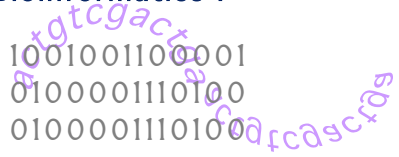

Hands-On Three Interesting Problems

Problem 1

Which of the following mutational changes would be predicted to harm an organism? Explain your answers.

a) Insertion of a single nucleotide near the end of the coding sequence (CDS).
b) Removal of a single nucleotide near the beginning of the CDS.
c) Deletion of three consecutive nucleotides in the middle of the CDS.
d) Deletion of four consecutive nucleotides in the middle of the CDS.
e) Substitution of one nucleotide for another in the middle of the CDS.

Problem 2

The Sonrisa protein is a hypothetical protein that causes people to smile more often. It is inactive in many chronically unhappy people.
The mRNA isolated from a number of different unhappy persons in the same family was found to lack an internal stretch of 173 nucleotides that is present in the Sonrisa mRNA isolated from a control group of generally happy people.
The DNA sequences of the Sonrisa genes from the happy and unhappy families were determined and compared. They differed by just one nucleotide change – and no nucleotides were deleted. Moreover, the change was found in an intron.

What can you say about the molecular basis of unhappiness in this family?

Problem 3

Consider the gene that specifies the structure of hemoglobin. Arrange the following events in the most likely sequence in which they would take place.

a) Anemia is observed.
b) The shape of the oxygen-binding site is altered.
c) An incorrect codon is transcribed into hemoglobin mRNA.
d) The ovum (female gamete) receives a high radiation dose.
e) An incorrect codon is generated in the DNA of the hemoglobin gene.
f) A mother (an X-ray technician) accidentally steps in front of an operating X-ray generator.
g) A child dies.
h) The oxygen-transport capacity of the body is severely impaired.

i) The tRNA anticodon that lines up is one of a type that brings an unsuitable amino acid.
j) Nucleotide-pair substitution occurs in the DNA of the gene for hemoglobin.

[*Introduction to Genetic Analysis* by Griffiths et al., 2005]