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; \( \varepsilon = 2[\varepsilon(\text{ApC})+\varepsilon(\text{CpG})+\varepsilon(\text{GpU})+\ldots\varepsilon(\text{ApG})] -[\varepsilon(\text{Cp})+\varepsilon(\text{Gp})+\varepsilon(\text{Up})\ldots+\varepsilon(\text{Ap})]; \) 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 (agrose and polyacrylamide): the reptation model.
- DNA bending: the concept; the intrinsic 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:
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: