

# ASTR/GEOL-2040-001: Search for Life in the Universe

Homework #2

Due: Wednesday Sep 13, 2017

- Given what you heard in the lecture (see also Section 6.1.2.3 on page 161 of Longstaff's book or my temporary link on: [http://lcd-www.colorado.edu/~axbr9098/teach/ASTR\\_2040/material/](http://lcd-www.colorado.edu/~axbr9098/teach/ASTR_2040/material/)), discuss whether life produces more disorder inside the cell, more disorder outside the cell, and/or more disorder everywhere (i.e., the system as a whole)?
- Is methane (CH<sub>4</sub>) a polar or a nonpolar (or apolar) molecule? Draw a sketch of the molecule to help explain your answer. Given your answer, would you say it is a hydrophilic, hydrophobic, or an amphiphilic molecule?
- The biochemistry on the early Earth (or on another world) could easily be slightly different from the biochemistry as we know it.
  - Briefly explain why it is plausible that the early genetic code might have been a binary code with just two base pairs. Make reference to related modern findings mentioned during the lecture.
  - How many different amino acids would an early protein contain if it was the result of such a binary code?
  - Suppose the early genetic code used just G bases (guanine) and C bases (cytosine), and suppose further that the words (=codons) of the early genetic code contained already three letters (similar to the modern one; see below), which amino acids would you expect in such early proteins?
  - Is it reasonable that the early code contained glycine (Gly)?

		Second Letter				
		U	C	A	G	
1st letter	U	UUU   Phe UUC   UUA   Leu UUG	UCU   UCC   Ser UCA   UCG	UAU   Tyr UAC   UAA   Stop UAG   Stop	UGU   Cys UGC   UGA   Stop UGG   Trp	U C A G
	C	CUU   CUC   Leu CUA   CUG	CCU   CCC   Pro CCA   CCG	CAU   His CAC   CAA   Gln CAG	CGU   CGC   Arg CGA   CGG	U C A G
	A	AUU   AUC   Ile AUA   AUG   Met	ACU   ACC   Thr ACA   ACG	AAU   Asn AAC   AAA   Lys AAG	AGU   Ser AGC   AGA   Arg AGG	U C A G
	G	GUU   GUC   Val GUA   GUG	GCU   GCC   Ala GCA   GCG	GAU   Asp GAC   GAA   Glu GAG	GGU   GGC   Gly GGA   GGG	U C A G
						3rd letter