MCB 142 Discussion

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1 Announcements

The final exam will take place in Pauly Ballroom, from 8 to 11 AM on Friday, December 19. Prof. Slatkin will hold his review on in Dwinelle 155, from 3 to 5 PM on Thursday, December 18.

I will be holding extra office hours next week in Stanley 482 from noon to 2 PM on Thursday, December 18.

Prof. Slatkin has made corrections to his lecture notes, so please be sure that you have the latest version when studying for the final.

2 Substitution Rates

- What is the probability of fixation of a new neutral mutation?

- What is the overall rate of fixation of neutral mutations?

- What is the average time to fixation of a new neutral mutation?

- What is the difference between a mutation and a substitution?

- If the substitution rate of replacement mutations is less than the subsitution rate of silent mutations for a given gene, what can you conclude?

- What is the significance of the fact that K_R will have different values for different protein domains?

- The substitution rate in pseudogenes is similar to K_S. What can you conclude?

- How does K_S lead to the molecular clock theory?

3 Gene Trees

- What is coalescence time?

- What is an outgroup, and why do you need it to generate gene trees?

- What are two methods of picking gene trees?

- How can you estimate coalescence time?

- What are trans-species polymorphisms?

4 Practice Problems

4.1

If $\mu = 2 \times 10^{-9}$ per site per year, how many substitutions would you expect to see if you compared 200 neutral sites in humans and mice, which diverged 8×10^7 years ago?

4.2

I	T	G	A	T	C	C	C	T	A	T	G	T	C	G	T	C	T
II	A	C	A	G	T	A	C	T	A	T	G	T	C	G	T	C	T
III	A	G	G	G	C	A	T	T	A	A	A	T	C	G	T	C	G
N	T	C	G	T	T	C	C	G	G	T	G	G	A	A	G	A	T

Infer the best tree using parsimony. Infer the best tree using distance.

4.3

You sample a group of 900 adults at the β-globin gene and find 560 AA, 320 AS and 20 SS individuals. Assume the frequency of A is at equilibrium under selection and that the newborns are in their HW frequencies, and estimate the survival rate of AA and SS individuals relative to AS individuals.