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CHEN 5103 - Biochemical Engineering

Homework Assignment #3

Due Feb 4th, 2022 at 11:59pm

Question 1: A single point mutation is a mutation occurs on a single nucleotide. For the codon AUC, list all the possible single point mutations and their corresponding amino acids. Which mutations do not make a change in the amino acid?

~~AAC~~

UUC = Phe

CUC = ~~Leu~~

GUC = ~~Gly~~
Val

AAC = Asn

AGC = Ser

ACC = Thr

Met
AUG = ~~Ser~~

AUU = Ile

AUA = Ile

do not
change amino
acid

Question 2:

You went to Mars (with Elon Musk) and discovered a new organism. The biologist on board was kidnapped by the Martians. But your team needs to determine what genetic codons the new organism uses. You isolated all the translational enzymes and tRNAs of this organism and kept them in several test tubes. Then you added different synthetic mRNA to test tubes and sequenced the final peptide chains in the test tubes (note: due to technological difficulty, you cannot sequence the amino acid peptide chains with less than 3 amino acids.)

These are your results.

Synthetic mRNA	Types of Polypeptides
<u>AAAAAAAA</u>	1. Lysine-Lysine-Lysine
<u>CACACACACA</u>	1. Threonine-Histidine-Threonine 2. Histidine-Threonine-Histidine-Threonine
<u>AAGAAGAAGAAC</u>	1. Threonine-Threonine-Threonine ACA 2. Glutamine-Glutamine-Glutamine-Glutamine CAA 3. Asparagine-Asparagine-Asparagine AAC 4. Glutamine-Glutamine-Glutamine CAA

a. From these results, what can you conclude about the genetic codon of this organism?

Possibly ~~that each~~ the amino acids need 4 codons

It's possible that codons require 4 nucleotides, not 3

b. You have conducted additional experiments. You found out there are 60 different types of amino acids in this organism. What can you speculate about the mutation rate of proteins in this organism compared to human?

For 3 required nucleotides, $4 \times 4 \times 4 = 64$ possible combinations

\therefore with 60 aa the organism can mutate faster because there will only be 4 duplicates rather than 40.

Question 3. Explain the events that take place during glycolysis.

During glycolysis, glucose is converted into Pyruvic acid

In the Cytoplasm, glucose reacts with ATP to make ADP and DHAP
and glyceraldehyde-3-phosphate \rightarrow glyceraldehyde-3-phosphate
is converted into Pyruvate and produces ATP and NADH

Question 4. Briefly explain the Crabtree Effect.

Respiration is inhibited when there's a high concentration of glucose or fructose

- Yeast produces ethanol under anaerobic conditions but can also produce ethanol under aerobic conditions if there's plenty of sugar