

Bio 112 Handout for Evolution 9

This handout contains:

- Today's iClicker Questions
- Handout for today's lecture

iClicker Question #6A - before lecture

Which of the following statements are true?

- A. The amino acid sequence of any given enzyme is the same in all organisms.
- B. Any change in the amino acid sequence of a protein will cause it to be non-functional.
- C. If there is a difference in the amino acid sequence of a given enzyme in two organisms, it reflects the fact that one is fitter than the other.
- D. More than one is true.
- E. None of the above are true.

iClicker Question #6B - after lecture

There are several assumptions that go into using molecular data to generate phylogenies. Which of the following assumptions is(are) **not** essential if you want to use molecular data to generate a phylogeny?

- A. Mutation rates are constant over time and constant in all species.
- B. Proteins with similar amino acid sequences reflect common ancestry rather than coincidence.
- C. Mutations do not change the amino acid sequence of proteins.
- D. The changes in amino acid sequence used to calculate molecular phylogenies do not cause changes in function.
- E. More than one of the above.

Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
 - a. Press the button corresponding to the answer you've selected (A thru E).
 - b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

Bio 112 Molecular Phylogeny Example

- Here is an example of molecular phylogeny; it uses the single-letter code for amino acids:
 P = proline F = phenylalanine L = leucine I = isoleucine
- Consider the hydrophobic core of a protein where the exact sequence is not important for the function of the protein:

Long ago

PPPPP
Species A₁

PFPPP
Species B

Now
IFPPP
Species D

Original Protein:

PPPPP
Species A

PPPPP
Species A₂

PPLPP
Species C

PPLFP
Species E

PPLPF
Species F

- Reconstructing the history from the modern species (D, E, F):
 • Species E vs. Species F

E: PPLFP

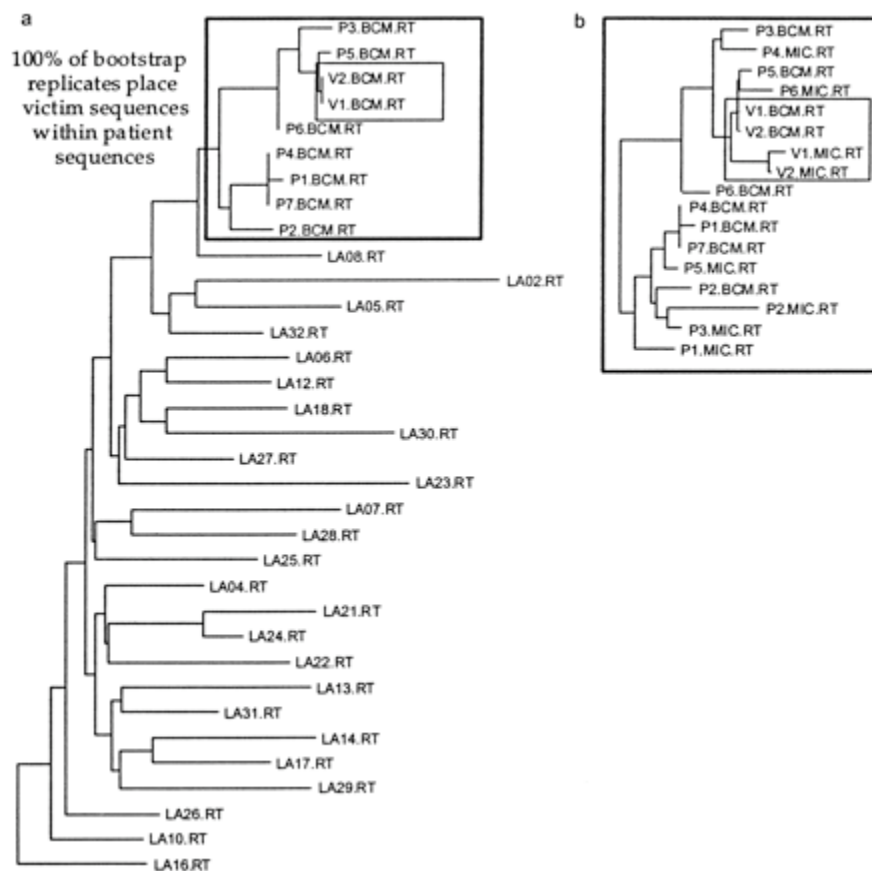
D: IFPPP

F: PPLPF

E: PPLFP

Molecular phylogeny & criminal justice

- 1994: Dr. Richard Schmidt accused of injecting his ex-girlfriend (the Victim) with HIV (AIDS virus) from one of his patients.
- HIV evolves very rapidly, even leading to multiple different sequences *in the same patient!*
- Police collected HIV samples from victim (V), Dr. Schmidt's patient (P), and many local HIV⁺ individuals from the community who were unrelated to the case (LA)
- They then used computer tools to construct the following phylogeny.



From: "Molecular evidence of HIV-1 transmission in a criminal case" by Michael L. Metzker, David P. Mindell, Xiao-Mei Liu, Roger G. Ptak, Richard A. Gibbs, and David M. Hillis. *Proceedings of the National Academy of Sciences* 99:22 14292-14297 (2002).