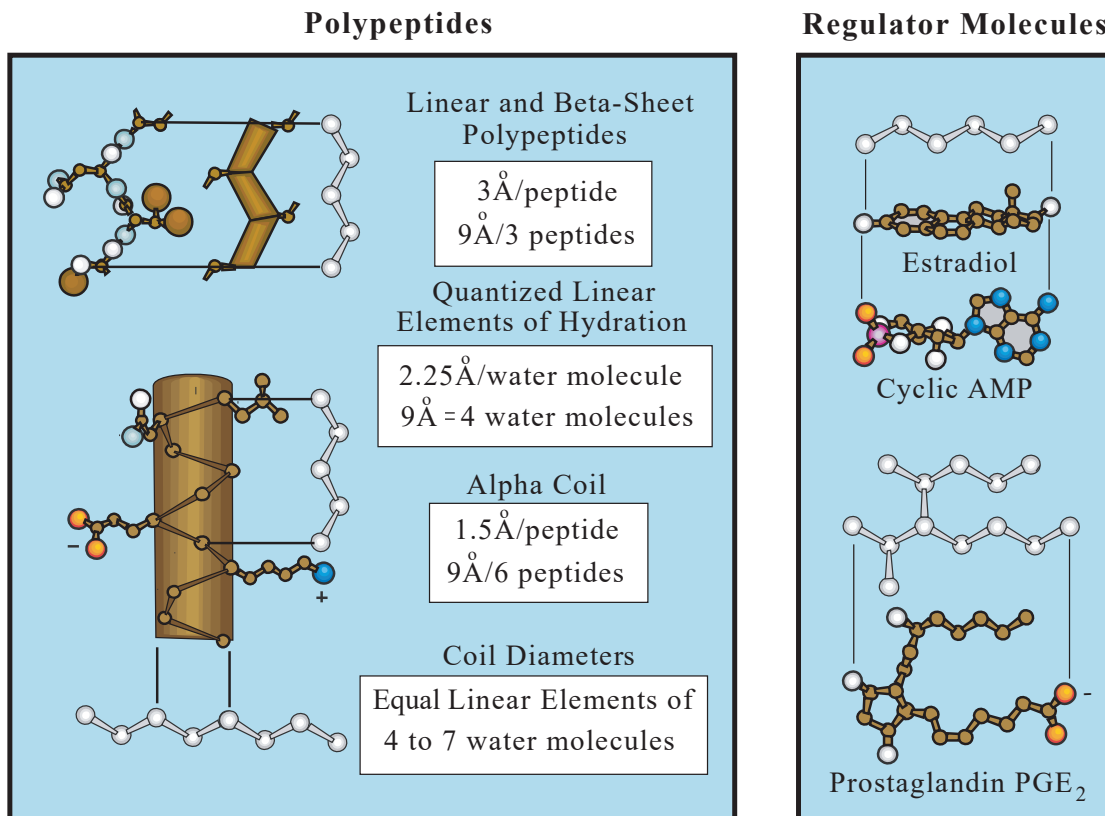


## I - Natural Molecules as Analogs of Covalent Elements of Hydration

First of all, it should be realized that liquid water, as the environment in which all natural molecules evolved, provided the patterning for their selection and interactions. Thus, it should not be surprising that dimensions in vital molecules correspond to quantized hydrogen-bonded elements of water molecules.



Although the theoretical length of three peptides in a linear segment is 11.4 Angstroms, the actual mean dimension in beta-sheets, because of a slight twist, is 9.0 Angstroms, the same length as two trimers,  $2 \times 4.5\text{\AA}$ .<sup>8</sup> In coils, the mean linear distance between each peptide is  $1.5\text{\AA}$  - half that of linear segments. However, in discussing surface water, it must be remembered that ordered forms are generated kinetically: they are not in equilibrium with the environment - they are short covalent linear elements which form repetitively to fill space and provide structural stability to intermediates but last no more than  $10^{-11}$  seconds. Tetrahedral hydrogen bond distances between water molecules and polar oxygen and nitrogen atoms may vary as much as 10% but kinetically-generated covalent hydrogen bonds are relatively ridged and hold water molecules about  $2.76\text{\AA}$  apart at an angle of  $109.5^\circ$  at  $25^\circ\text{C}$ . By forming repetitively in particular orientations on hydrophobic surfaces and between polar atoms and ions, they fill space to increase spatial stability in intermediate states but, thermodynamically, they are unstable.

Thus, it should be no surprise that molecules which span open spaces in proteins to regulate functions often mimic quantized forms of water. Estradiol, cyclic AMP and most neurotransmitters and regulator molecules mimic transient covalent linear elements of water molecules. In fact, the glucose molecule, which is the fundamental energy-storage molecule and the most abundant natural molecule on earth, mimics the dimension of the trimer. It and numerous other dimensional analogies with transient covalent elements of water molecules are presented in [www.linearwater.com](http://www.linearwater.com) and [www.molecularcreation.com](http://www.molecularcreation.com).