NMR study on the structure and stability of bio-molecules

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Since 1984 when a protein structure determination by Nuclear Magnetic Resonance (NMR) spectroscopy in solution was established, NMR has been developed as a tool for the structure determination of the biomacromolecules. Multi-dimensional NMR techniques and stable isotope (13C, 15N, 2D) labeling have enabled us to determine the precise structure of high molecular weight proteins. As compared to X-ray crystallography, advantageous points of NMR are to obtain the solution structure of proteins, nucleic acids and other classes of biomolecules in various environmental parameters (temperature, pH, denaturant, etc.), and to obtain the information about inter-molecular interaction between protein and ligands. Without determining precise three-dimensional structure, NMR can provide us with plenty of information about the relationship between the structure and activity. Among many useful NMR techniques, hydrogen-deuterium (H-D) exchange experiment is very powerful and broadly applicable to solve biological problems.

In the lecture, we introduce general feature of NMR spectra of protein and present practical applications to conformational fluctuation and inhibitory activity of protease inhibitor [1], self-association of peptide hormone [2], heme proteins-ligand interaction [3], and protein-metal complex [4]. NMR study of unique four-stranded DNA structures will be presented briefly [5].

[1] Oda *et al.* (2002) *J. Biochem.* **132,** 991; Tamura *et al.,* (1991) *Biochemistry* **30,** 5275.

[2] Kanaori & Nosaka (1996) *Biochemistry*, **35,** 12671 Kanaori & Nosaka (1995) *Biochemistry,* **34,** 12138.

[3] Tanaka et al. (2000) *Biochemisty,* **39,** 12063; Yonetani *et al.* (2002) *J. Biol. Chem.* **251,** 95.

[4] Kanaori *et al.,* (1997) *FEBS LETT*, **412,** 301; Kanaori *et al.,* (1996) *Biochemistry,* **35,** 5949.

[5] Kanaori *et al.* (2001) *Nucleic Acids Res.,* **29,** 831; Kanaori et al. (1998) *Biochemistry* **37,** 12979.