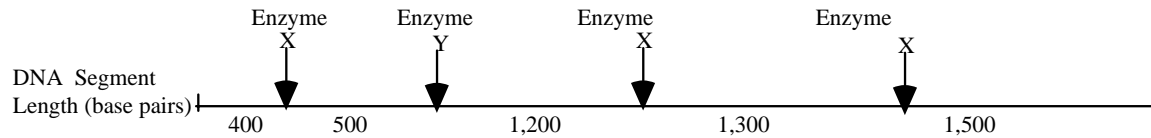


1995:

The diagram below shows a segment of DNA with a total length of 4,900 base pairs. The arrows indicate reaction sites for restriction enzymes (enzyme X and enzyme Y).



(A) Explain how the principles of gel electrophoresis allow for the separation of DNA fragments.

(B) Describe the results you would expect from the electrophoretic separation of fragments from the following treatments of the DNA segment above. Assume that the digestions occurred under appropriate conditions and went to completion.

- I. DNA digested with only enzyme X
- II. DNA digested with only enzyme Y
- III. DNA digested with enzyme X and enzyme Y combined
- IV. Undigested DNA

(C) Explain both of the following.

- (1) The mechanism of action of restriction enzymes.
- (2) The different results you would expect if a mutation occurred at the recognition site for enzyme Y.

1987:

Describe the production and processing of a protein that will be exported from a eukaryotic cell. Begin with the separation of the messenger RNA from the DNA template and end with the release of the protein at the plasma membrane.

1976:

Each year a number of children are born with biological defects that impair normal function. For THREE of the following conditions, discuss such aspects as the biological cause, the methods of treatment and possible means of detection and/or prevention.

- a. Phenylketonuria (PKU)
- b. Sickle cell anemia
- c. Down syndrome
- d. Cretinism
- e. Erythroblastosis fetalis
- f. Blue-baby condition
- g. Tay-Sachs

1993:

Assume that a particular genetic condition in a mammalian species causes an inability to digest starch. this disorder occurs with equal frequency in males and females. In most cases, neither parent of affected offspring has the condition.

- (a) Describe the most probable pattern of inheritance for this condition. Explain your reasoning. Include in your discussion a sample cross(es) sufficient to verify your proposed pattern.
- (b) Explain how mutation could cause this inability to digest starch.
- (c) Describe how modern techniques of molecular biology could be used to determine whether the mutant allele is present in a given individual.

1982:

A portion of a specific DNA molecule consists of the following sequence of nucleotide triplets:

TAC GAA CTT CGG TCC

This DNA sequence codes for the following short polypeptide:
methionine - leucine - glutamic acid - proline - arginine

Describe the steps in the synthesis of this polypeptide. What would be the effect of a deletion or an addition in one of the DNA nucleotides? What would be the effect of a substitution in one of the nucleotides?

1985:

Describe the operon hypothesis and discuss how it explains the control of messenger RNA production and the regulation of protein synthesis in bacterial cells

Some scientists say that we are living in a RNA world and that RNA may prove to be more important than DNA. Explain these statements. Include in your explanation junk DNA and the "central Dogma"