**Topic 7.2: Transcription and Gene Expression**

**Essential Idea: Information stored as a code in DNA is copied onto mRNA.**

**Statements & Objectives:**

**7.2.U1 Gene expression is regulated by proteins that bind to specific base sequences in DNA.**

Define gene expression.

(**Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

State two reasons why gene expression must be regulated.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Outline the environmental regulation of the breakdown of lactose in E. coli.

(**Outline** Give a brief account or summary.)

Outline the role of enhancers, silencers and promoter-proximal elements in regulation of gene expression.

(**Outline** Give a brief account or summary.)

**7.2.U2 The environment of a cell and of an organism has an impact on gene expression.**

Describe the use of twin studies to measure the impact of environment on gene expression.

**(Describe**: Give a detailed account)

Outline two examples of environmental influence on gene expression.

(**Outline** Give a brief account or summary.)

**7.2.U3 Nucleosomes help to regulate transcription in eukaryotes.**

Outline the effect of methylation on nucleosome tails on rates of gene expression.

(**Outline** Give a brief account or summary.)

Outline the effect of acetylation of nucleosome tails on rates of gene expression.

(**Outline** Give a brief account or summary.)

**7.2.U4 Transcription occurs in a 5’ to 3’ direction.**

Describe the initiation of transcription, including the role of the promoter, transcription factors, the TATA box and RNA polymerase.

**(Describe**: Give a detailed account)

Describe elongation of transcription, including the role of nucleotide triphosphates and the direction of transcription.

**(Describe**: Give a detailed account)

Describe termination of transcription, including the role of the terminator.

**(Describe**: Give a detailed account)

**7.2.U5 Eukaryotic cells modify mRNA after transcription.**

List two major differences in gene expression between prokaryotic cells and eukaryotic cells.

(**List** Give a sequence of brief answers with no explanation.)

Describe the three post-transcriptional modifications of pre-mRNA in eukaryotes.

**(Describe**: Give a detailed account)

**7.2.U6 Splicing of mRNA increases the number of different proteins an organism can produce.**

Describe the process of alternative RNA splicing.

**(Describe**: Give a detailed account)

Outline an example of alternative splicing the results in different protein products.

(**Outline** Give a brief account or summary.)

**7.2.A1 The promoter as an example of non-coding DNA with a function.**

Outline the role of promoter DNA.

(**Outline** Give a brief account or summary.)

**7.2.S1 Analysis of changes in the DNA methylation patterns.**

State the effect of DNA methylation on gene expression.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Compare methylation patterns in twins using superimposed images of dyed chromosomes.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

**7.2.NOS Looking for patterns, trends and discrepancies- there is mounting evidence that the environment can trigger heritable changes in epigenetic factors.**

Define epigenetic and epigenome.

(**Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

List types of epigenetic tags.

(**List** Give a sequence of brief answers with no explanation.)

Discuss the role of reprogramming and imprinting on epigenetic factors.

(**Discuss** Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence.)

**Key Terms**

Transcription

​3'

​methylation

​​RNA polymerase

nucleotide triphosphates

​post-transcriptional modifications

alternative RNA splicing

​epigenetic

promoter

gene expression

​nucleosome tails

​elongation

​prokaryotic cells

splicing

promoter DNA

epigenome

nucleosomes

lactose

TATA box

Terminator

base sequence

histones

​acetylation

epigenetic tags

5'

enhancers elements

silencers elements

promoter-proximal elements

​mRNA

​eukaryotic cells

​DNA methylation