S1.Which of the following would appropriately be described as a transgenic organism?

A. The sheep “Dolly,” which was produced by cloning.

B. A sheep that produces human a-1-antitrypsin in its milk.

C. The FlavrSavr strain of tomato.

D. A hybrid strain of corn produced from crossing two inbred strains of corn. The inbred strains were not transgenic.

Answer:

A. No. Dolly was not produced using recombinant techniques. There were not pieces of DNA that were cut and combined in a new way.

B. Yes.

C. Yes.

D. No. The hybrids simply contain chromosomal genes from two different parental strains.

S2. Describe the strategy for producing human proteins in the milk of livestock.

Answer: Milk proteins are encoded by genes with promoters and regulatory sequences that direct the expression of these genes within the cells of the mammary gland. To get other proteins expressed in the mammary gland, the strategy is to link the promoter and regulatory sequences from a milk-specific gene to the coding sequence of the gene that encodes the human protein of interest. In some cases, it is also necessary to add a signal sequence to the amino terminal end of the target protein. A signal sequence is a short polypeptide that directs the secretion of a protein from a cell. If the target protein does not already have a signal sequence, it is possible to use a signal sequence from a milk-specific gene to promote the secretion of the target protein from the mammary cells and into the milk. During this process, the signal sequence is cleaved from the secreted protein.

S3. Explain how one type of probe can be used to identify multiple bands in the Southern blot of a DNA-fingerprinting experiment. Why do the lengths of these bands vary among different individuals?

Answer: The reason why the same probe can identify multiple bands is because the probe is complementary to a genetic sequence that is located at several different sites throughout the genome. Not only is the sequence located at several different sites, it is also tandemly repeated at each site. Within populations, there is variation in the number of these tandem repeats at each site. If the number of tandem repeats at a given site is high, this will yield a higher molecular weight band (i.e., a longer band) in a Southern blot. This type of site is termed a VNTR (for variable number of tandem repeats).