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 substitution 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 $8 \times 10^7$ years ago?

4.2

\begin{tabular}{l}
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 \\
N & T & C & G & T & T & C & C & G & G & T & G & G & A & A & G & A & T \\
\end{tabular}

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

4.3
You sample a group of 900 adults at the $\beta$-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.