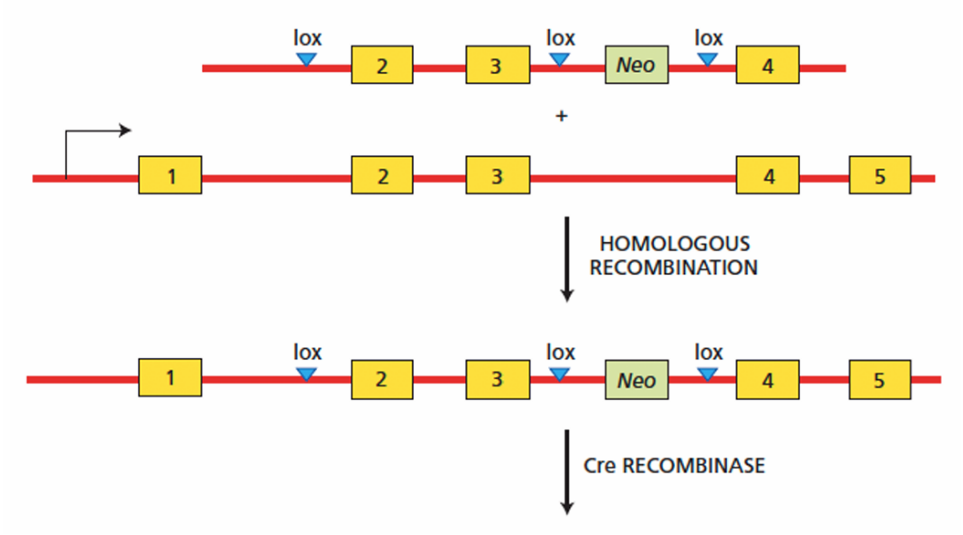
Multiple Choice Questions

1) ES cells are modified by adding lox sites as well as a Neo (neomycin resistance) cassette (step 1 on the figure). After homologous recombination, the lox sites and Neo cassette are inserted on the genome. How many possible products might you get from the expression of the Cre recombinase in those modified ES cells?



a) One knock-out product (genetic modification where a gene is completely inactivated or removed).

b) Five different products.

c) Two knock-out products and one knock-in (genetic modification where a specific DNA sequence is inserted into a precise location in the genome).

d) Three products: one knock-out, one knock-in, and one wild type (the original sequence).

e) Four different products.

2) You need to generate a knock-in animal to study the function of a mutated gene in the liver. Which method is the least efficient for you to obtain the knock-in animal?

a) Genome editing by CRISPR-Cas9.

b) Pro-nuclear injection.

c) Manipulation of ESC (Embryonic Stem Cells).

d) Nuclear transfer.

e) All.

3) What is the role of sticky ends in the DNA cloning process, and why must they be compatible?

a) Sticky ends enable complementary base pairing between DNA fragments.

b) Compatible sticky ends increase the efficiency of DNA ligase activity.

c) Non-compatible sticky ends can still anneal but with lower stability.

d) Sticky ends are only required for the plasmid, not for the DNA insert.

4) Which of the following techniques are used to study gene expression, and what specific information do they provide?

a) Northern blotting: Detects and quantifies RNA levels in a sample.

b) RNA-seq: Provides a global view of all RNAs being transcribed, including their abundance.

c) Microarrays: Detect changes in gene expression using hybridization with known sequences.

d) RT-PCR: Measures DNA levels directly to infer gene expression.

5) Which genetic test needs to be used to compare the phenotypes of different combinations of mutations to determine the order in which the genes act?

a) qRT-PCR.

b) Conditional mutation test.

c) Sequencing different genes.

d) Epistasis analysis.

e) Combinatorial test (experimental used to study the interactions or combined effects of multiple genetic or molecular elements simultaneously).

6) What is correct concerning FRET?

a) The excitation wavelength of the fluorescent protein that is excited by a light source must match the excitation spectrum of the second fluorescent protein.

b) The emission wavelength of the fluorescent protein that is excited by a light source must match the emission spectrum of the second fluorescent protein.

c) The excitation wavelength of the fluorescent protein that is excited by a light source must match the emission spectrum of the second fluorescent protein.

d) The emission wavelength of the fluorescent protein that is excited by a light source must match the excitation spectrum of the second fluorescent protein.

e) The emission wavelength of the fluorescent protein that is excited by a light source must be larger than the emission spectrum of the second fluorescent protein.

True or False:

1) Western blotting can allow identifying two proteins resulting from splice variants of the same gene.

2) Loss-of-function mutations are usually recessive.

3) The use of RNA sequencing allows for the detection of RNA splicing, RNA editing, and non-coding RNAs in addition to quantifying mRNA levels.

4) Eukaryotic genes are always expressed properly in bacteria, as bacteria have all the necessary machinery for post-translational modifications.

5) Microarrays require that the sequences of mRNA samples to be analyzed are already known and represented by corresponding probes on the array.