

# MOLECULAR CLOCK



AARHUS  
UNIVERSITY  
DEPARTMENT OF MOLECULAR BIOLOGY AND GENETICS

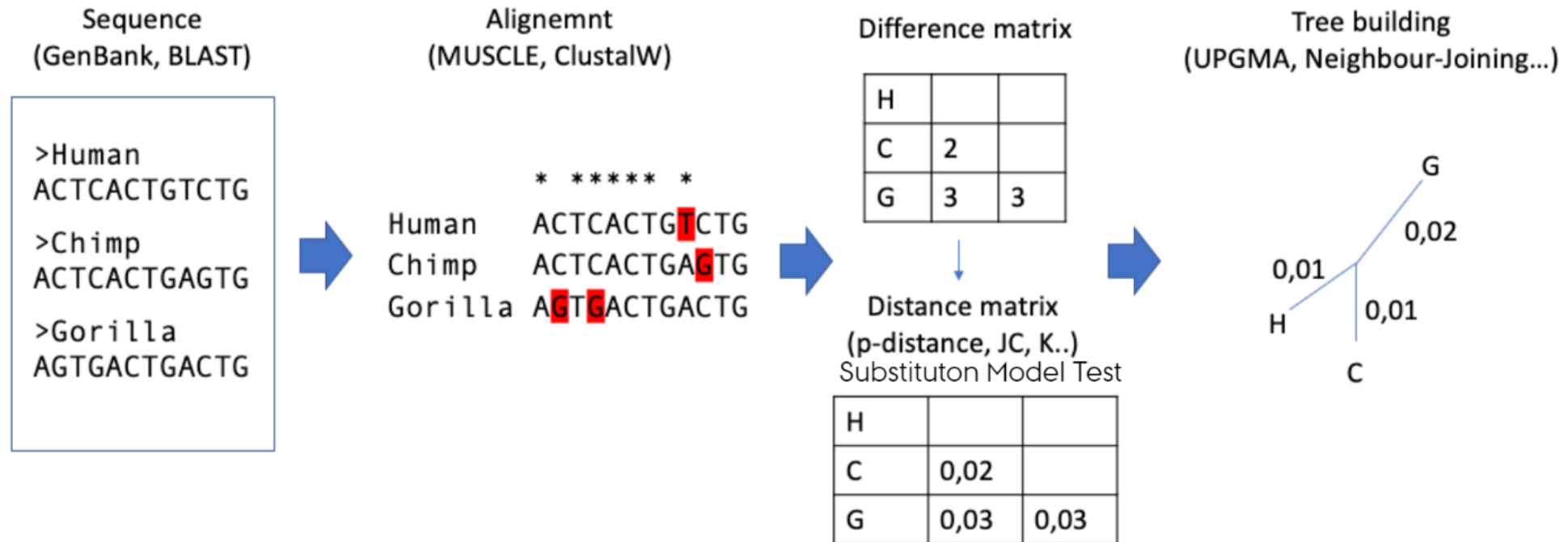
EVOLUTIONARY THINKING 2023  
WEEK 37

CALIN PANTEA  
PHD STUDENT



# BRIEF RECAP

12:15-12:25

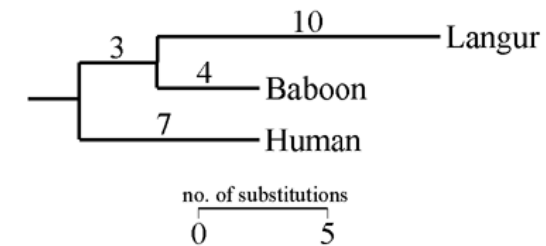


Distance based phylogeny tree building

# MOLECULAR CLOCK

12:15-12:25

- sequence evolution rate constant across time or among lineages
- discrepancy between molecular divergence dates and fossil-based estimates
  - why?
- substitution rate heterozygosity
  - also why? And how to circumvent this?

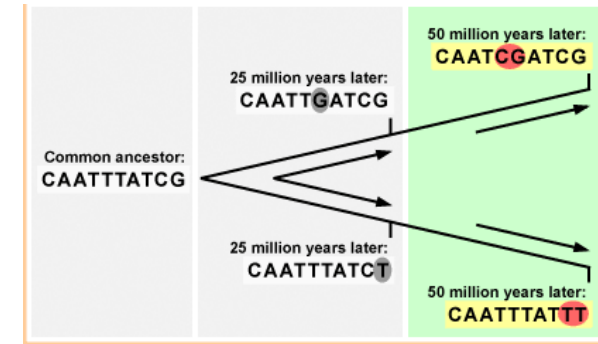
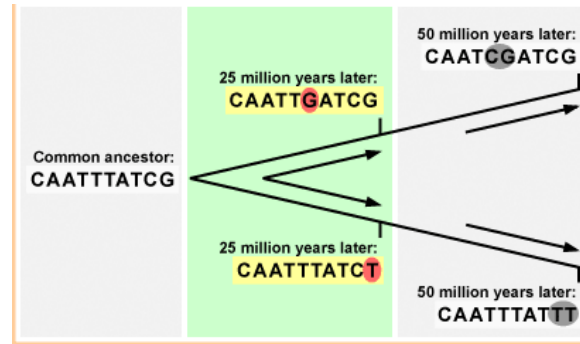
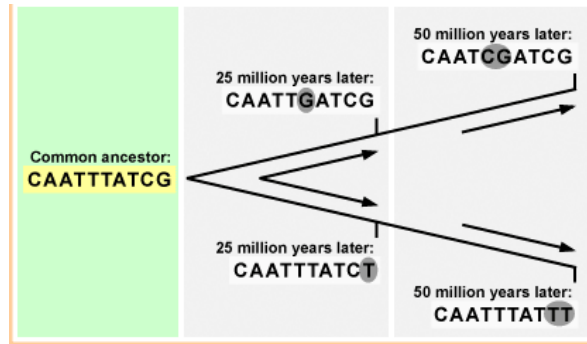


Amino acid substitutions in lysozyme C  
in some primates

Data from C-B Stewart & A.C. Wilson 1987, Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters. Cold Spring Harb. Symp. Quant. Biol. 52: 891-899

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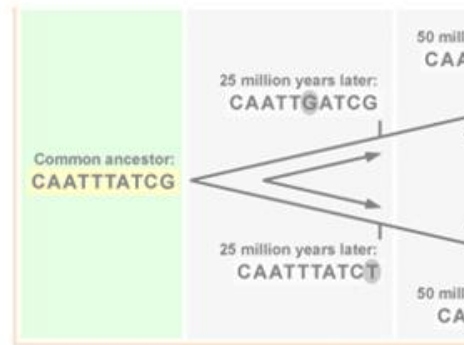
But!

[Molecular clock mirages \(Ayala 1999\)](#) – nice summary on Wikipedia:

- Changing generation times (If the rate of new mutations depends at least partly on the number of generations rather than the number of years)
- Population size (Genetic drift is stronger in small populations, and so more mutations are effectively neutral)
- Species-specific differences (due to differing metabolism, ecology, evolutionary history, ...)
- Change in function of the protein studied (can be avoided in closely related species by utilizing non-coding DNA sequences or emphasizing silent mutations)
- Changes in the intensity of natural selection.

# MOLECULAR CLOCK

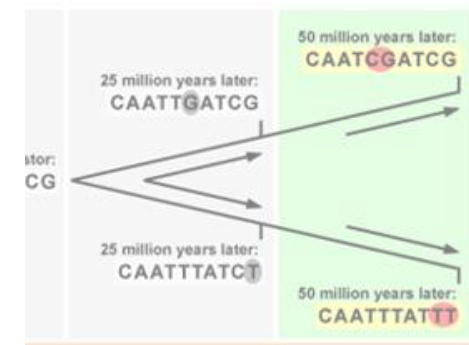
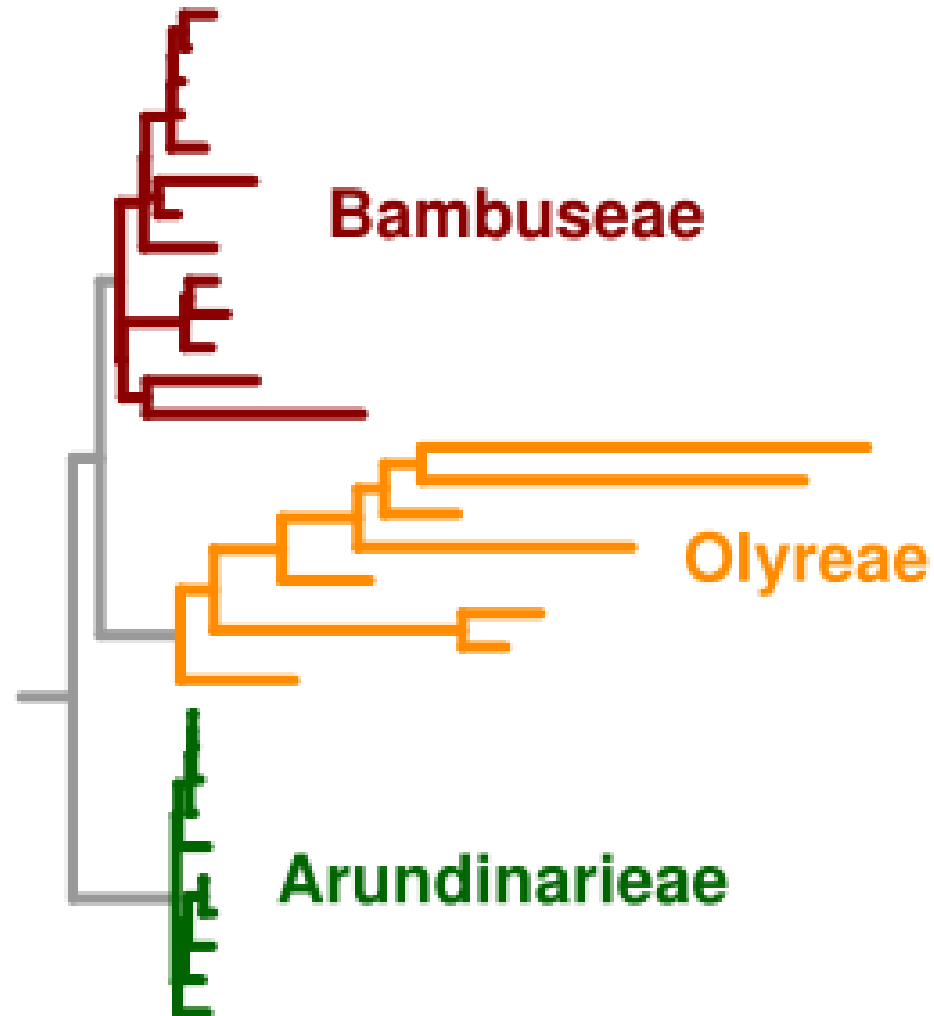
12:15-12:25



But!

## Molecular clock mirage

- Changing generation times (If the rate of evolution is faster in species with shorter generation times)
- Population size (Genetic drift is stronger in smaller populations)
- Species-specific differences (due to different rates of evolution)
- Change in function of the protein studied (due to different rates of mutations)
- Changes in the intensity of natural selection



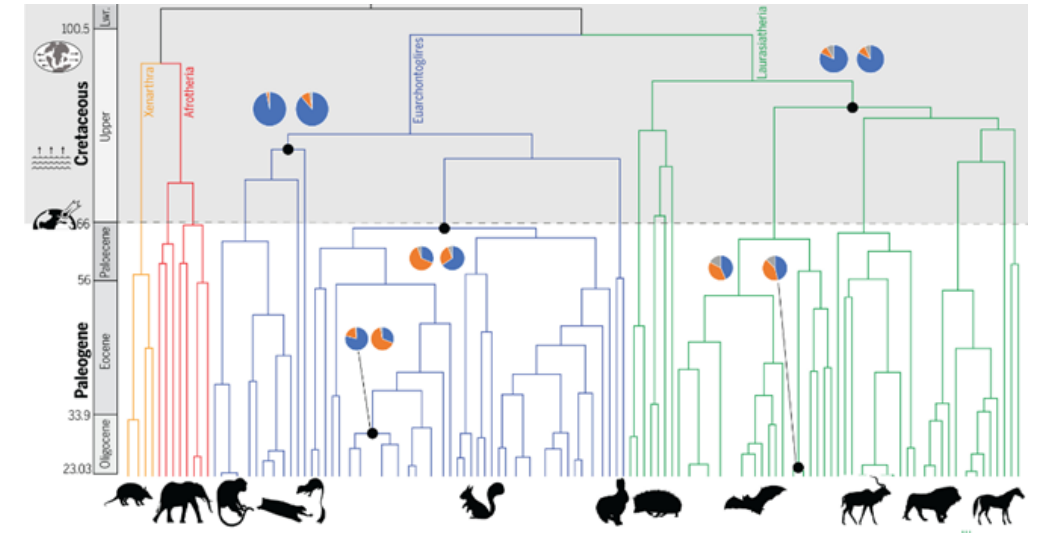
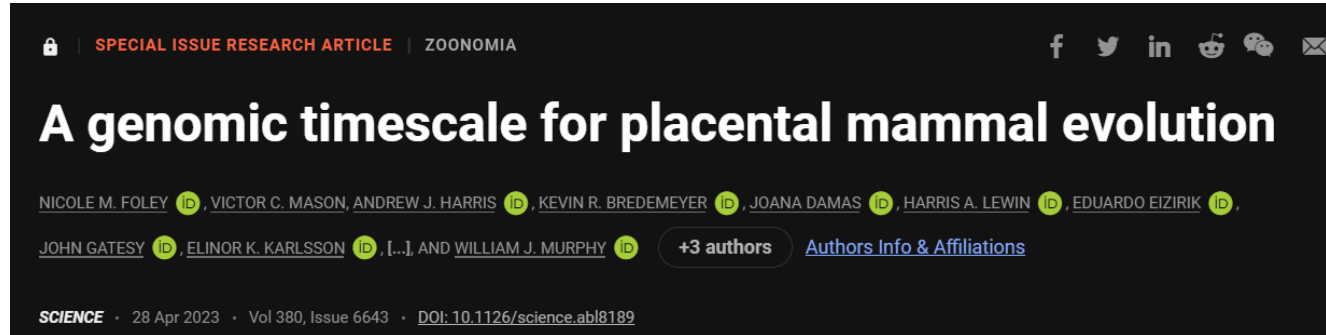
number of years)

emphasizing silent



# ZOONOMIA PAPER

12:25-12:55  
13:10-13:40



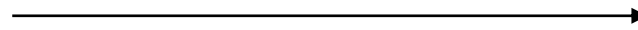
- A look into estimating divergence times based on multiple clock models
- Simple idea: look at how differently recombining chromosomes evolve
- Let's see how that went!

# ZOONOMIA PAPER

12:25-12:55  
13:10-13:40

- Group discussion:

Questions 1-8



Group 1

Last Name • First Name, Username, Org Defined ID
Barnett, Felix, au752670, 752670
Jørgensen, Jonas Riber, au683396, 683396
Martensen, René, au685166, 685166
Petersen, Simon, au649962, 649962

Group 2

Last Name • First Name, Username, Org Defined ID
Chutznisileiou, Savvas, au752684, 752684
Chen, Chongming, au746597, 746597
Kongsgaard, Viktor, au661993, 661993
von Vegetack, Hans Carlo, au752686, 752686

Group 3

Last Name • First Name, Username, Org Defined ID
Dahl, Astrid Kildgaard, au612796, 612796
Grund, Christina Espeneth, au683054, 683054
Hansen, Johanne Constance Hagen, au71424, 671424
Vargen Pichers, Anna Gabriela, au752667, 752667

Group 4

Last Name • First Name, Username, Org Defined ID
Groth, Thorbjørn Sej, au665701, 665701
Jensen, Ane Naur, au672628, 672628
Suclito, Abby Kurniawati, au747615, 747615
Wahab, Adam Faridhan, au667387, 667387

Group 5

Last Name • First Name, Username, Org Defined ID
Fiedikus, William, au682687, 682687
Saha, Anik, au746885, 746885
Thingholm, Mette Skovmand, au599620, 599620

1

1-5

Questions 1-3 and 8-12



Group 6

Last Name • First Name, Username, Org Defined ID
Andersen, Søren Villum Poulsen, au635621, 635621
Coto Escofet, Aiba, au731539, 731539
Gao, Jiahui, au747088, 747088
Lütken, Gorm Hjørth, au681865, 681865

Group 7

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Eiriksd, Björn, au709133, 709133
Grandjean, Niels, au752683, 752683
Jensen, Sebastian Kjellerup Godtke, au64538, 64538
Jørgensen, Søren, au643843, 643843

Group 8

Last Name • First Name, Username, Org Defined ID
Dam, Peter Konrad Alling, au610427, 610427
Martin Pestana, David, au752685, 752685
Nikolaïdou, Eleni, au752666, 752666
Svenningsen, Laurids, au632957, 632957

Group 9

Last Name • First Name, Username, Org Defined ID
DE SILVA, HELENIA HEW BRESLA MORAES, au744824, 744824
Hüb, Karl Brunsen, au721087, 721087
Marcus, Aikens, au744256, 744256
Slav, Anna Karlina Jensen, au64681, 64681

Group 10

Last Name • First Name, Username, Org Defined ID
Fut, Laura Marie Hagen, au640803, 640803
Gálfi, Nóra, au752687, 752687
Jørgensen, Carolina Ferreira, au799004, 799004
Lilstrup, Johan Christensen, au664823, 664823

Group 11

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Baker, Li-Rene Zhi, au752655, 752655
Culdrón, Elia, au752669, 752669
Charlton, Chester Henry, au747554, 747554
Danger, Sönja Weiberg, au643027, 643027

6-11

6-11

- Then brief run through the paper

# BREAK

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12:55-13:10



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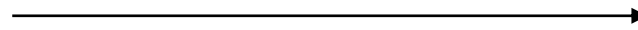


# ZOONOMIA PAPER

13:10-13:40

- Group discussion (60' total):

Questions 1-8



Questions 1-3 and 8-12



- Then brief run through the paper (15')

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6-11

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Google Docs

# EUTHERIAN DIVERSIFICATION

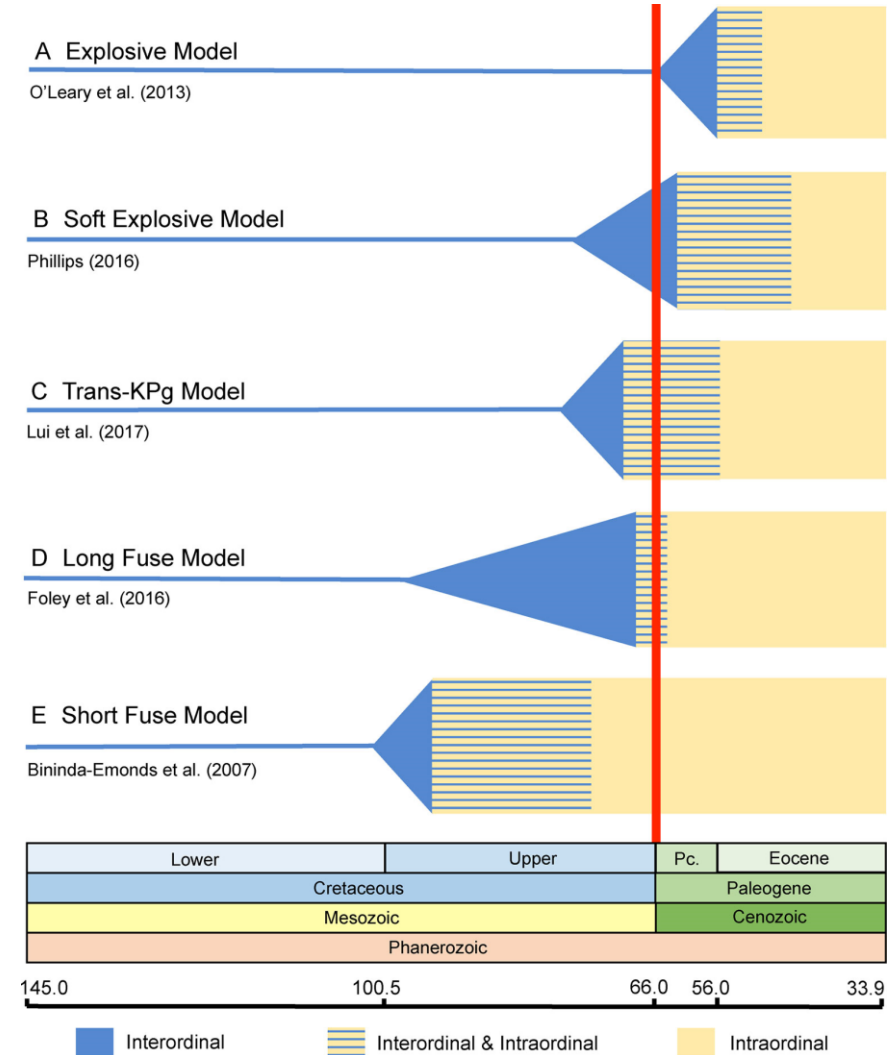
13:55-14:00

Replacing Menti quiz this Wednesday:

Very brief discussion on the models

Use your intuition from the Zoonomia paper:  
does the long fuse model make sense?

What arguments supporting the other  
models can you think of?





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