Assignment

- Review the concepts of the DNA supercoiling, the linking number, the writhe, the twist, and the supercoiling density.
- Read the following papers three times: chapter 10 (Supercoiled DNA) of the book by Bloomfield et al and the review article of Cozzarelli et al (Primer on the Topology and Geometry of DNA Supercoiling).

Assignment 2

- Memorize the chemical structures of the five bases; draw five times of the following DNA oligomer: pGATC.
- Review the following concepts: configuration and conformation; the torsion angle; the glycosidic bond; Hydrogen-bond donors and acceptors of bases; base pairs; general features of the DNA duplex; structure parameters of A-, B-, and Z-DNA; twist, roll, tilt, rise, slide, and propeller twist.
- Read chapters 1, 2, 4, and 5 of the book by Bloomfield et al.

Assignment 3

- Understand UV and CD spectroscopy; Hypochromicity and Hyperchromicity; ε = 2[ε(ApC)+ε(CpG)+ε(GpU)+…ε(ApG)]
  -[ε(Cp)+ε(Gp)+ε(Up)…+ε(Ap)];
  Differential Scanning Calorimetry and isothermal titration calorimetry; FRET.
- Read chapter 6 of the book by Bloomfield et al.

Assignment 4

- Review how to extract thermodynamic data from the UV melting curves and how to extract thermodynamic data from DSC melting data.
- Prediction of oligomer stability: possible to predict melting by simple addition (Short oligomers); Nearest neighbor models. The relationship between Tm and GC content.
- Read chapter 8 of the book by Bloomfield et al.

Assignment 5

- Understand the wormlike chain model of DNA: the concept of persistent length;
- Understand the gel electrophoresis (agaose and polyacryamide): the reptation model.
- DNA bending: the concept; the intrisic bending and protein-induced bending; the gel permutation method to study DNA bending; the models.
- Read chapter 9 of the book by Bloomfield et al.
- Read the following articles:

  1. Wu and Crothers (1984) The locus of sequence directed and protein-induced DNA bending. Nature, 308, 509-513.

  2. Kim et al (1989) Bending of DNA by gene-regulatory proteins: construction and use of a DNA bending vector. Gene, 85, 15-23.

Assignment 6

- Understand the following concepts: the winding number, the surface twist and the surface linking number.
- Understand the geometry of supercoiled DNA for plectonemic and solenoidal supercoiling.
- Understand the energetics of DNA supercoiling.
- Understand transcription-driven DNA supercoiling.
- Read the following papers three times: chapter 10 (Supercoiled DNA) of the book by Bloomfield et al and the review article of Cozzarelli et al (Primer on the Topology and Geometry of DNA Supercoiling).
- Read the following paper:

  Liu and Wang (1987) Supercoiling of the DNA template during transcription. PNAS, 84, 7024-7027

Assignment 7

- Classification of topoisomerases.
- Understand the features of type IA, IB, and II of topoisomerase; understand the features of E. coli topoisomerase I, III, IV, and gyrase.
- Read the following review articles: