12.007 Geobiology
Spring 2009

PS 2 Due on Thursday 25/2/09

1. Find the sequence of human 18s rRNA using PubMed and compare it to
   a) Metagenomic information from environmental genomes
   using BLAST and environmental genomes. Search for "homo 18s RNA" on www.pubmed.com (select "nucleotide" from the list). Then go to BLAST website, select nucleotide blast and then "environmental").

   Examine the highest-scoring hits. Are there any surprising hits? How similar is this sequence to any sequence from the *Bos taurus* genome?
   b) Compare the human 18s rRNA sequence to the Neanderthal genome (blast-> microbial -> environmental on the top menu -> Neanderthal)
   Why does the first hit have a better score although there are fewer identities than in the second hit?
   What information could help you understand whether there are significant changes in the sequence of between humans and Neanderthals?

2. Find the sequence for lactase, an enzyme that helps us digest milk and compare it by BLAST to the Neanderthal metagenome. (Pubmed, select "Protein" from the menu, search for "homo lactase", copy the sequence and then go to the BLAST website).

   a) Were Neanderthals able to digest cow's milk? Explain your reasoning using the scores of your BLAST search. Discuss possible sources of error.

3. You need to design PCR primers to study the diversity of microbes in human gut. Explain how you would do this:
   a) Which gene(s) would you probe for?
   b) How would you design your primers (think about how PCR works and what determines the specificity of primers).
   c) Once you made the primers, how would you determine how many different organisms live in the gut?