SCI260 – Introduction to Biochemistry Lesson #9

1. Which of the double-stranded DNA sequences below will require more heat to separate the two strands (select Option A or Option B)?

Option A require more heat in order for it to undergo denaturation. Since it is consist mainly of G-C pairs which has a higher number of hydrogen bonds holding them together.

1. Why is more heat is required to separate the strands?

Option A 5’-GGACTCCCGGGTGAG-3’ 3’-CCTGAGGGCCCACTC-5’ Option B 5’-AACTGTTTAAAGACA-3’ 3’-TTGACAAATTTCTGT-5’

Higher temperature is required for the strands to separate since it has more G-C base pairing. G-C base pair consist of three hydrogen bonds in opposing to A-T base pair which only has two hydrogen bonds. This results to greater force or more heat is required to break the bonds.

(3) What will be the mRNA sequence that is produced during the transcription of the DNA sequence below? Hint: As we discussed in class, there is a slight difference in the nucleotides used in DNA vs RNA. 5’-ACGTCAGGTTTCCGT-3’

3’-UGCAGUCCAAAGGCA-5’

(4) Based on what was discussed in Lecture 9, name four (4) enzymes/proteins that play a role in human DNA replication, and briefly describe the specific role each plays during human DNA replication.

1. Helicase- unwinds the double helix, in a process that is driven by ATP.

2. Topoisomerase- relieve torsional proteins that result from helicase-induced unwinding.

3. Primase- synthesizes short segments of complementary RNA primers

4. DNA polymerase- elongates the DNA strand by adding new deoxyribonucleotides. Synthesis proceeds in the 5’ to 3’ direction only. Leading strand is synthesized continuously. Lagging strand consists of Okazaki fragments. Mismatched nucleotides are removed using the enzyme’s 3’→5’ exonuclease (proofreading).

Resources:

PhD, J. H. E. (2015). *Guyton and Hall Textbook of Medical Physiology (Guyton Physiology)* (13th ed.). Saunders.

Rodwell, V., Bender, D., Botham, K., Kennelly, P., & Weil, A. P. (2018). *Harper’s Illustrated Biochemistry Thirty-First Edition* (31st ed.). McGraw-Hill Education / Medical.