

Problem Sets 1: Background

Due: 03-20-2010

1. Compare the **structure of DNA and RNA**. Keywords: nucleotides, 5-prime, 3-prime, deoxyribonucleotides, ribonucleotides, anti-parallel double-helix, hairpin loop, stem-and-loop, double-stranded, single-stranded
2. What is the **basic subunit** used to build a protein. Describe the 3 levels of protein structures. Keywords: amino acid, N-terminus, C-terminus, primary-secondary-tertiary structure.
3. Explain the **Central Dogma** in biology. Keyword: DNA, RNA, protein, replication, transcript, translation, reverse transcription
4. Explain what is called **genetic code**. Keywords: translation, tri-nucleotide codon, tRNA
5. Compare the basic structure of **eukaryotic and prokaryotic cells**. Keywords: nucleus, organelle, mitochondria, ribosome
6. Describe the **structure of a eukaryotic gene**, compared to the prokaryotic gene.

Discontinuous structure {exons, introns}, versus prokaryotic continuous, and often overlapping.

7. A disease is reported to be of the incidence of 0.5% among the population around you. One of your friends was told by his doctor that his diagnosis result is positive, while history have indicated that the very diagnostic method bear the false positive rate of 5%. What is the probability that the guy suffered from the disease? Keywords: **Bayes' rule**
8. **Biological network** harbors a much broader definition than internet. Can you give us some instances of the so-called "network".

Transcription regulatory network, metabolic network, protein-protein interaction network, ...

9. Can you rewrite the following DNA sequence in the form of numeric vector and matrix? How?

ACCGACTTACGGTACCGGCT

However, sometimes mutation can occur to a unique site in the sequence upon some individuals, forming the so-called "**single nucleotide polymorphism (SNP)**". In this situation how would you represent this kind of mutations?

Vector: (0,1,1,3,0,1,2,2,0,1,3,3,2,0,1,1,3,3,1,2)

Matrix:

**((A 1,0,0,0,1,0,0,0,1,0,0,0,0,1,0,0,0,0,0,0),
(C 0,1,1,0,0,1,0,0,0,1,0,0,0,0,1,1,0,0,1,0),
(T 0,0,0,0,0,0,1,1,0,0,0,0,1,0,0,0,0,0,0,1),
(G 0,0,0,1,0,0,0,0,0,0,1,1,0,0,0,0,1,1,0,0))**

Consensus sequence can also be described using matrices; however not all the elements are zero or one, they can be any number between 0 and 1. But remember each column should sum to 1.

10. Would you like to describe your interests and your future plans (career goals)?