**Mechanisms of Genetic Exchange and Recombinant DNA Techniques**

1. Define:

   **Transformation** – Transformation is a naturally occurring genetic exchange mechanism allowing DNA to be transferred from dead donor cells to live recipients. It can also be viewed as a mechanism allowing bacteria to pick up naked DNA from their environment. This process was first observed to occur in *Steptococcus pneumoniae* that had been introduced into mice by Frederick Griffith. DNA transferred through transformation may be incorporated into the chromosome of the host, or remain separate (as a plasmid).

   **Episome** – An episome is a segment of extrachromosomal DNA that can become incorporated into the chromosome. The DNA involved may be either plasmid DNA or viral DNA. **Note** - Although some references define episomes as being plasmids, others consider bacteriophage lambda DNA to be an episome, and it is viral DNA.

   **Sexduction** – Sexduction is a specific type of conjugation that involves the "mating" of an F' (F-prime) with an F- (F-minus) cell, and which results in the formation of a cell that is male, F' (F-prime), recombinant and partially diploid.

   **Transduction** – Transduction is a genetic exchange mechanism involving the transfer of DNA from a donor cell to a recipient cell via a virus. Transduction may be categorized as either specialized (specific) or generalized depending on the type of virus involved.

   **Restriction endonuclease** – Restriction endonucleases are enzymes (sometimes called restriction enzymes) that cut double-stranded DNA (they break phosphodiester bonds). The most useful of these cut the DNA in a site specific manner, i.e., they bind the DNA at specific nucleotide sequences known as recognition sequences, and then cut within or near these sequences (always in the same place). These enzymes probably evolved as a defense against viruses, because they do tend to recognize foreign DNA and "chop" it up.

2. Recombinant DNA/ genetic exchange (also called lateral gene transfer)

3. Recombinant DNA

4. Restriction endonucleases (restriction enzymes)

5. Homologous

6. The genetic exchange processes that occur in bacteria are all similar in that: 1) the cells involved do not fuse to form a zygote, 2) usually only a small amount of DNA is exchanged, 3) the exchange is one way, i.e., from a donor to a recipient, but not back again, 4) the process is more likely to be successful if the organisms involved are closely related (within the same species), and 5) the DNA that is transferred usually replaces homologous DNA already present.

7. Fuse to form a zygote/ bacteria contain restriction enzymes that will recognize and "chop up" foreign DNA. **Note** - Some bacteria can only bind DNA with a species-specific nucleotide sequence, so can only take in DNA carrying that sequence.

8. Transformation (DNA mediated transformation)/ Frederick Griffith/ *Steptococcus*
9. Naked DNA (non-viral), from their environment/ competent
10. Conjugation/ sexduction
11. Sex pili/ F-factor plasmids or F-plasmid
12. Episome
13. High frequency recombinant (Hfr)
14. Sexduction/ recombinant/ partial diploid
15. Generalized transduction
16. Specialized transduction
17. Replicon or cloning vector
18. Cosmid
19. Human genes encode m-RNA molecules with introns (they are split genes), but *E. coli* genes do not, consequently, *E. coli* cells do not have the spliceosomes necessary to remove introns. In order to obtain DNA carrying the information required to form human proteins within bacteria, human m-RNA is collected (after it has been processed by spliceosomes, so the introns have been removed), and is reverse transcribed to form complimentary-DNA (c-DNA). A viral enzyme called reverse transcriptase will copy information from m-RNA into DNA, and will also replicate the resulting single-stranded DNA to form double-stranded DNA. This DNA must be exposed to modification enzymes from the host *E. coli* cells, and then it can be taken up and expressed by those bacteria.
20. Matching letter sequence is – I, H, G, B, C, J, D, E, A, F.