

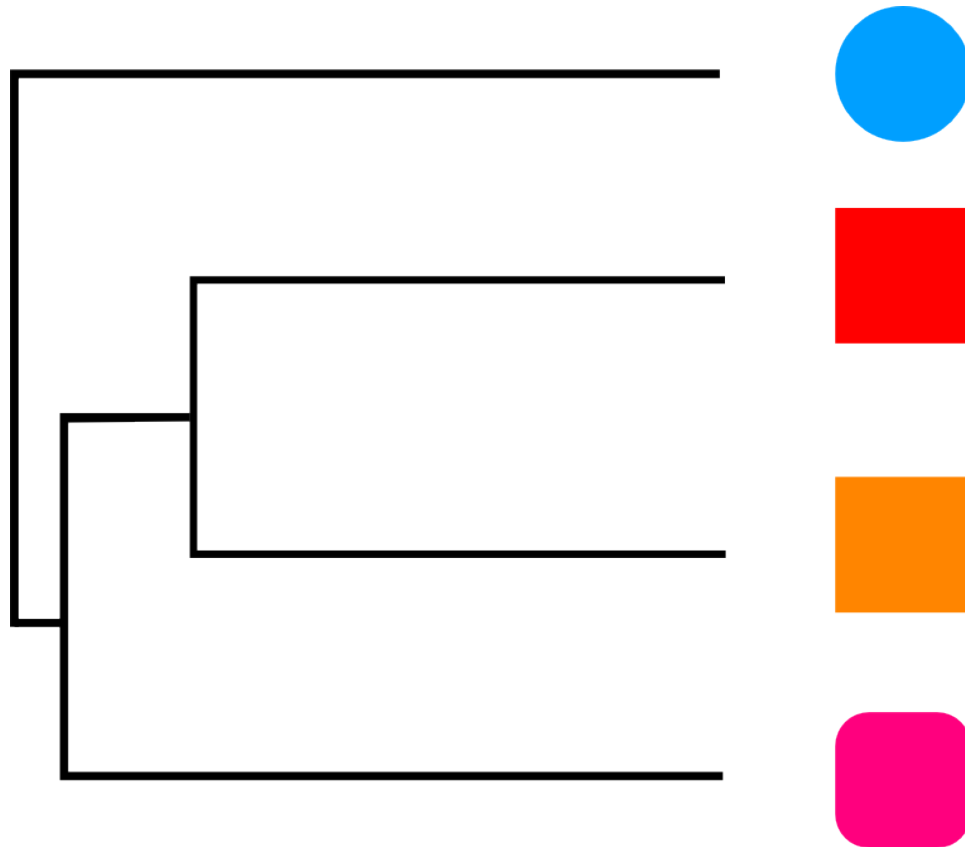
MDSC 308

Phylogenetics

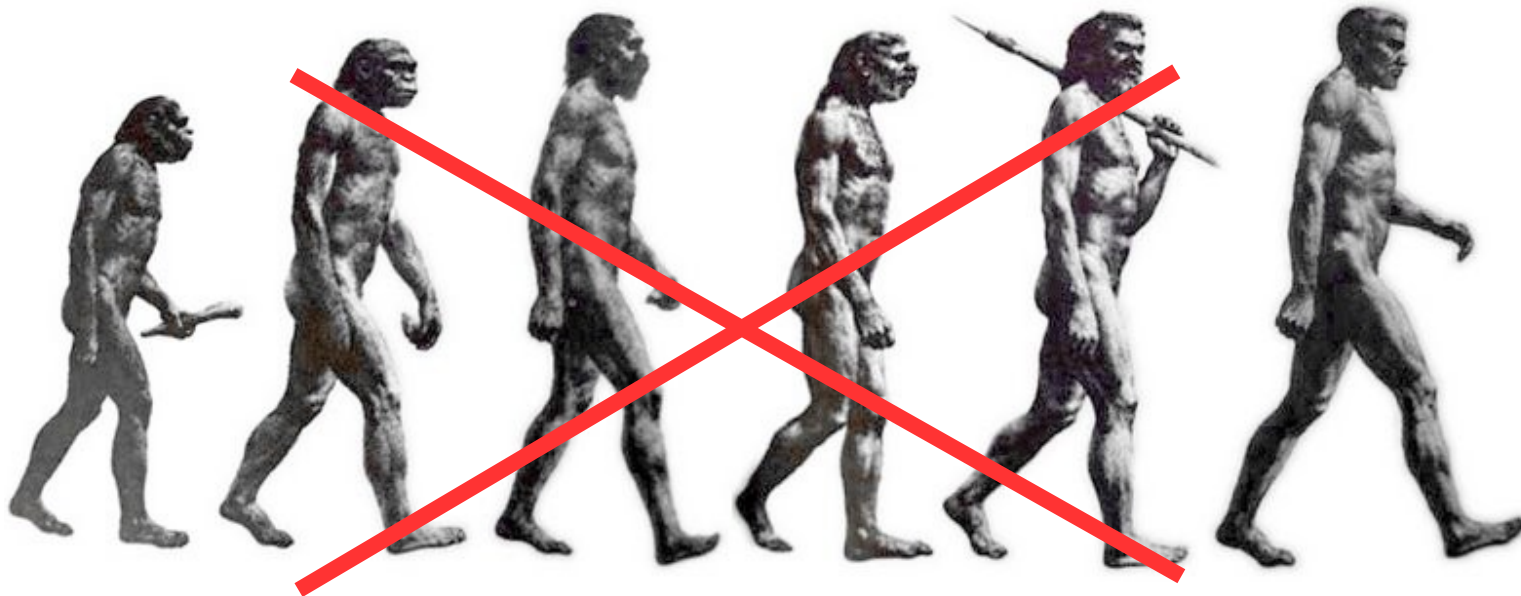
*“Nothing in Biology Makes Sense Except in the
Light of Evolution”*

Theodosius Dobzhansky, 1973

Comparing things

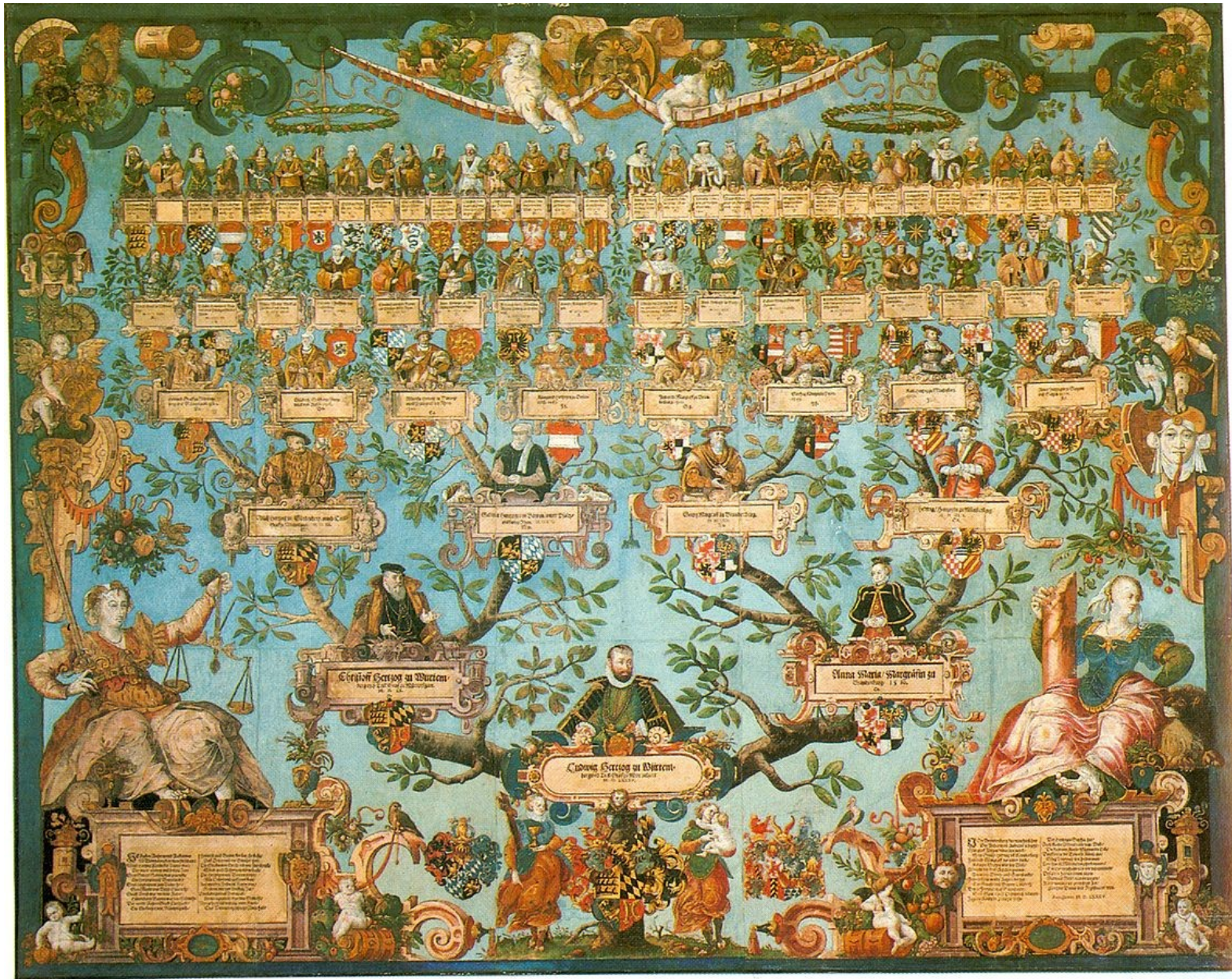


Evolution?

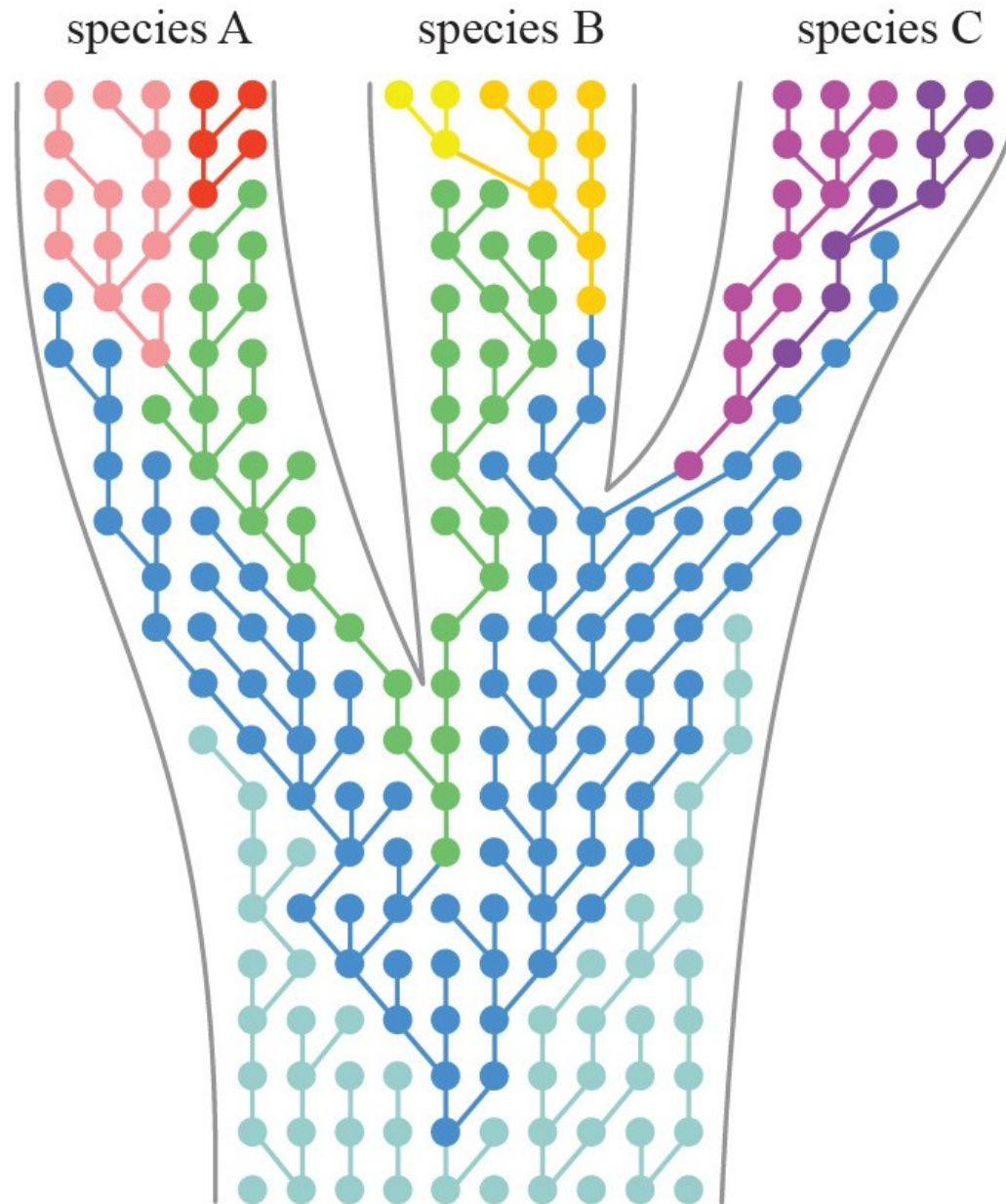


WRONG

Kingdom of Wurttemberg



Trees



Tracing HIV infections

THE DAILY ADVERTISER
Acadiana's Daily Newspaper
Louisiana Thursday, October 22, 1998

DNA debate

David Hillis, right, of the University of Texas, leaves court Wednesday with David P. Mindell, of the University of Michigan. Both were expert witnesses for the prosecution.

Jury hears AIDS DNA evidence against Schmidt

Bill Decker
Staff Writer

LAFAYETTE — Testimony in the attempted murder trial of Dr. Richard Schmidt turned Wednesday to the prosecution's DNA evidence — and on defense attempts to cast doubt on that evidence.

A Baylor College of Medicine study asserts that a "close relationship" exists between the genetic material in AIDS viral strains found in alleged victim Janice Trahan Allen and one of Schmidt's patients. The study supports the prosecution's case that Schmidt intentionally injected Allen with the AIDS-tainted blood drawn from patient Donn McClelland on Aug. 4, 1994.

Michael Metzker, who performed the study in 1995 and 1996 as a doctoral candidate at Baylor, and David Hillis, a University of Texas expert who reviewed Metzker's work, testified Wednesday.

Hillis' time on the stand was marked by verbal sparring with defense attorney Michael Fawer. Both men repeatedly interrupted each other.

And Hillis, a recognized authority on the technique used to compare the viral DNA samples, insisted on explaining his answers beyond a simple yes or no.

He drawn from McClelland and injected it into Allen that night, a few weeks after she ended their 10-year affair.



McClelland, who has AIDS, 1994. McClelland testified that he remembers having blood drawn when he went to the clinic. "I dare say on every occasion," he said.

Defense attorney Michael Fawer, left, leaves court followed by Dr. Richard Schmidt, after Wednesday's proceedings. Testimony continues at 9 a.m. today.

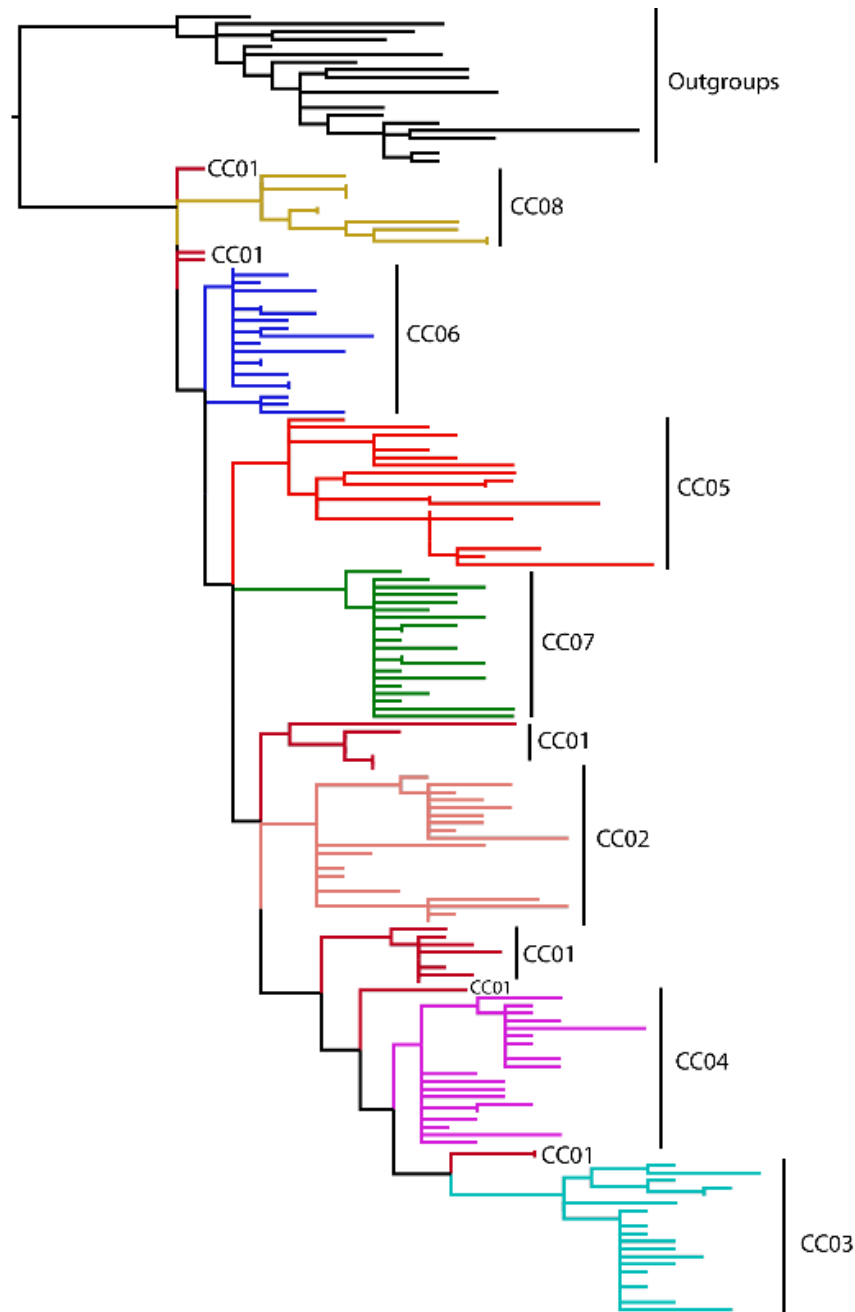
Alleged source of AIDS-tainted blood testifies

Bill Decker
Staff Writer

LAFAYETTE — Former teacher Donn McClelland testi-

Tracing HIV infections



Tracing HIV infections

Acadiana's Daily Newspaper
THE DAILY ADVERTISER
Louisiana
Saturday, October 24, 1998

Schmidt guilty

Doctor faces 50-year jail sentence

Bill Decker
Staff Writer

LAFAYETTE — A Lafayette Parish jury found Dr. Richard Schmidt guilty late Friday of attempted second-degree murder, charging a homicide and perjury, sitting trial.

Schmidt, 36, was accused of intentionally injecting the AIDS virus into nurse Janice Trohan Allen of Lafayette in 1996, after she broke off their 10-year affair. Allen is now HIV-positive.

Waiting for the verdict just after 8:30 p.m. Friday, Allen, 36, clutched the hand of husband Jerry Allen. When the clerk read the verdict, Allen began sobbing loudly.

Schmidt stood at the verdict was read, showing his emotion. But as the discussion turned to whether his \$500,000 bond would be continued pending sentencing, Schmidt sat and put his head in his hand. Moments later, he turned to embrace his wife, Barbara, who sobbed loudly.

Allen later fainted and was taken from the courtroom in a wheelchair.

"I didn't think this is what the jury should do," defense attorney Michael Fawer said after the trial. "I still don't. I thought we made it real clear that this case was brought with reasonable doubt."

Fawer said he plans to appeal.

The nine-woman, three-man jury went out to consider Schmidt after about four hours of deliberation. The jury received the formal



AP Photo/Tom Schell

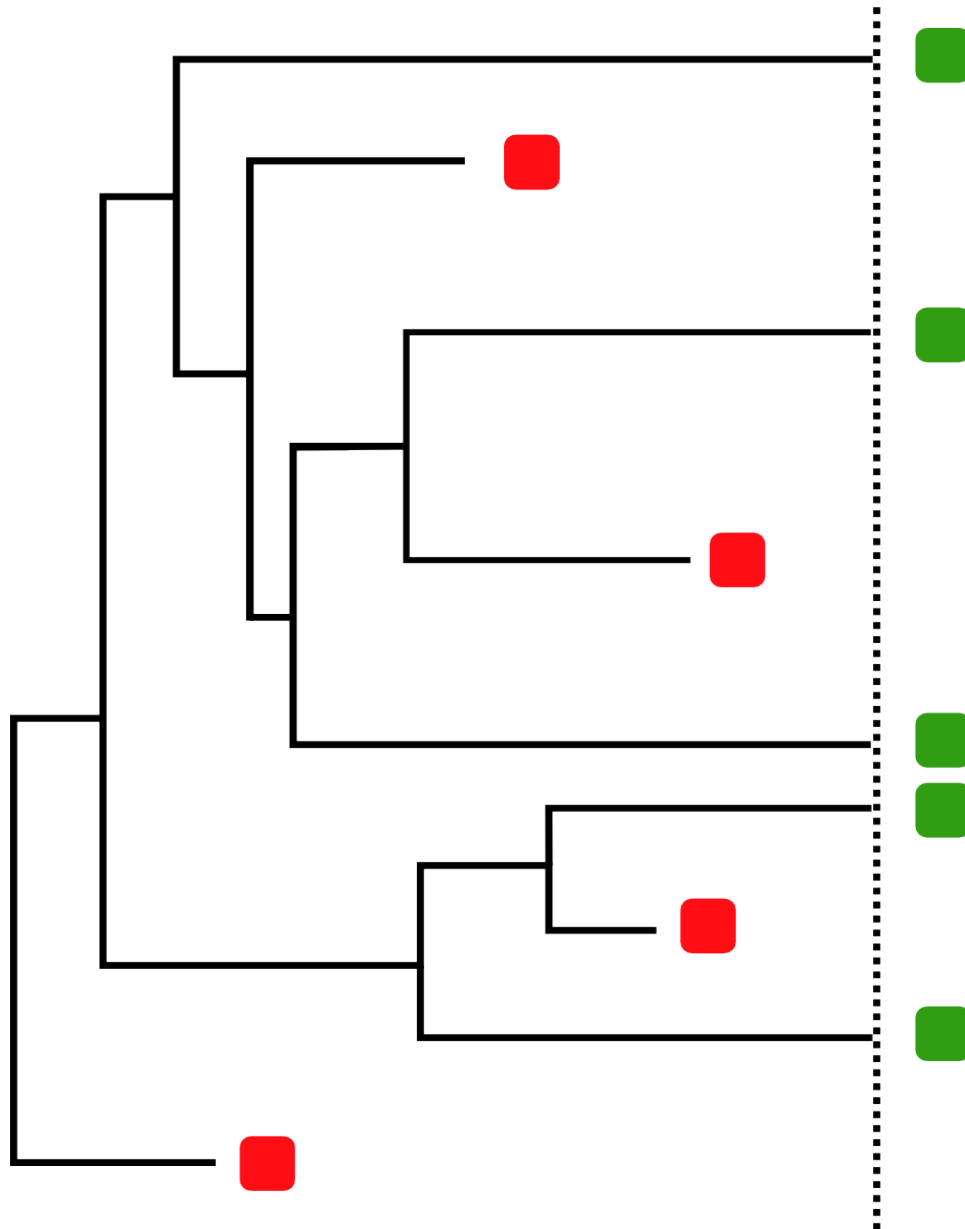
Dr. Richard Schmidt, center, leaves the Lafayette Parish Courthouse Friday night with his despondent wife, Barbara, after being convicted of attempted second-degree murder. Schmidt is accompanied by courthouse security and defense attorney Gerald Block, left.

Claps, sobs, fainting spell greet verdict

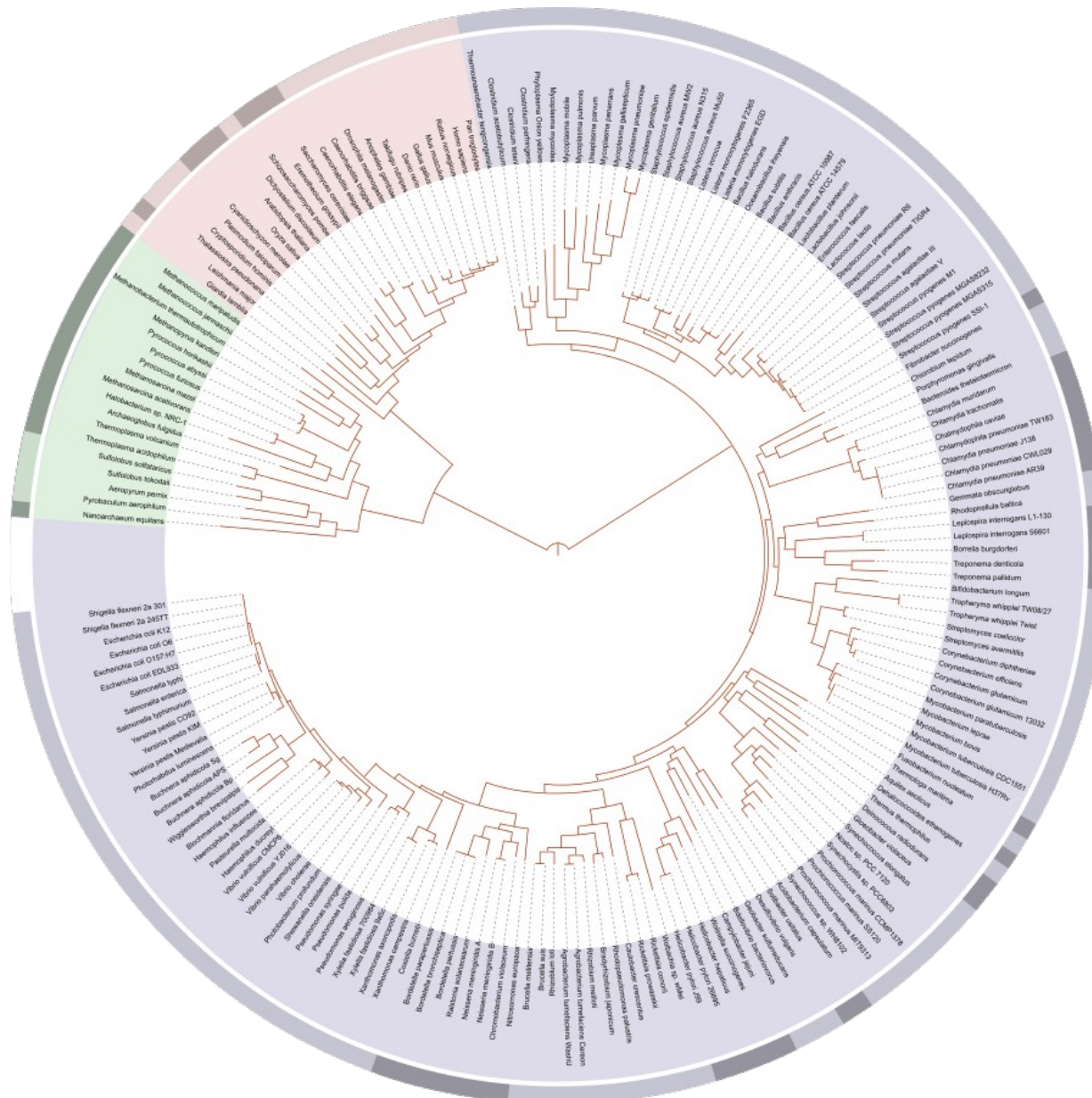
Lauren Ayo
Staff Writer



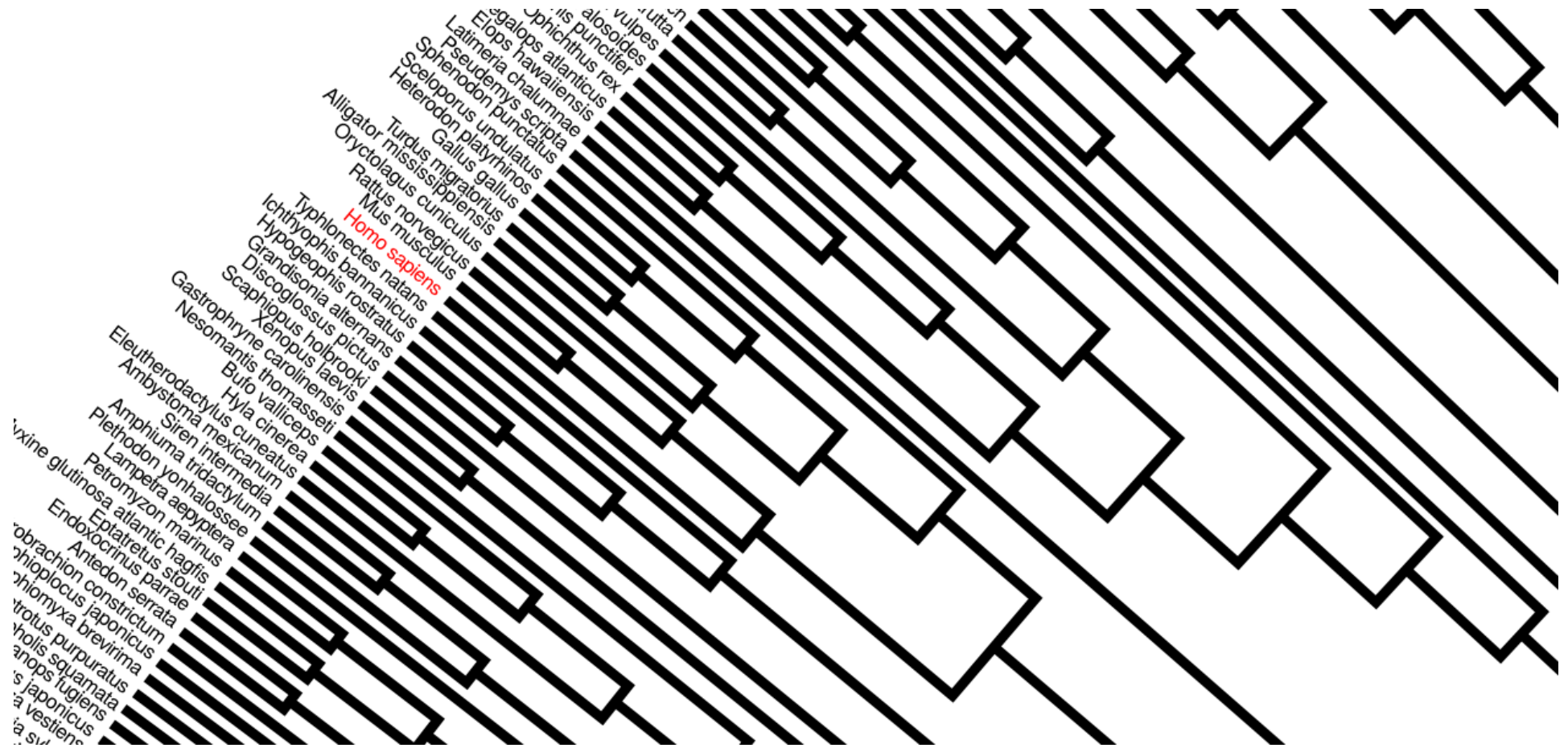
Extinction



Tree of life



Tree of life

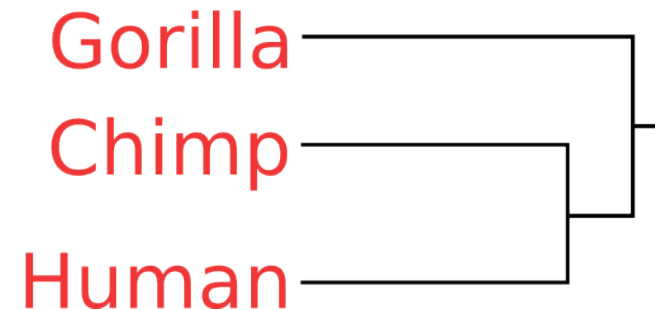
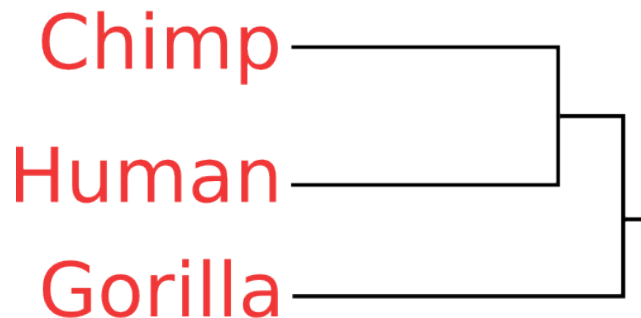
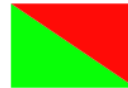
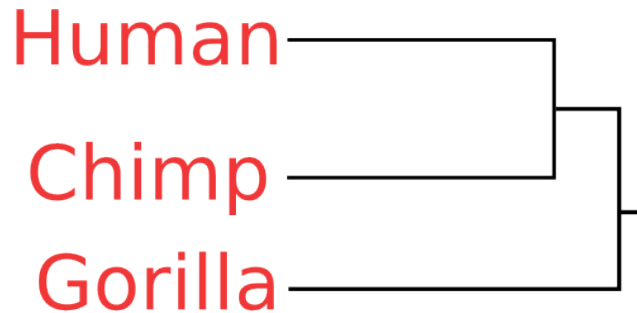


Mobiles



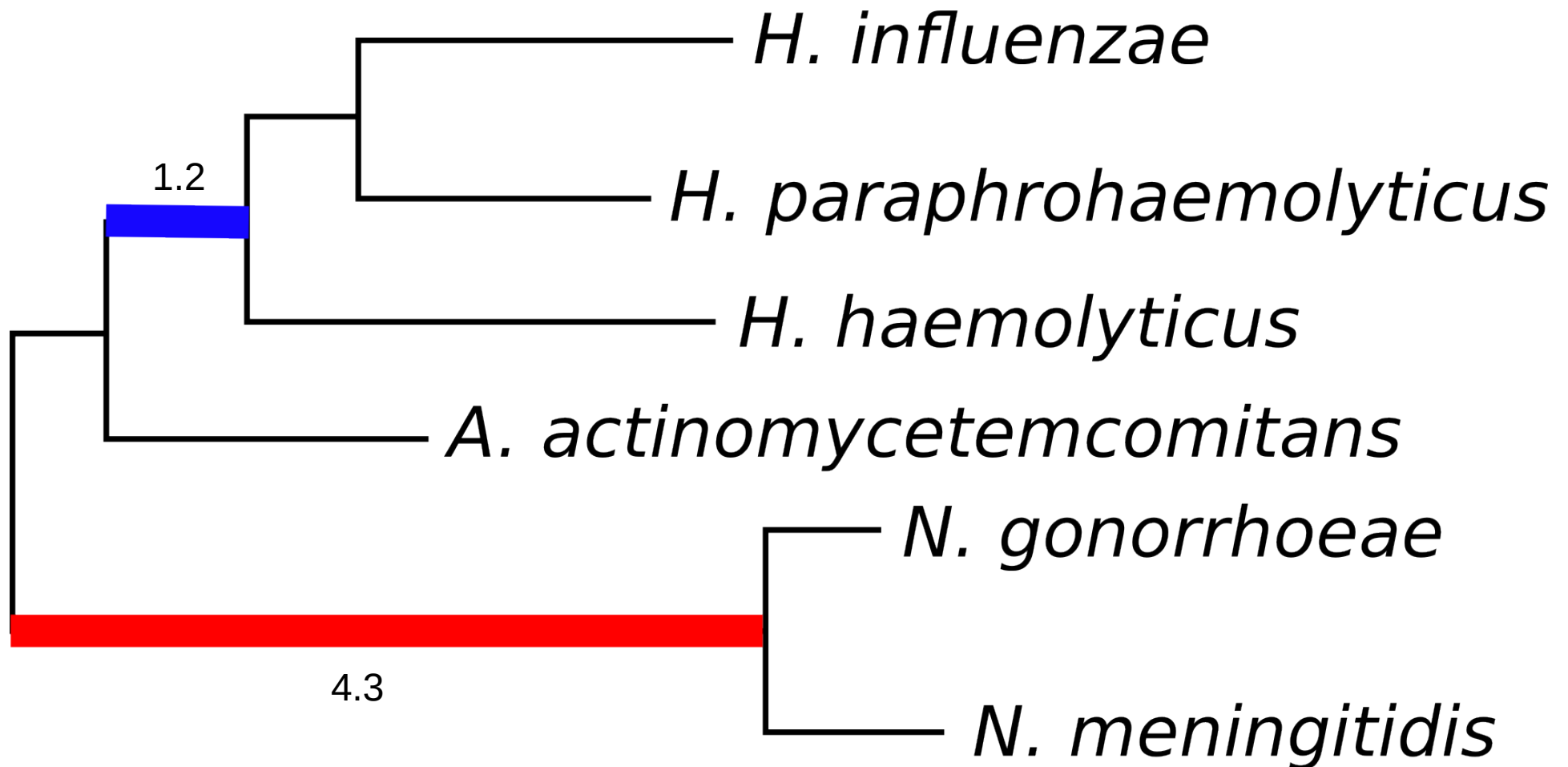
Mobiles

- There is no linear order
- Only branchings matter

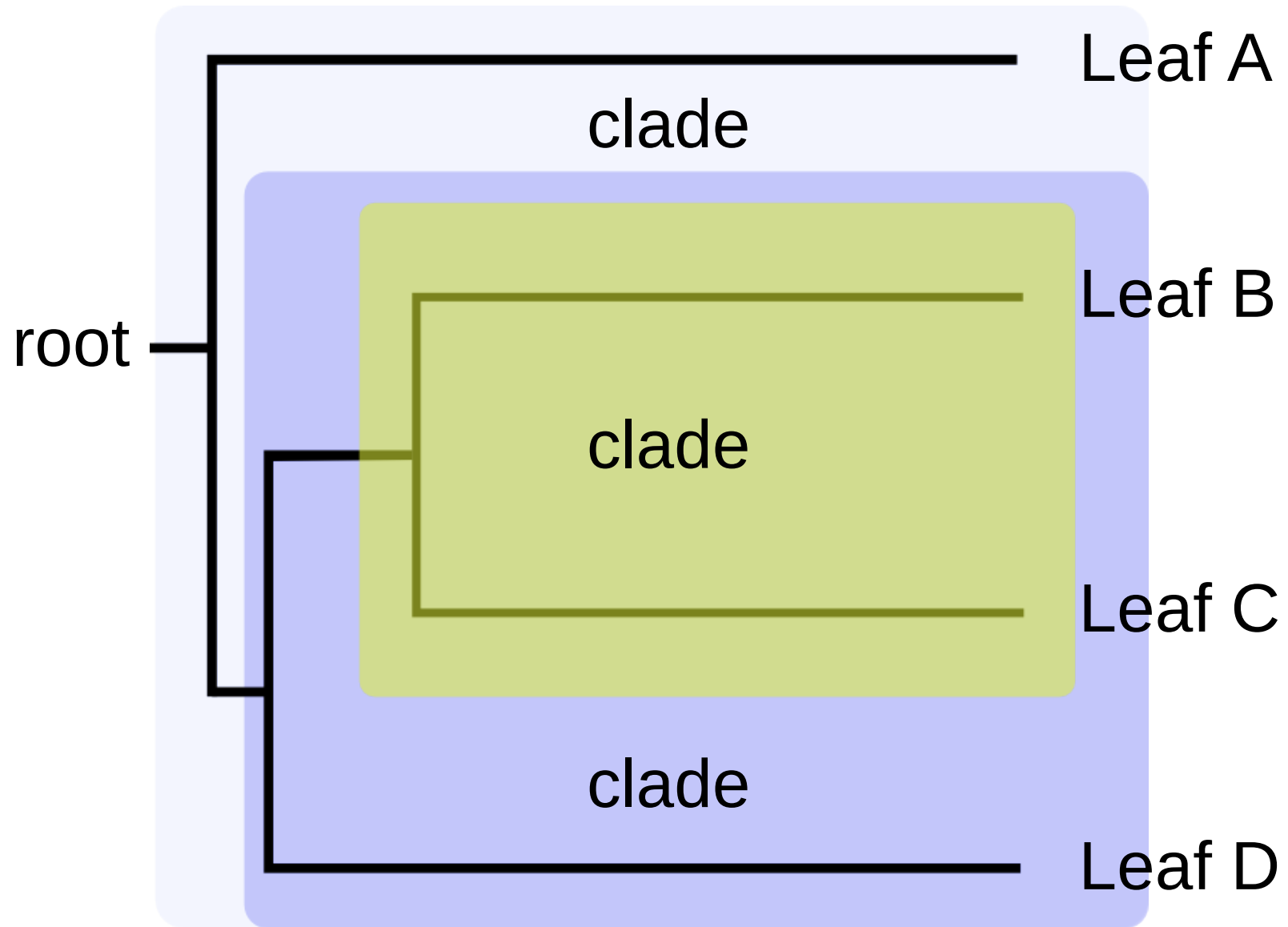


Branch length

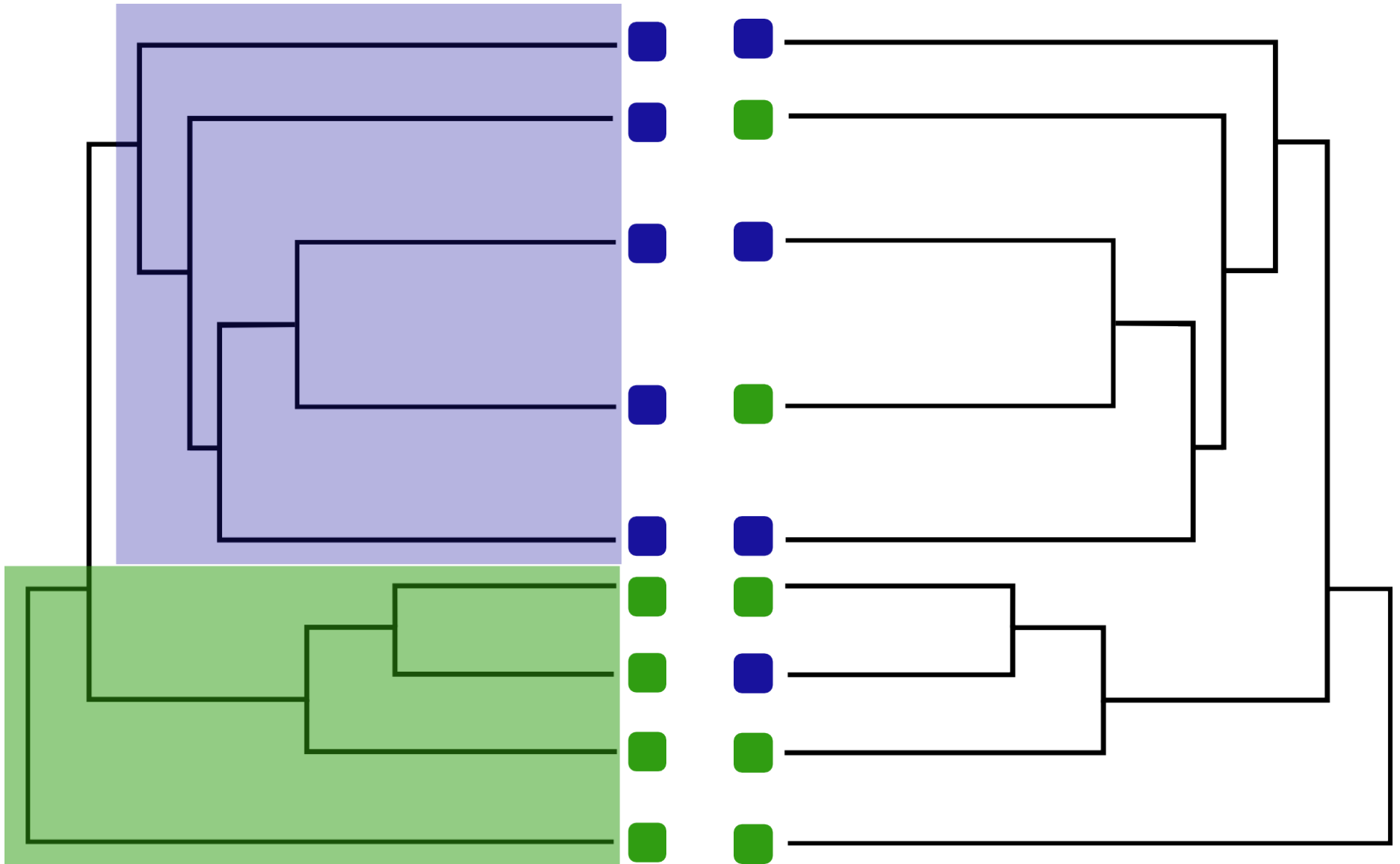
Distance = time * rate of substitutions



Jargon



Grouping



How many trees are there?

$$N_r = \prod_{k=2}^T (2k-3)$$

$$N_u = \prod_{k=3}^T (2k-5)$$

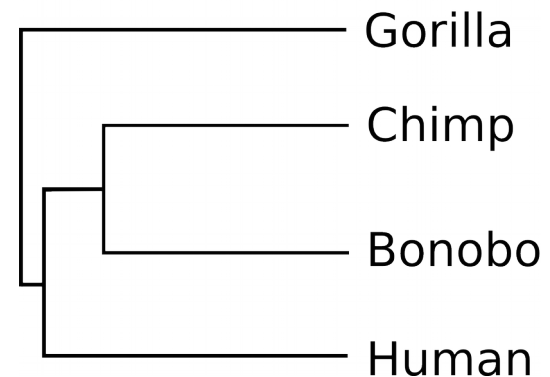
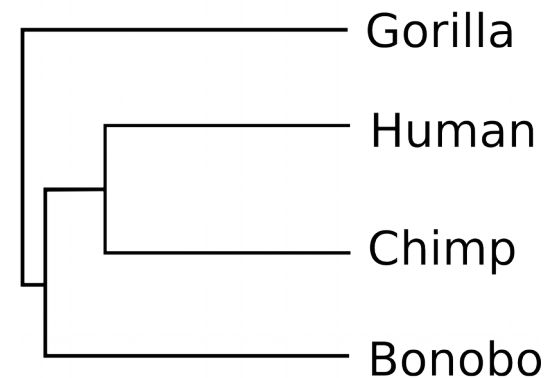
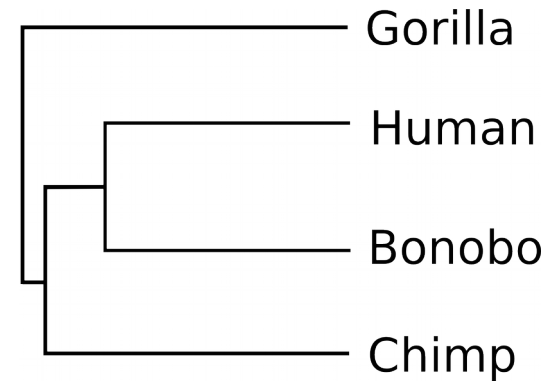
T	Unrooted	Rooted
10	2,027,025	3×10^7
15	7×10^{12}	2×10^8
20	2×10^{20}	8×10^{21}
100	2×10^{182}	2×10^{184}

Ways to build a tree

- Parsimony
 - Minimize number of mutations
 - Simple, but inaccurate
- Maximum Likelihood (most common)
 - Maximize probability of observation given model
 - Harder, but accurate
 - Does not provide confidence intervals
- Bayesian inference
 - Choose best model that maximizes probability given data
 - Hardest, very accurate
 - Explores all reasonable hypotheses

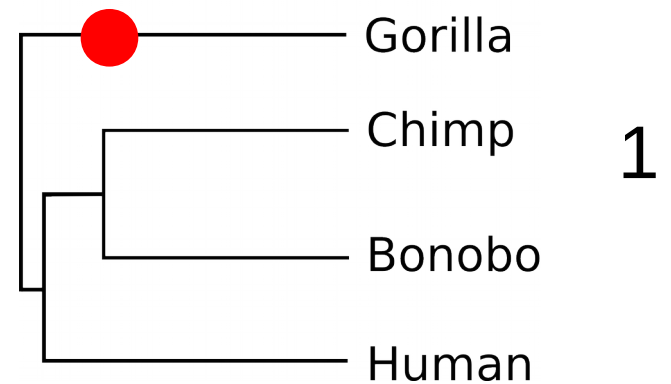
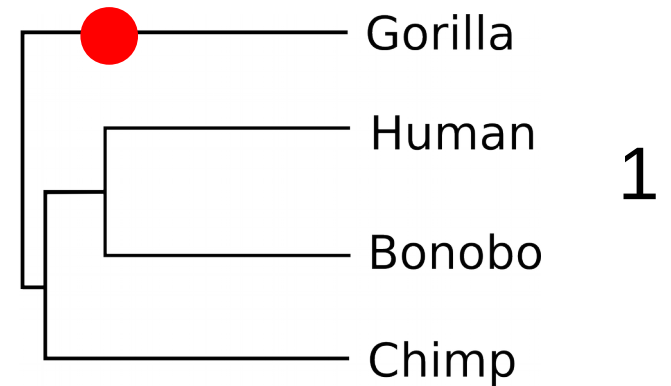
Parsimony

H: ACTGCATG
C: ACGGCCTC
G: CCGGCATG
B: ACTGCCTC



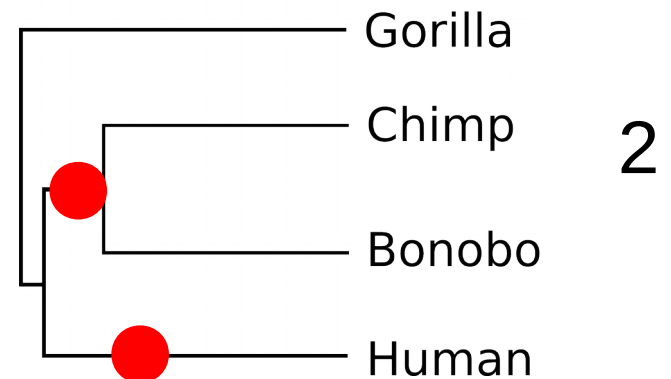
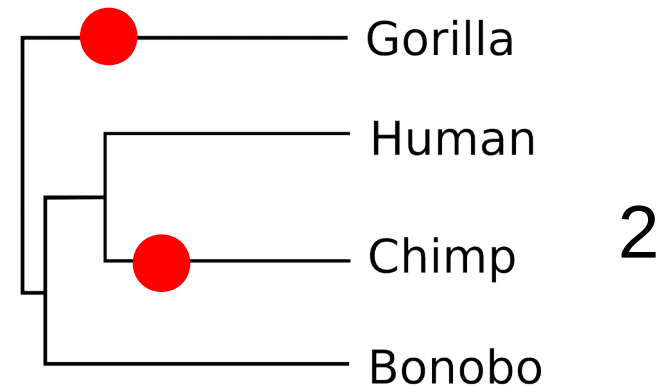
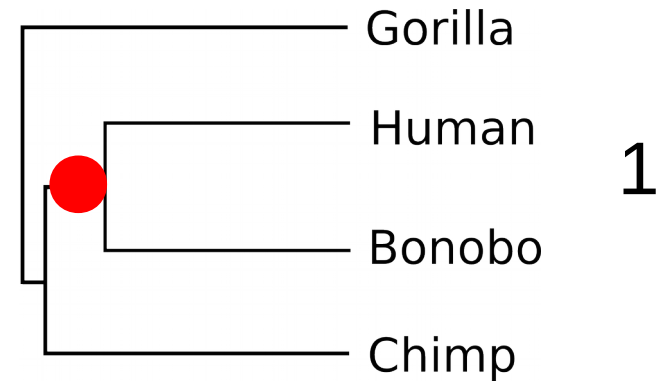
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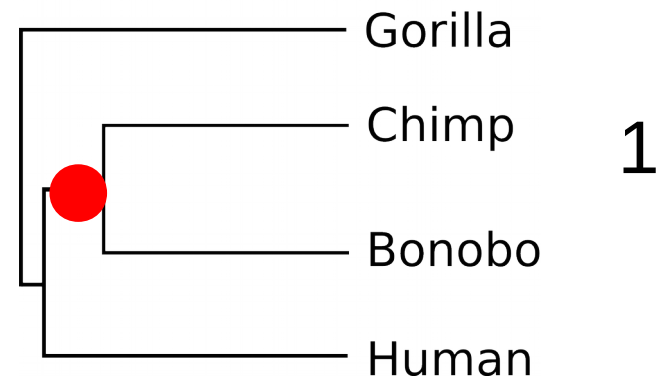
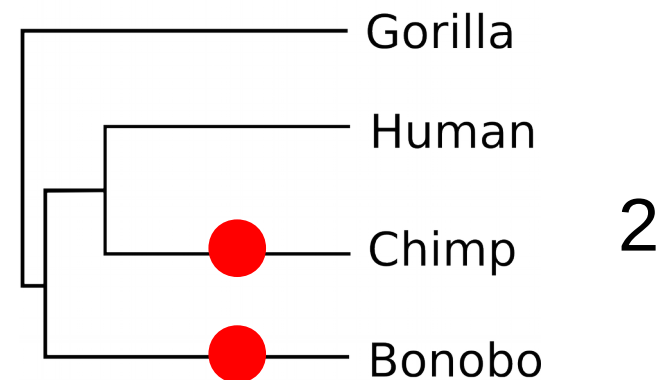
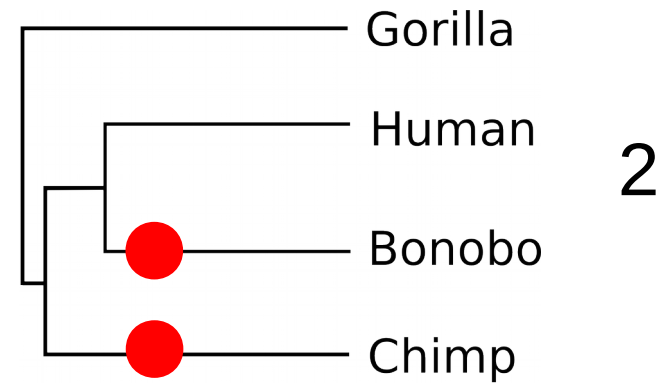
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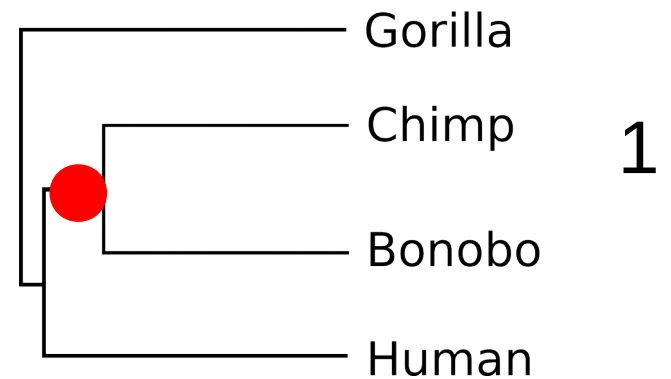
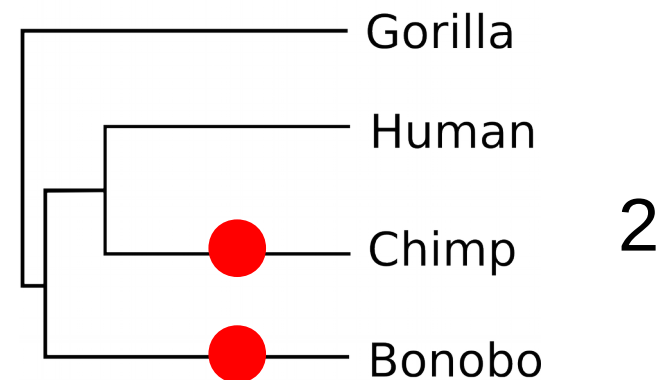
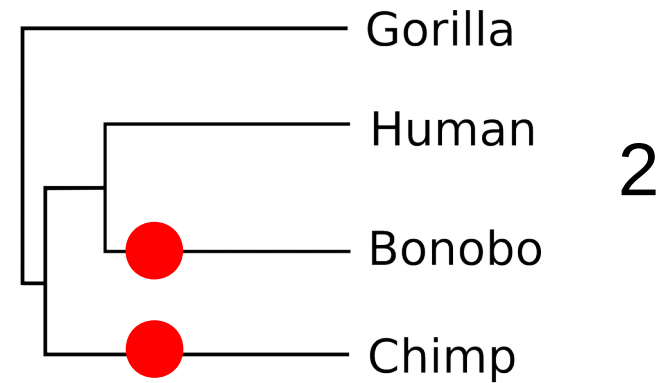
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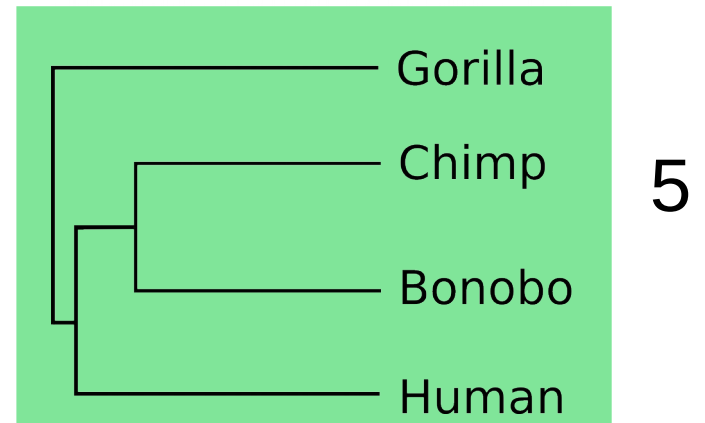
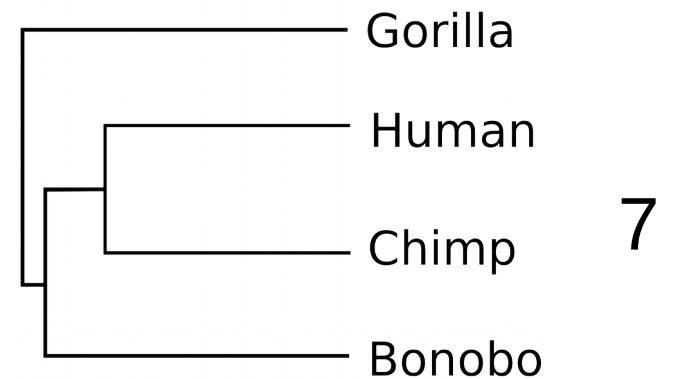
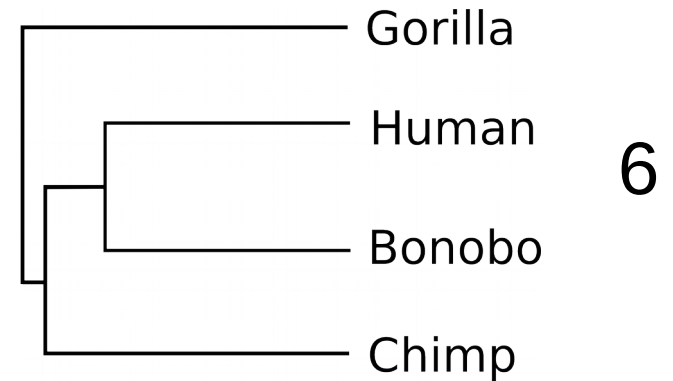
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Parsimony

H: ACTGCATG
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Likelihood

- Calculate the probability of each event according to a model
- Need to do this for all substitution histories
- Kimura 2 parameter model
 - Transition rate a
 - Transversion rate b

	A	C	T	G
A		b	a	b
C	b		b	a
T	a	b		b
G	b	a	b	

A diagram illustrating a phylogenetic tree with a mutation event. The tree has four tips. The top two tips are labeled 'G' and have orange bars above them. The middle two tips are labeled 'A' and have purple bars above them. A red dot on the branch leading to the 'A' tips represents a mutation event labeled 'G -> A'. A yellow box with the letter 'G' is on the left side of the tree.

$$P(T) = P(G) \times P(G \rightarrow G) \times P(G \rightarrow G) \times P(G \rightarrow G) \times P(G \rightarrow A) \times P(A \rightarrow A) \times P(A \rightarrow A)$$

Bootstrap

H: ACGCGTAT

C: ACGCCGCT

G: CCGCGGAT

B: ACGCCTCT

H: ATGGCTCA

C: AGCGCTCC

G: CGGGCTCA

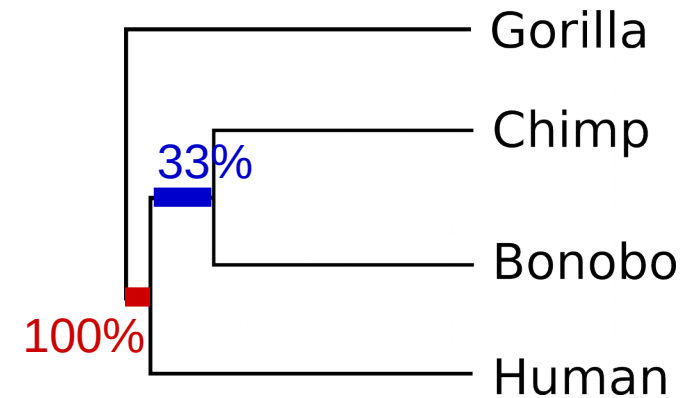
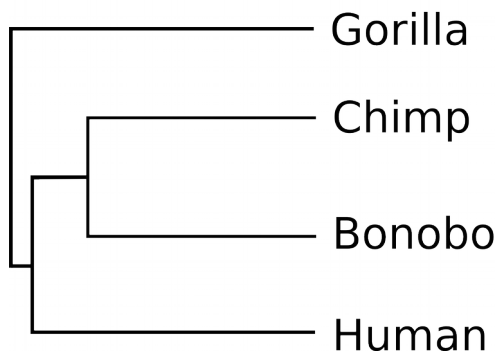
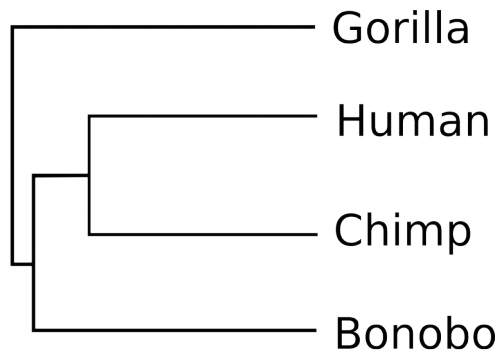
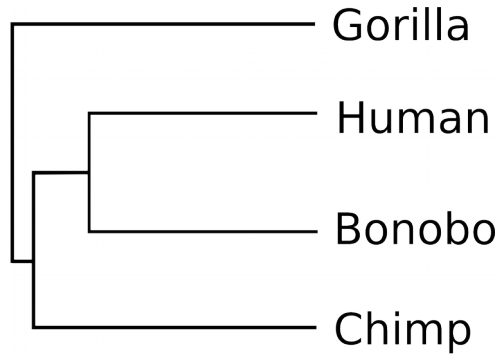
B: ATCGCTCC

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G: CCGGCATG

B: ACTGCCTC



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