

Gene Expression Quiz Questions and Answers PDF

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What is the primary role of mRNA in gene expression?

- Carry genetic information from DNA to ribosomes ✓
- Synthesize DNA
- Modify proteins
- Replicate RNA

mRNA serves as a messenger that carries genetic information from DNA to the ribosome, where it is translated into proteins. This process is essential for gene expression, as proteins are the functional products that carry out various roles in the cell.

Which of the following is a post-transcriptional modification of mRNA?

- DNA replication
- Protein folding
- Polyadenylation ✓
- RNA splicing

Post-transcriptional modifications of mRNA include processes such as capping, polyadenylation, and splicing, which are essential for mRNA stability and translation efficiency.

Which type of mutation does not change the amino acid sequence of a protein?

- Missense mutation
- Nonsense mutation
- Silent mutation ✓
- Frameshift mutation

A silent mutation is a type of mutation that does not change the amino acid sequence of a protein, as it occurs in the DNA sequence but does not affect the final protein product due to the redundancy of the genetic code.

Which enzyme is responsible for synthesizing RNA during transcription?

- DNA polymerase
- RNA polymerase ✓
- Ligase
- Helicase

The enzyme responsible for synthesizing RNA during transcription is RNA polymerase. This enzyme catalyzes the formation of RNA from a DNA template, playing a crucial role in gene expression.

What is the function of tRNA during translation?

- Transcribes DNA into RNA
- Carries amino acids to the ribosome ✓
- Synthesizes ribosomal RNA
- Modifies mRNA

The function of tRNA during translation is to transport specific amino acids to the ribosome, where they are added to the growing polypeptide chain according to the sequence of codons in the mRNA.

Discuss the differences between prokaryotic and eukaryotic gene expression.

In prokaryotes, gene expression is typically regulated at the transcriptional level, often involving operons. In eukaryotes, gene expression is more complex, involving multiple levels of regulation, including transcriptional, post-transcriptional, translational, and post-translational modifications. Eukaryotic cells also have a nucleus, where transcription occurs separately from translation.

How do enhancers and silencers affect gene expression? Provide examples.

Enhancers are DNA sequences that increase the rate of transcription when bound by specific proteins, while silencers decrease transcription. For example, the enhancer region in the immunoglobulin heavy chain gene increases its expression in B cells, while silencers in the same region prevent expression in non-B cells.

Outline the steps involved in the translation process and their importance.

Translation involves initiation, where the ribosome assembles around the target mRNA; elongation, where tRNA brings amino acids to the ribosome and the polypeptide chain is formed; and termination, where the completed polypeptide is released. Each step is crucial for accurate protein synthesis.

What are the potential applications of gene expression profiling in medicine?

Gene expression profiling can be used to identify disease biomarkers, understand disease mechanisms, and develop targeted therapies. It is particularly useful in cancer diagnosis and treatment, where it helps in classifying tumors and predicting patient response to specific treatments.

Explain the process of transcription and its significance in gene expression.

Transcription is the process of copying a segment of DNA into RNA by the enzyme RNA polymerase. It is significant because it is the first step in gene expression, allowing the genetic information in DNA to be transferred to RNA, which then serves as a template for protein synthesis.

Describe how a frameshift mutation can affect protein synthesis.

A frameshift mutation, caused by insertions or deletions of nucleotides, alters the reading frame of the genetic code. This can lead to the production of a completely different and often nonfunctional protein, as the sequence of amino acids is changed from the point of mutation onward.

Which factors can influence epigenetic regulation of gene expression?

- DNA methylation ✓
- Histone modification ✓
- RNA interference ✓
- Codon usage

Epigenetic regulation of gene expression can be influenced by various factors including environmental stimuli, lifestyle choices, and genetic predispositions. These factors can lead to modifications such as DNA methylation and histone modification, ultimately affecting gene activity.

What are the roles of enhancers in gene expression?

- Increase transcription levels ✓
- Decrease transcription levels
- Bind transcription factors ✓
- Replicate DNA

Enhancers are regulatory DNA sequences that increase the likelihood of transcription of specific genes, playing a crucial role in gene expression by interacting with transcription factors and the transcriptional machinery.

What is the primary function of ribosomes in gene expression?

- Replicate DNA
- Translate mRNA into proteins ✓
- Transcribe RNA
- Modify proteins

Ribosomes are essential cellular structures that facilitate the translation of messenger RNA (mRNA) into proteins, which is a critical step in gene expression.

Which of the following techniques are used to study gene expression?

- RT-PCR ✓
- Western blotting
- RNA-seq ✓
- Microarrays ✓

Techniques used to study gene expression include quantitative PCR, microarrays, RNA sequencing, and in situ hybridization. These methods allow researchers to measure the levels of mRNA and analyze gene activity in various conditions.

What is the central dogma of molecular biology?

- RNA → DNA → Protein
- DNA → RNA → Protein ✓
- Protein → RNA → DNA
- DNA → Protein → RNA

The central dogma of molecular biology describes the flow of genetic information within a biological system, primarily stating that DNA is transcribed into RNA, which is then translated into proteins.

Which of the following are stages of translation?

- Initiation** ✓
- Elongation** ✓
- Termination** ✓
- Replication

Translation consists of three main stages: initiation, elongation, and termination. These stages collectively facilitate the synthesis of proteins from messenger RNA (mRNA).

Which processes are involved in the regulation of gene expression?

- Transcriptional control** ✓
- Post-transcriptional control** ✓
- Translational control** ✓
- Post-translational control** ✓

Gene expression regulation involves multiple processes including transcriptional control, post-transcriptional modifications, translational regulation, and epigenetic changes.

In prokaryotes, what is an operon?

- A single gene
- A group of genes regulated together** ✓
- A type of mutation
- A protein synthesis site

An operon is a cluster of genes in prokaryotes that are transcribed together under the control of a single promoter, allowing coordinated regulation of gene expression.

Which of the following are components of the transcription process?

- RNA polymerase** ✓
- Promoter region** ✓
- Ribosome
- Transcription factors** ✓

The transcription process involves several key components, including RNA polymerase, DNA template, and ribonucleotides. These elements work together to synthesize RNA from a DNA template during gene expression.