20.17: Nucleic Acids

Given the tremendously important role of proteins in the functioning of any organism, the question arises of how cells synthesize appropriate polypeptides. Although more than 11400 enzymes[1] are currently known, these constitute a very small fraction of the possible combinations of the 20 amino acids in chains of 100 or more. Clearly a great many of these combinations are worthless, in the sense that they are not adapted to any biological function. It would be pointless for any organism to construct them. Indeed, if they did occur, it would be useful for a living system to hydrolyze them to their individual amino acids and use these to build up proteins which did carry out necessary functions. Therefore it is reasonable to expect a living cell to contain some kind of "blueprint" which specifies the structures of those proteins which are essential for the cell's normal functioning. Without such a guide an incredible amount of effort would be wasted in synthesizing unusable polypeptides just to get small amounts of those that worked.

The blueprint just described is contained in the molecular architecture of deoxyribonucleic acid (DNA). The structure of DNA also provides an obvious mechanism by which the information necessary to specify protein structure can be reproduced and passed from a parent cell to its progeny. The complicated task of building protein structures from the DNA blueprint involves several types of ribonucleic acids (RNA's) whose structures are closely related to that of DNA. Hence the storage, reproduction, and application of information about protein structure depends on **nucleic acids**.

1. ↑ PDB Statistics. RCSB Protein Data Bank. Accessed September 29, 2009. http://www.rcsb.org/pdb/statistics/h...Classification