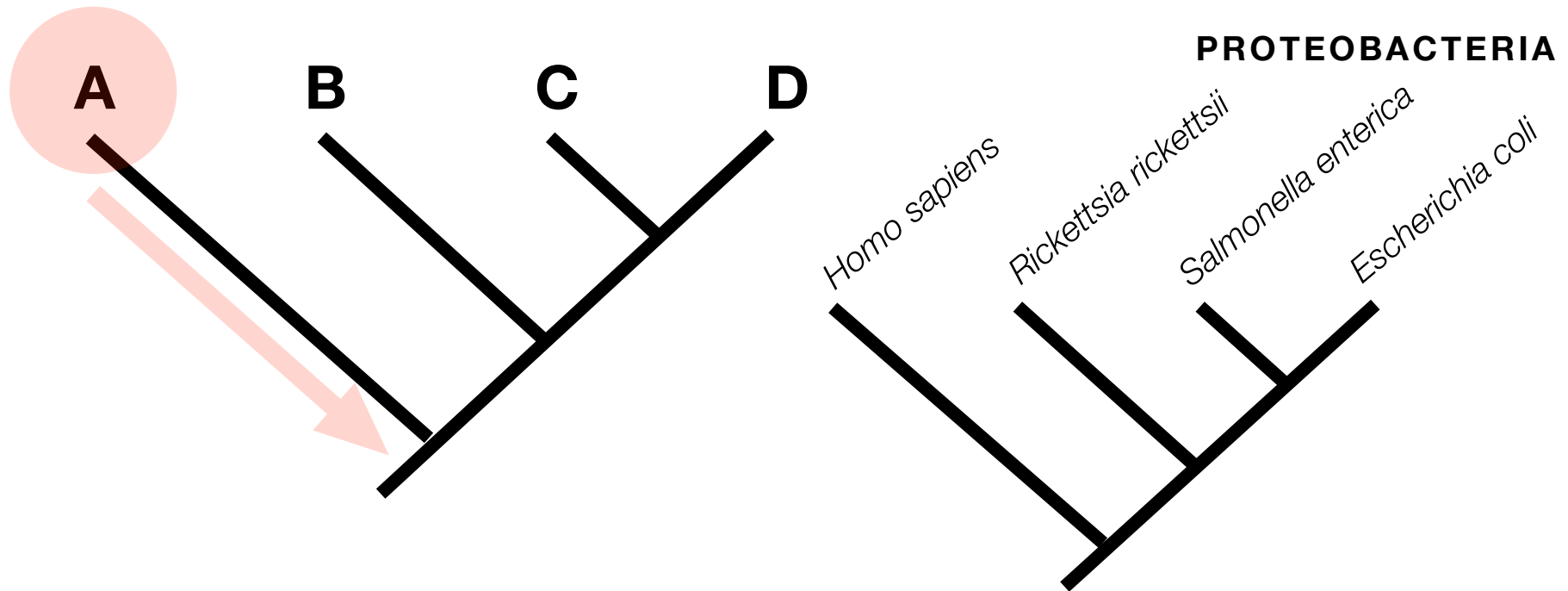
## What's so special about model organisms?

Rachel A. Ankeny, Sabina Leonelli<sup>1</sup>

School of History and Politics, Number 423, University of Adelaide, Adelaide 5005 SA, Australia

- Godfrey-Smith (2008), Model-based science
- Ankeny & Leonelli (2011), What's so special about model organisms?
- Serrelli (2012), What's wrong with the semantic view of scientific theories?

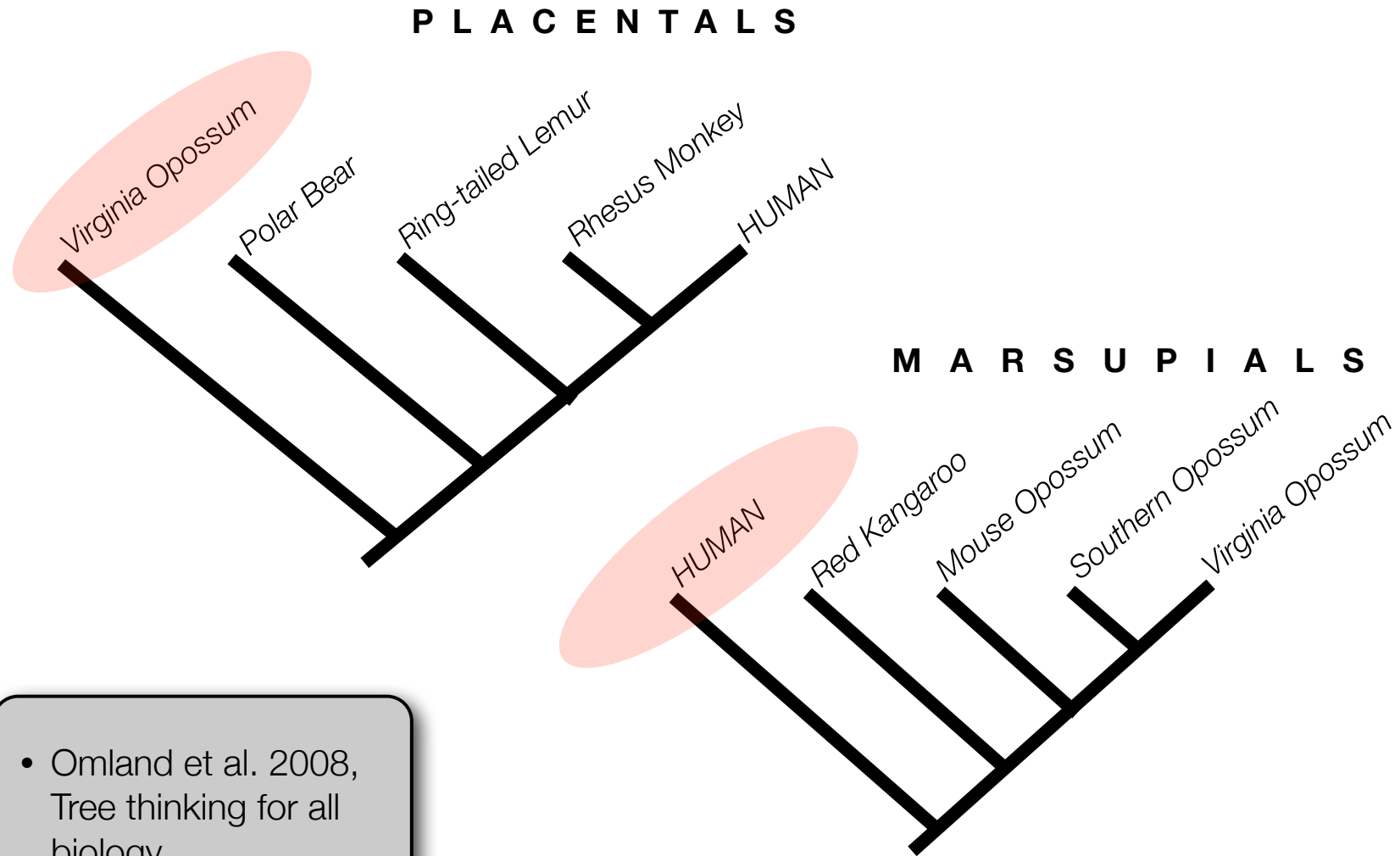
# Tree thinking: conceptual issues



- O'Hara (1992), Telling the tree
- O'Hara (1998), Population thinking and tree thinking in systematics
- Baum et al. 2005, The Tree-Thinking Challenge
- Omland et al. 2008, Tree thinking for all biology
- ...

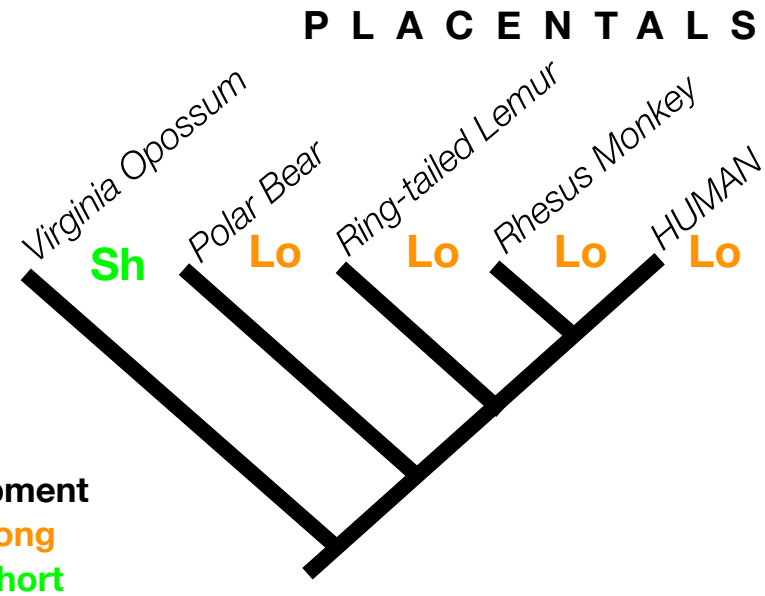
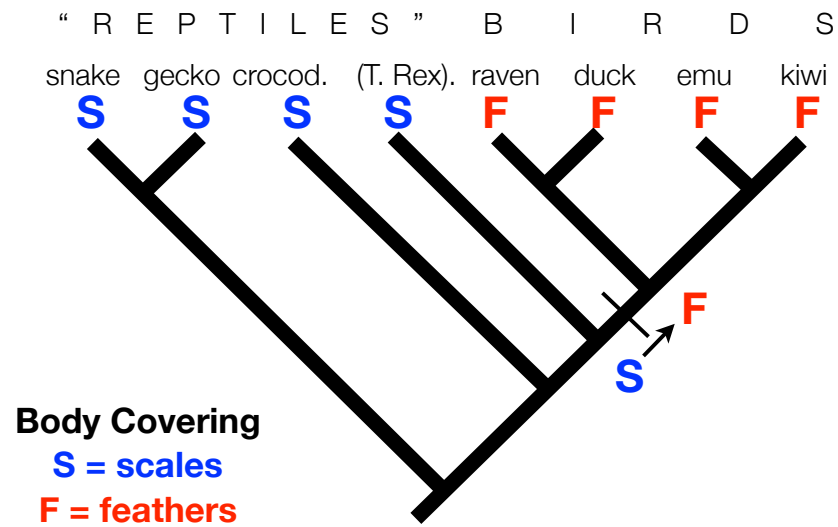
# Tree thinking: conceptual issues

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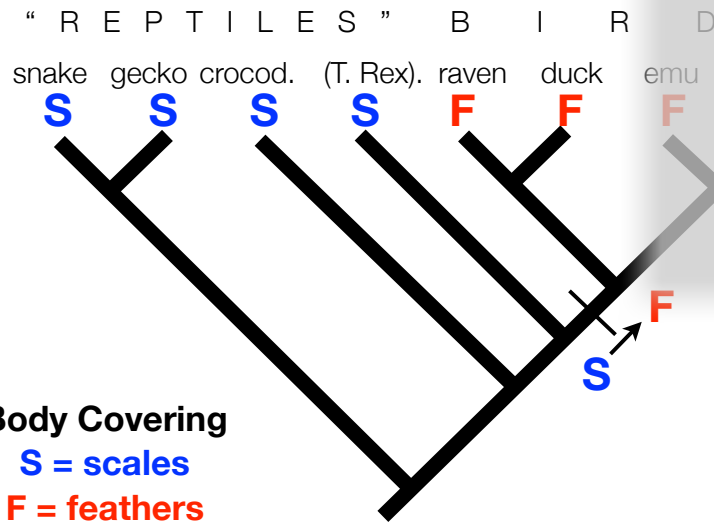
• Omland et al. 2008,  
Tree thinking for all  
biology

# Tree thinking

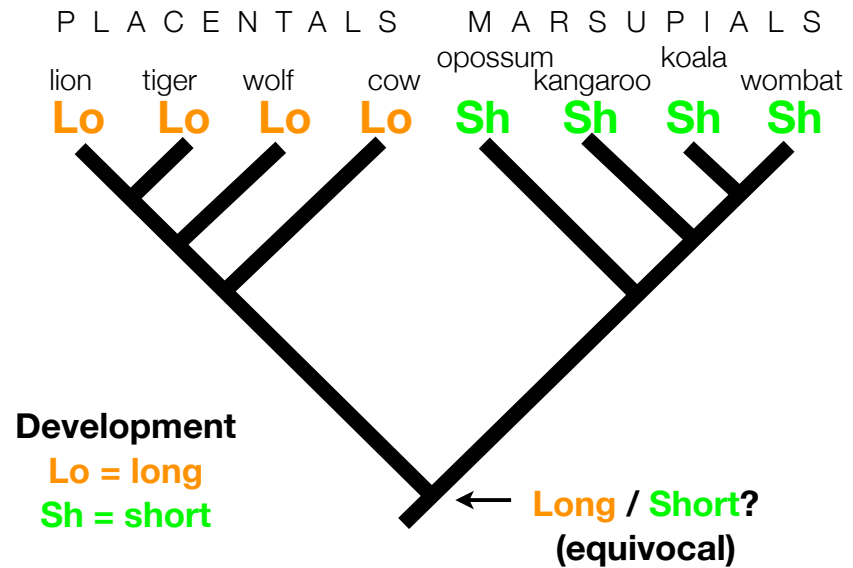


• Omland et al. 2008,  
 Tree thinking for all  
 biology

# Tree thinking



*"Which of the species is the oldest? Which is the youngest? Which is most ancestral? Most derived? Most primitive? Most simple? Most complex? The answer is that a phylogeny provides no information about any of these questions!"*

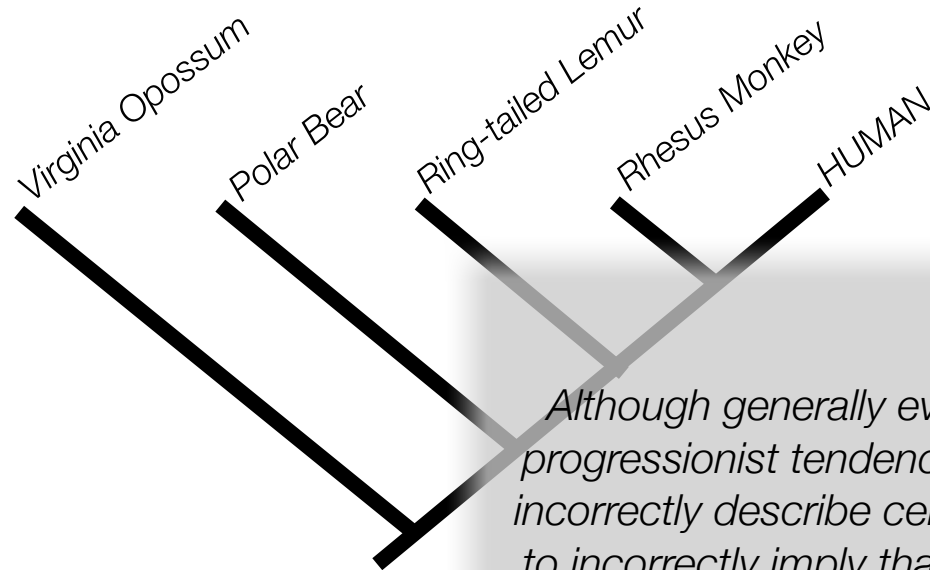


• Omland et al. 2008, Tree thinking for all biology

# Tree thinking

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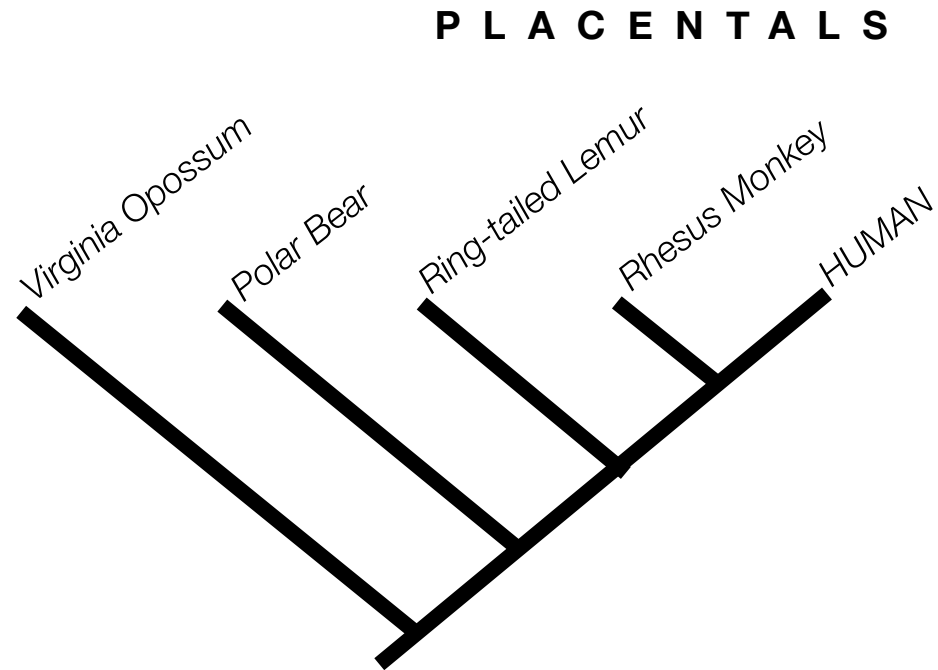
## PLACENTALS



*Although generally evolution has not stopped in any lineage, a progressionist tendency brings some researchers to "continue to incorrectly describe certain present-day species as 'primitive' and to incorrectly imply that extant species may be ancestral to other extant species" (p. 855).*

- Omland et al. 2008, Tree thinking for all biology

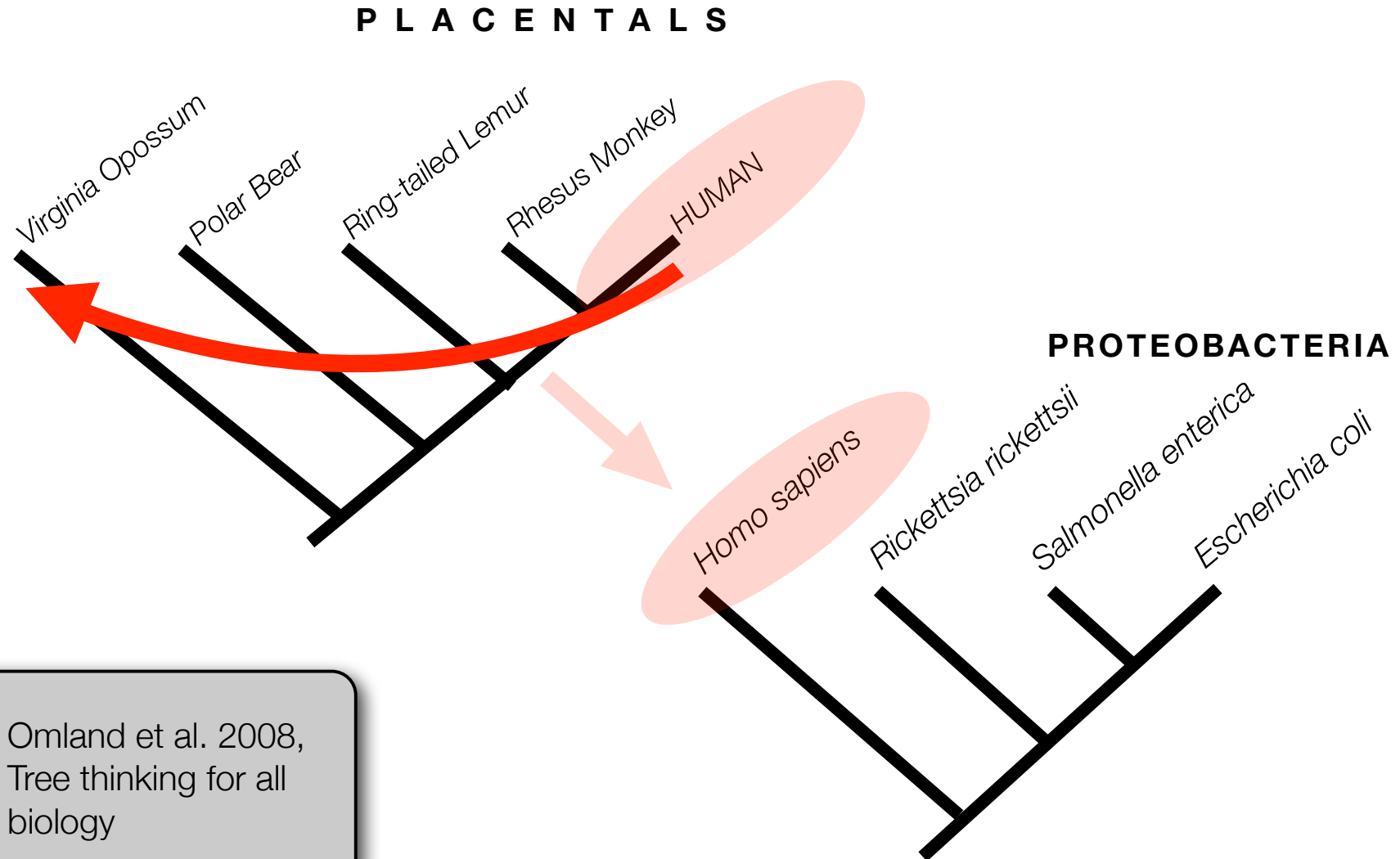
# Tree thinking



- Omland et al. 2008, Tree thinking for all biology

# Tree thinking

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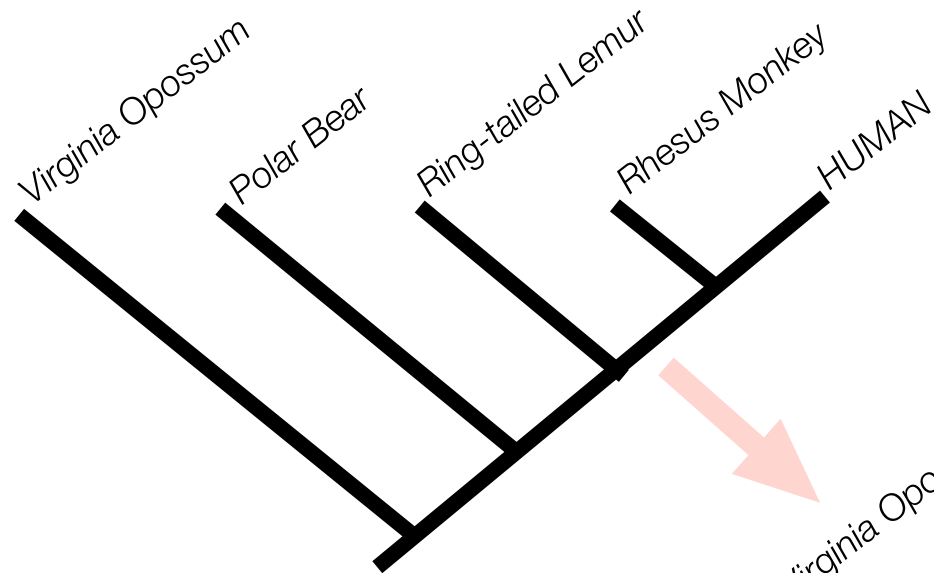
- Omland et al. 2008, Tree thinking for all biology



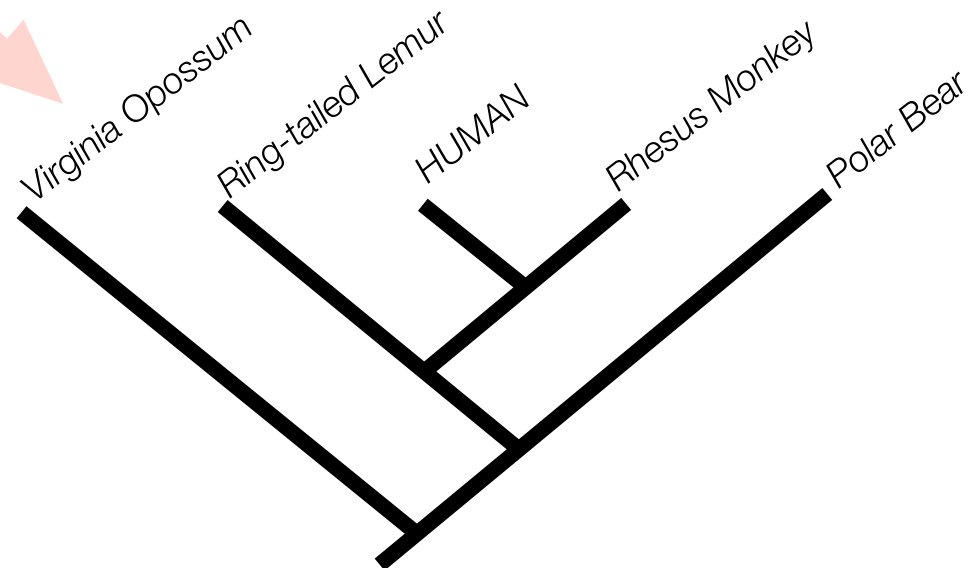
# Tree thinking

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## PLACENTALS



## PLACENTALS



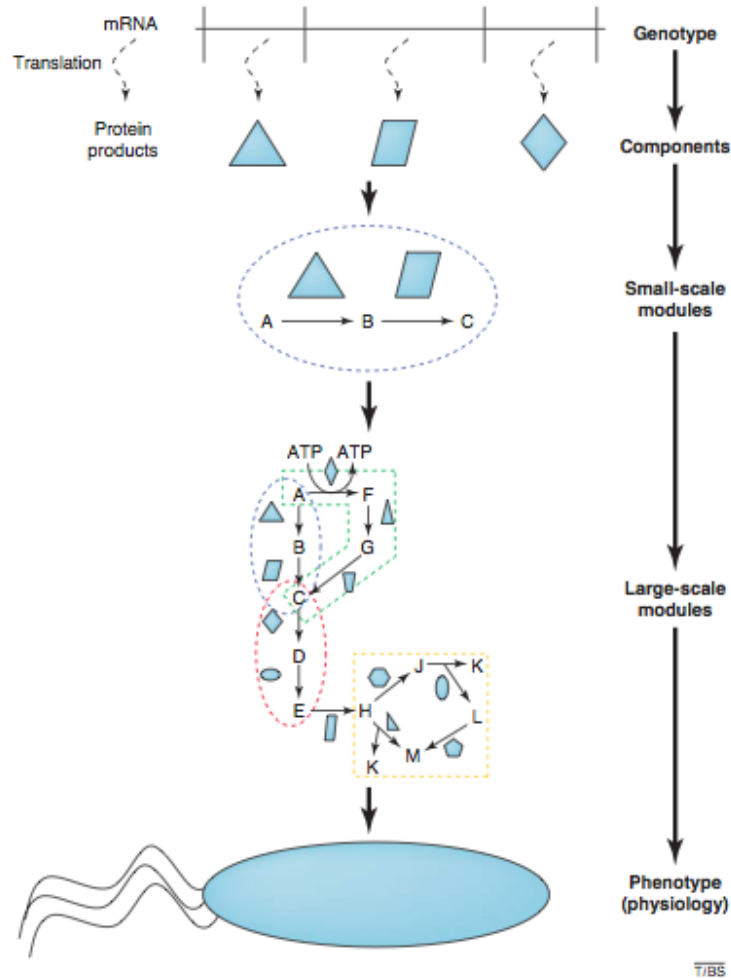
- Omland et al. 2008, Tree thinking for all biology

# Tree-thinking training

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- Thanukos, A., 2009. A Name by Any Other Tree. *Evolution: Education and Outreach*, 2(2), pp.303–309.
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- Torrens, E. & Barahona, A., 2012. Why Are Some Evolutionary Trees in Natural History Museums Prone to Being Misinterpreted? *Evolution: Education and Outreach*.
- Follow the links...

# Network thinking: conceptual issues...?



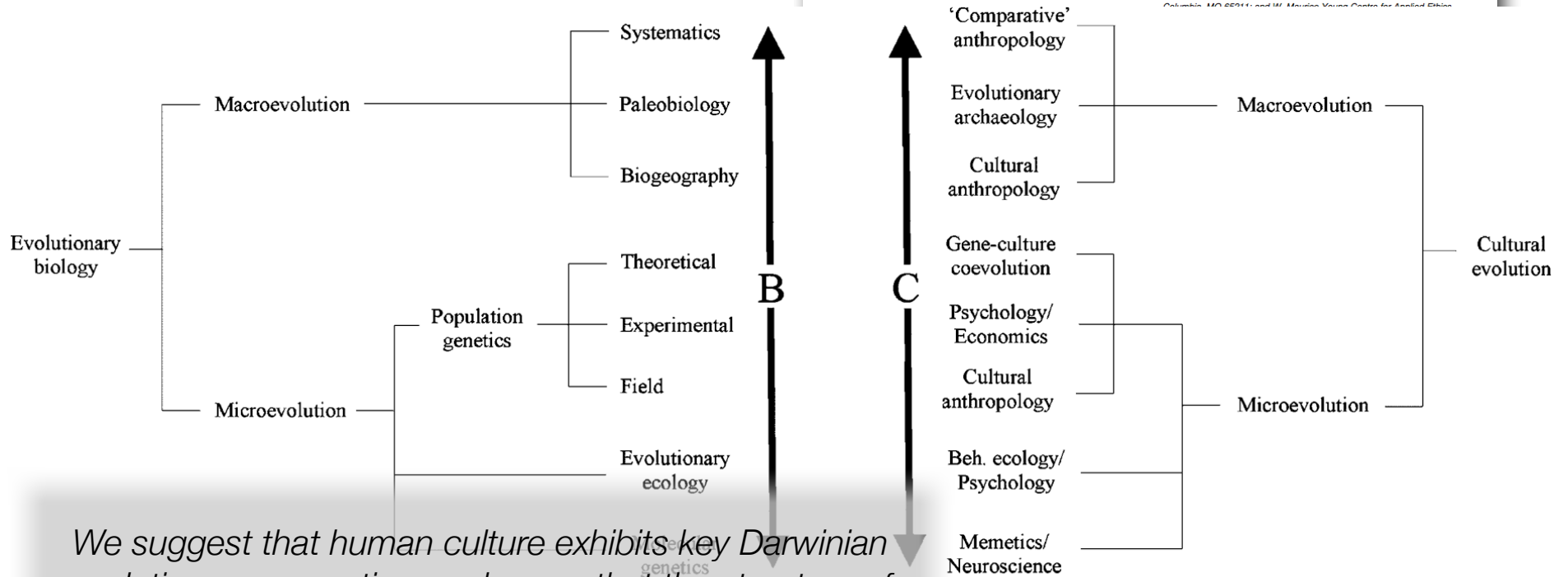
- Papin, Reed, Palsson (2004), Hierarchical thinking in network biology

# Conclusion

## Towards a unified science of cultural evolution

Alex Mesoudi

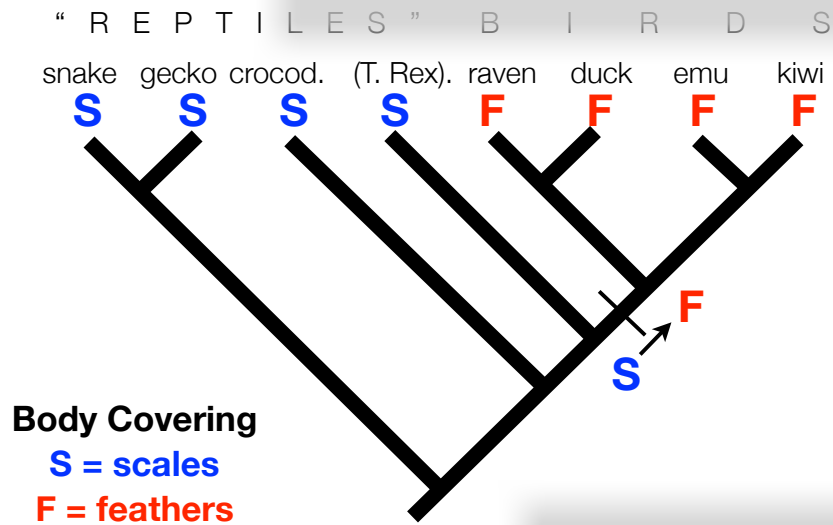
Centre for Social Learning and Cognitive Evolution and School of Psychology,  
 University of St. Andrews, St. Andrews, Fife KY16 9JP, Scotland, United  
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*We suggest that human culture exhibits key Darwinian evolutionary properties, and argue that the structure of a science of cultural evolution should share fundamental features with the structure of the science of biological evolution.*

# Conclusion: think by ways of thinking

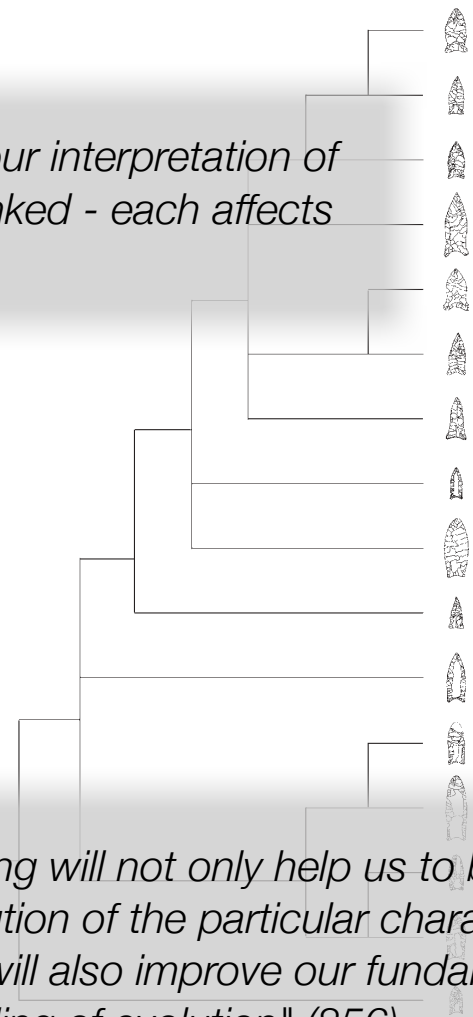
*"Our conception of evolution and our interpretation of phylogenetic trees are intimately linked - each affects the other" (854)*



- Omland et al. 2008, Tree thinking for all biology

*"Improved tree thinking will not only help us to better understand the evolution of the particular characters we are studying, but will also improve our fundamental understanding of evolution" (856)*

Figure 2. A phylogenetic tree of 17 projectile points from the Southeastern United States, from O'Brien and Lyman (2003), illustrating divergence from a single common ancestor.



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