

# Structural Analysis of Nucleic Acids by CD and NMR

Higher-order structure of nucleic acids varies depending on the base sequence, salt concentration and temperature. CD (circular dichroism) and NMR (nuclear magnetic resonance) are commonly used for the evaluation of higher-order structure of nucleic acids. The following are examples of structural analysis of nucleic acids using the CD and NMR.

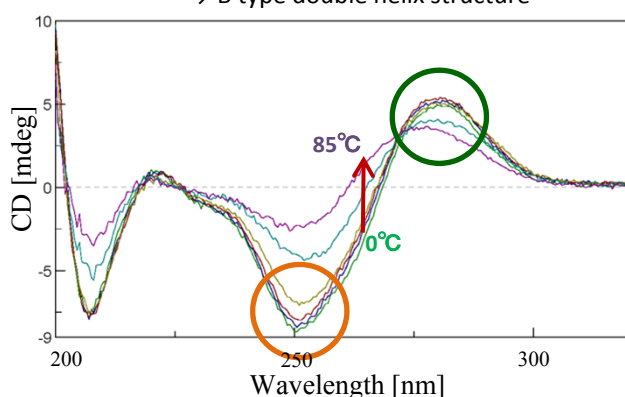
## CD analysis

- Confirmed the double helix structure by CD spectrum waveforms

Mainly A, B and Z types which show different spectra

ex. **Negative peaks around 250 nm** and  
**Positive peaks around 280nm**

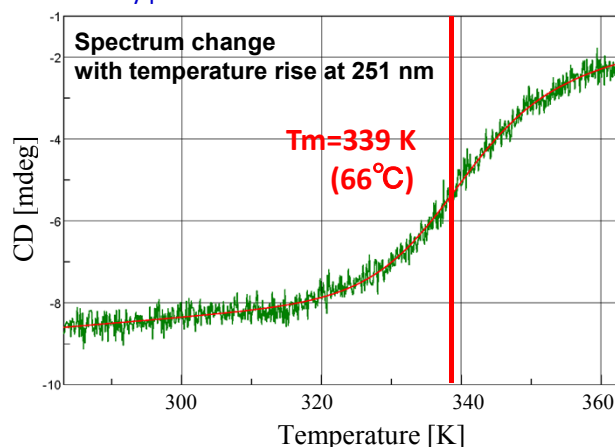
→ B type double helix structure



Model nucleic acid : d(CGCGAATTCGCG)<sub>2</sub>

- Calculation of  $T_m$  value  
(The melting temperature at which 50% of double strand changes to single strand)

Stability parameter of nucleic acids

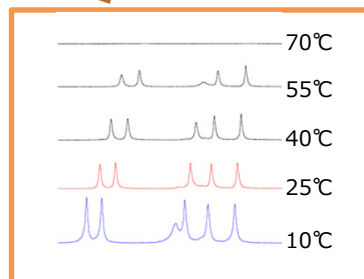
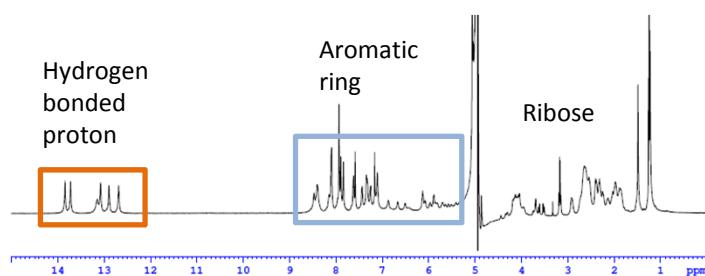


CD measurement conditions: 0.2 mg/mL DNA, 100 mM NaCl, 10 mM NaH<sub>2</sub>PO<sub>4</sub>, pH=7

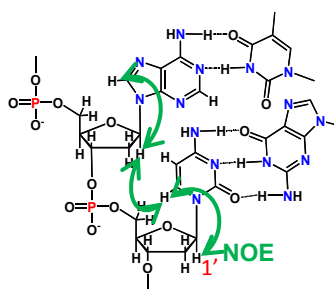
## NMR analysis

- <sup>1</sup>H NMR spectrum

**Peaks around 12~14ppm**: Hydrogen atoms forming hydrogen bonds  
→ Indicating double strand formation

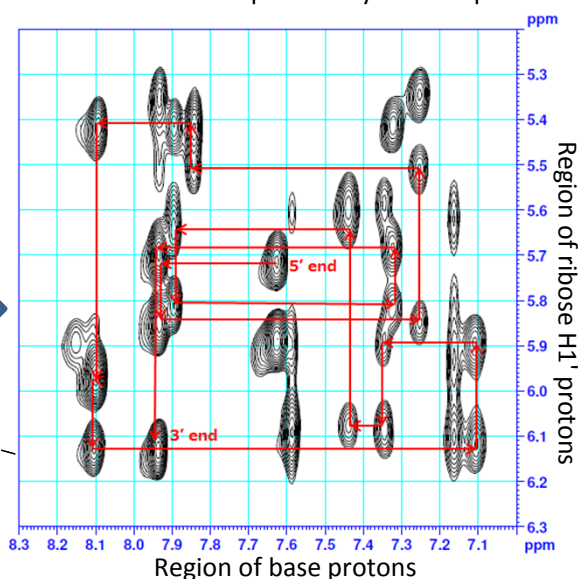


Observed double strand dissociations with temperature rise



- Analysis of base sequences by two-dimensional NMR

Sequential assignments on correlations between base protons and ribose H1' protons by NOESY spectrum



NMR measurement conditions : 10 %D<sub>2</sub>O, 8.0 mg/mL DNA, 100 mM NaCl, 10 mM NaH<sub>2</sub>PO<sub>4</sub>, pH=7; 500MHz