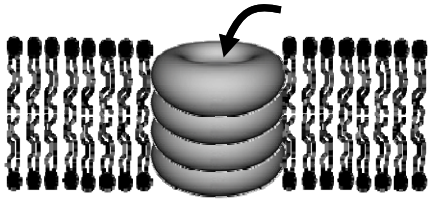
Molecular Biology Through Discovery
Problem Set 3: Protein Structure



PS3.1. Some antibiotics form rings that stack and create a pore through the membrane. Consider a cyclic polypeptide antibiotic in which each ring is composed of the four amino acids: serine, glycine, threonine, and alanine. If each atom of the backbone is about 2 angstroms in length, estimate the circumference of the pore (presume it to be a circle) and the diameter of a molecule that could fit through it. Approximate the circumference ($\pi \cdot$diameter) to be $3 \cdot$diameter. (Show work)

PS3.2. When we considered the article by Dorothy Wrinch [Wrinch DM (1936). Protoplasma 25:550-569], we blipped over a section beginning on p.555 that concerned itself with protein structure. Let's go back to that.

2a. Does the description of protein structure that begins Section 6 accord with your current understanding of proteins? How?

2b. At the bottom of p.555 Wrinch begins a discussion of "di-amino acids". What are the amino acids she's referring to?

2c. She makes a claim in this same discussion that the chromosome should be rich in basic amino acids. As it happens, she was right. Why?

PS3.3. In Section 10 of the same article, Wrinch opined that the unit length of a gene (the aggregate) could "hardly be greater than a few hundred angstroms". From this, deduce her opinion of the maximum number of amino acids in a protein. Was her opinion correct?

PS3.4. Before you cook an egg, the egg "white" is not at all white: it's clear. After you cook the egg, the "white" is white, because the large amount of globular protein has denatured (i.e., unfolded), and as a consequence, the protein has precipitated. Why should unfolding globular protein that are normally soluble in water cause them to stick to each other (which is what "precipitate" means)?

PS3.5. Lactate dehydrogenase (the last enzyme in human anaerobic glycolysis) is a soluble, multimeric protein. If you were to try to fold a single linear polypeptide chain of lactate dehydrogenase, you would find it impossible to do so without leaving a large number of hydrophobic amino acids exposed to water. Explain.

PS3.6. Make a set of 20 different graphical symbols representing the 20 amino acids. You may use colors, shapes, fill style, etc, but no letters or numbers. The symbols should be organized so that important characteristics shared by more than one amino acid are reflected in the symbols.