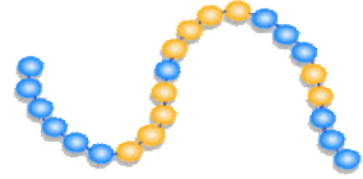


Subcommittee on Genetic Modification
Orientation for Staffers
Problem Set 3: Proteins and Translation

Part of every answer (now and always) should be the reasoning that led to it.

- 3.1.** Consider the cartoon of a newly synthesized protein to the right. Spheres are supposed to be amino acids: blue – hydrophilic; gold – hydrophobic.



- 1.a.** What are some examples of amino acids that could be blue? Yellow? You might make use of this [chart of amino acids](#).
- 1b.** If this protein is in solution able to move around (but the amino acids stay attached to each other), what do you predict will be its final configuration?
- 3.2.** Most proteins have over 100 amino acids, but there is a remarkable protein of only 13 amino acids that regulates the developmental fate of certain cells.
- 2.a.** How many nucleotides are in the gene encoding this protein?
- 2.b.** A DNA sequence containing the gene in its entirety (plus several more nucleotides) is shown below. Figure out what must be the amino acid sequence of the corresponding protein.

AGATTATGAAGGCAATTATGTTAGTGAATTTCTGTGATGAGCGCGGTAGTGGTAGATAGAACGA

- 3.3.** Sickle cell anemia is the result of a mutation in the 6th amino acid of beta-globin, leading to aggregation of the protein. Here are the first several amino acids of normal beta-globin and mutant beta-globin

Normal: Val-His-Leu-Thr-Pro-**Glu**-Glu-Lys-Thr-Als

Sickle: Val-His-Leu-Thr-Pro-**Val**-Glu-Lys-Thr-Als

- 3.a.** Using a genetic code table, figure out (to the extent possible) what is the nucleotide sequences of the normal and mutant beta-globin genes.
- 3.b.** Why might the mutation from glutamate to valine lead to aggregation?
- 3.c.** Hemoglobin is a multimeric protein consisting of two subunits of alpha-globin and two subunits of beta-globin. One genetic treatment for sickle cell anemia is to induce the expression of gamma-globin, which is normally expressed only in fetuses and is a component of fetal hemoglobin. Do you imagine that gamma-globin is more similar to alpha-globin or beta-globin? Why?
- 3.4** Huntington's disease is caused by the expansion of a series of 3-nucleotide repeats, where the normal gene (called *huntingtin*) has typically 11 to 34 copies of the repeat, while a person affected with the disease may have over 66 copies. Here is the sequence of an internal portion of the normal and affected *huntingtin* gene:

Normal: ...CCTTCCACCAGCAGC... [AGC] **20**...AGCAGCCGCC...

Affected: ...CCTTCCACCAGCAGC... [AGC] **80**...AGCAGCCGCC...

From this information describe (to the extent possible) how the protein sequence differs between those with normal and affected *huntingtin* genes.