CSC 314, **Bioinformatics Lab #4 Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Gene Expression Lab, Spring 2024**

Use the genetic code (on page 12 of the Gene Expression notes) to answer the following questions. To answer these correctly, it is important to understand the following:

1. the difference between the DNA **template** **(anti-sense)** **strand** and the DNA **sense** **strand,**
2. during transcription, the DNA *template* strand is read from the 3’ to 5’ direction in order to synthesize a mRNA molecule from its 5' to 3' end. The mRNA molecule will be identical to the *sense* strand except *U* replaces *T* in mRNA.
3. translation produces a polypeptide by reading a mRNA from its 5' to 3' end.

Assume that unless otherwise indicated, DNA sequences do *not* contain introns. Note that for this exercise, not all transcripts will begin with a start codon, or end with a stop codon. However, translation should stop (no more amino acids are produced) when a stop codon is present, and “translation” of a stop codon should be indicated with an ‘X’.

1. What is the amino acid sequence of the polypeptide produced from translation of the following mRNA molecule?

5' — AUGGAAUUAUGAGGG — 3'

1. What is the mRNA sequence and amino acid sequences of the polypeptide produced following transcription and translation of the DNA sequence on the *sense* strand of the DNA molecule?

5' —TGTTTAGATTTG — 3'

1. What is the mRNA sequence and amino acid sequences of the polypeptide produced following transcription and translation of the DNA sequence on the *sense* strand of the DNA molecule? **Hint**: remember that the mRNA is synthesized from its 5’ to 3’ end.

3' — TACTGATTTAAAGTA — 5'

1. What is the mRNA sequence and amino acid sequences of the polypeptide produced following transcription and translation of the DNA sequence on the *template* strand of the DNA molecule?

3' – GTTAGAACG — 5'

1. What is the mRNA sequence and amino acid sequence of the polypeptide produced from the following DNA sequence on the *sense* strand of the DNA molecule, with exons and introns as indicated?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| exon | intron | exon | intron | exon |
| 5' —ATGC | ACGATGA | AGAAAA | CTATGTCA | GACTGA— 3' |

1. Consider the DNA sequence on the *sense* strand

5' – ATGTGTCACACCGAGTGA – 3'

that will express the following polypeptide:

Met-Cys-His-Thr-Glu-X

The DNA sequences below each contain a mutation relative to the above sequence. In each case the *sense* strand is shown. Specify the polypeptide sequence produced from the mutated sequence, as well as the *type(s)* of mutations (choose one of the following: silent, missense, nonsense, insertion, deletion, frameshift leading to nonsense, frameshift leading to missense).

a. wild-type sequence: 5' – ATGTGTCAC**A**CCGAGTGA – 3'

mutated sequence: 5' – ATGTGTCAC**T**CCGAGTGA – 3'

b. wild-type sequence: 5' – ATGTG**T**CACACCGAGTGA – 3'

mutated sequence: 5' – ATGTG**A**CACAACGAGTGA – 3'

c. wild-type sequence: 5' – ATGTGT**C**ACACCGAGTGA – 3'

mutated sequence: 5' – ATGTGTACACCGAGTGA – 3'

d. wild-type sequence: 5' – ATGTGTCACAC**C**GAGTGA – 3'

mutated sequence: 5' – ATGTGTCACAC**G**GAGTGA – 3'