2. Infrared (IR) Spectroscopy

2.1. Introduction

Infrared spectroscopy is an absorption method in the wavelength region of 1 to 100 μm in that extends the region of the visible light to longer wavelengths and smaller frequencies/energies. The energy of infrared light is no longer sufficient to induce transitions of valence electrons. Instead, infrared radiation excites vibrational and rotational motions in molecules. Except for the differences in the energy transfer from the radiation to the molecule, the principles of IR spectroscopy are the same as those of VIS/UV spectroscopy or other spectroscopic techniques. The absorption of infrared light is again characterized by the Bouger-Lambert-Beer Law.
However, infrared spectra are usually presented by a plot of the percentage of transmission vs the wavenumber in cm^{-1} (as opposed to a plot of absorbance vs. the wavelength in nm in UV/VIS spectroscopy). A typical IR spectrum is therefore recorded from about 4 000 to 10 000 cm^{-1} (upper limit) to about 100-800 cm^{-1} (lower limit).

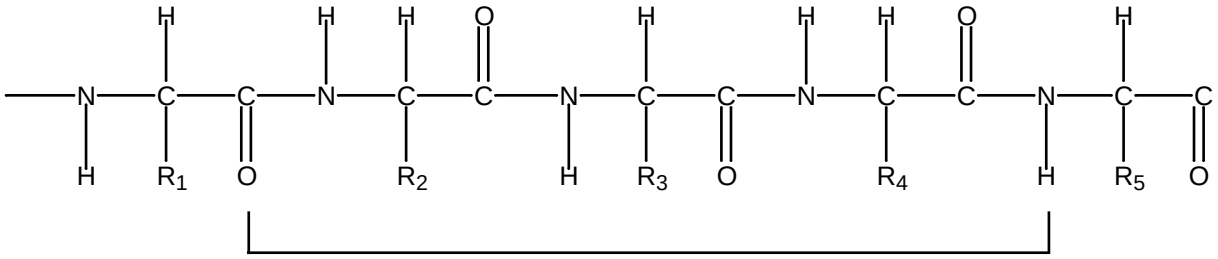

Figure 2.1 In an α-helix the hydrogen bond is formed between the carbonyl group of residue n and the amide nitrogen of residue n+4

What information can be deduced by IR spectroscopy from biological samples ?
As an example for the utility of Infrared spectroscopy in biology, the amide bond can be used to identify protein secondary structure. *Figure 2.1* shows a sequence of the polypeptide chain of proteins. This sequence can lead to different types of a secondary structure, for example α-helix and β-sheet, which were correctly predicted by Corey and Pauling (Figure 2.2) using theoretical considerations before these structural elements were found experimentally.