**TRANSCRIPTION AND TRANSLATION**

You have the following bacterial DNA sequence that is going to make a short mRNA molecule.

TACTAAGAAGGATCATCGAGACCAACCCTTGTTAAATACACCCCCTCGTAGGTATTTCAACACAACCCTGATACAACT

What is the sequence of the mRNA that will be transcribed from this DNA?

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| DNA | T | A | C | T | A | A | G | A | A | G | G | A | T | C | A | T | C | G | A | G | A | C | C | A | A | C | C | C | T | T | G | T | T |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | A | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C | A | A | C |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | C | C | T | G | A | T | A | C | A | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Convert the RNA sequence to codons, and using the genetic code on the last page, translate the codons into amino acids

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| CODON |  |  |  | |  |  |  |  | |  |  |  |  |
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| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

**POINT MUTATIONS**

One type of mutation is a point mutation, where just a single nucleotide is changed.

How would the following mutation affect your protein? (the changed nucleotide is underlined, all others are the same).

TACTAGGAAGGATCATCGAGACCAACCCTTGTTAAATACACCCCCTCGTAGGTATTTCAACACAACCCTGATACAACT

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | T | A | C | T | A | G | G | A | A | G | G | A | T | C | A | T | C | G | A | G | A | C | C | A | A | C | C | C | T | T | G | T | T |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | A | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C | A | A | C |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | C | C | T | G | A | T | A | C | A | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Convert the RNA sequence to codons, and using the genetic code on the last page, translate the codons into amino acids

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| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

Do you think this would majorly affect the function of your protein? Why?

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How would the following mutation affect your protein? (the changed nucleotide is underlined, all others are the same).

TACTAAGAAGGATCATCGAGACCAAC**T**CTTGTTAAATACACCCCCTCGTAGGTATTTCAACACAACCCTGATACAACT

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | T | A | C | T | A | A | G | A | A | G | G | A | T | C | A | T | C | G | A | G | A | C | C | A | A | C | T | C | T | T | G | T | T |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | A | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C | A | A | C |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | C | C | T | G | A | T | A | C | A | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Convert the RNA sequence to codons, and using the genetic code on the last page, translate the codons into amino acids

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| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

Do you think this would majorly affect the function of your protein? Why?

**FRAMESHIFT MUTATIONS**

Frameshift mutations are caused by additions or deletions of nucleotides.

How would the following addition change your protein? (addition is underlined).

TACTACTAAGAAGGATCATCGAGACCAACCCTTGTTAAATACACCCCCTCGTAGGTATTTCAACACAACCCTGATACAACT

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | T | A | C | T | A | C | T | A | A | G | A | A | G | G | A | T | C | A | T | C | G | A | G | A | C | C | A | A | C | T | C | T | T |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | G | T | T | A | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | A | A | C | C | C | T | G | A | T | A | C | A | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Convert the RNA sequence to codons, and using the genetic code on the last page, translate the codons into amino acids

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| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

Do you think this would majorly affect the function of your protein? Why?

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TACTAAGAAGGATCATCGAGACCAACCCCTTGTTAAATACACCCCCTCGTAGGTATTTCAACACAACCCTGATACAACT

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| DNA | T | A | C | T | A | A | G | A | A | G | G | A | T | C | A | T | C | G | A | G | A | C | C | A | A | C | C | C | C | T | T | G | T |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | T | A | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C | A | A |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | C | C | C | T | G | A | T | A | C | A | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Convert the RNA sequence to codons, and using the genetic code on the last page, translate the codons into amino acids

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| CODON |  |  |  | |  |  |  |  | |  |  |  |  |
| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |
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| CODON |  |  |  | |  |  |  |  | |  |  |  |  |
| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |
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| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

**FRAMESHIFT MUTATIONS**

Frameshift mutations are caused by additions or deletions of nucleotides.

How would the following addition change your protein? (deletion is in parentheses). Do you think this would majorly affect the function of your protein?

TACTAAGAAGGATCATCGAGACCAACCCTTGTTAAATACACCCCCTCGTAGGTATTTCAACACAACCCTGAT(ACA)ACT

What is the sequence of the mRNA that will be transcribed from this DNA?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | T | A | C | T | A | A | G | A | A | G | G | A | T | C | A | T | C | G | A | G | A | C | C | A | A | C | C | C | T | T | G | T | T |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | A | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C | A | A | C |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DNA | C | C | T | G | A | T | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Convert the RNA sequence to codons, and using the genetic code on the last page, translate the codons into amino acids

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| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

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What is the sequence of the mRNA that will be transcribed from this DNA?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | T | A | C | T | A | A | G | A | A | G | G | A | T | C | A | C | G | A | G | A | C | C | A | A | C | C | C | T | T | G | T | T | A |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DNA | A | A | T | A | C | A | C | C | C | C | C | T | C | G | T | A | G | G | T | A | T | T | T | C | A | A | C | A | C | A | A | C | C |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DNA | C | T | G | A | T | A | C | A | A | C | T |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| RNA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| CODON |  |  |  | |  |  |  |  | |  |  |  |  |
| Amino  Acid |  |  |  | |  |  |  |  | |  |  |  |  |

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