TUTORIAL 3: DNA Transcription

Q1. Define transcription in the context of molecular biology. (2 marks)

Transcription is a transfer of information of DNA to mRNA, using RNA Polymerase.

Q2. What are the two chemical differences between DNA and RNA? (2 marks)

- DNA has deoxyriobose sugar, while RNA has ribose sugar.
- DNA deoxyriobose sugar has one less oxygen atom than RNA ribose sugar.

Q3. Name the enzyme responsible for synthesizing mRNA during transcription. (1 mark)

RNA Polymerase

Q4. Explain the role of the sigma factor in bacterial transcription. (3 marks)

- Sigma factor binding to RNA polymerase.
- When sigma factor complex recognizes correct promoter, it binds to it.
- Sigma factor dissociate from RNA polymerase.

Q5. Why are consensus sequences important in transcription? (2 marks)

- Because consensus sequence act as binding site.
- Promoter strength depends partky on how closely matched the ideal sequence of -10 and -35 site to perfection.

Q6. Given the DNA template strand sequence 3'-TACCGTAG-5', determine the mRNA sequence synthesized. (3 marks)

- The mRNA sequence synthesized for this DNA strand is 5'-AUGGCAUC-3' which is complementary to the DNA strand.
- In this mRNA sequence Thymine (T) is replaced by Uracil (U).

Q7. Describe how RNA polymerase recognizes where to stop transcription. (3 marks)

- A terminator sequence consist of two inverted repeats separated by several bases followed by a string of A's in template strand of DNA.
- A string of U's paired with a string of A's in the template strand of DNA is a weak structure which causes RNA transcript to dissociate from DNA and RNA polymerase to pause and stop transcription.

Q8. Compare the mechanisms of activator and repressor proteins in gene regulation. (4 marks)

- Activator binds to a specific activator binding site in the DNA while repressors bind to operator sequence near the promoter.
- In activator, the active form will find the genes needed for growth and activates them while in repressors, it will block the binding of RNA polymerase getting in the way.

Q9. Analyze the importance of transcriptional regulation in bacteria. (4 marks)

- The importance of transcriptional regulation in bacteria is energy efficiency which help to converse energy and resources by preventing systhesis of some unnecessary proteins.
- Other than that, adaptation to environmental changes is also one of the importance because this regulation enable bacteria to adjust to a new changes very quickly.
- Transcriptional regulation also plays vital role in the growth of bacteria as some of them need specific gene to keep growing and survive.