

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) 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

Original Protein:
PPPPP
Species A

Now

PFPPP
Species B

IFPPP
Species D

PPPPP
Species A₂

PPLPP
Species C

PPLFP
Species E

PPLPF
Species F

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

E: **PPLFP**

F: **PPLPF**

- Species D vs. Species E

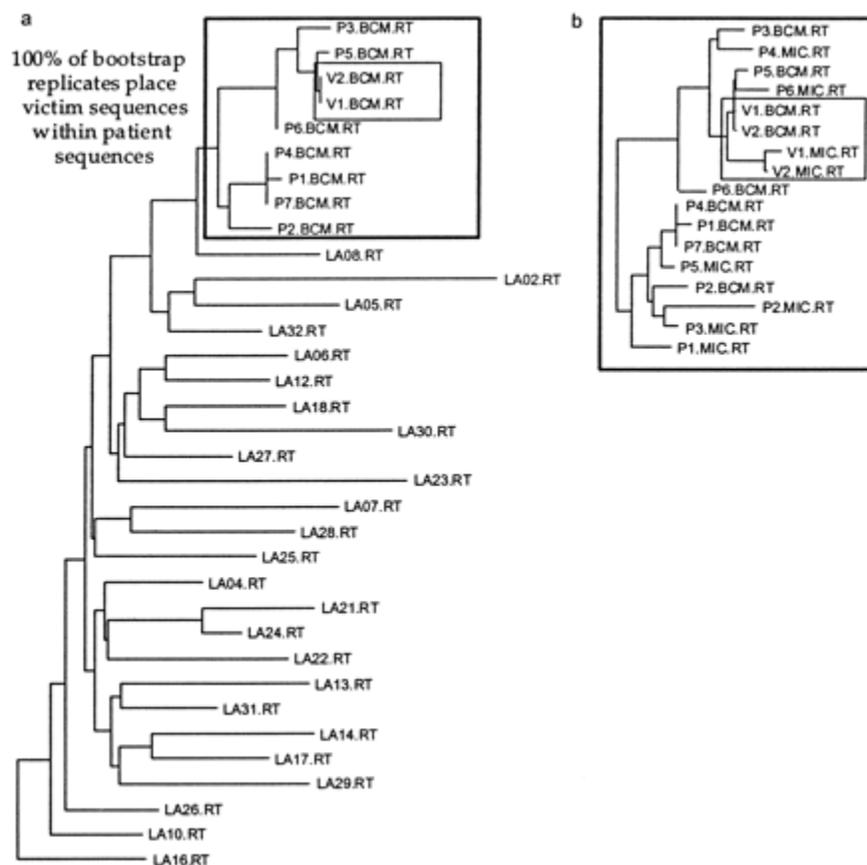
D: **IFPPP**

E: **PPLFP**

Evolution 9 - 2

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).