Biotechnology

1. The most recent techniques developed in the biological sciences allow the manipulation of DNA with the ultimate goal of intervening directly with the _____ fate of organisms.

2. Enzymes that cleave DNA at specific sites are called _____.

3. The procedure for producing a line of genetically identical cells from a single "altered" cell is called _____.

4. Single-stranded complementary tails that are produced by restriction digestion are called _____ ends.

5. Viruses and bacterial plasmids are used as _____ to insert foreign DNA into host cells and create recombinant genomes.

6. Gel _____ is a process that separates DNA or protein fragments according to their size, by causing them to migrate within a gel in response to an electric field.

7. The _____ plasmid from *Agrobacterium tumefaciens* is used in genetic engineering involving crop plant genes.

8. _____ is a human protein synthesized in small amounts that can dissolve blood clots.

9. A _____ vaccine is produced by using only a part of the viral genome.

10. In addition to bacteria, _____ can also be used as vectors to insert foreign DNA into host cells and create recombinant genomes.

11. DNA can be cleaved at a specific site, generating in most cases two fragments with short single-stranded ends. The chemical tool used to cleave the DNA is called

    A. a hybridization enzyme
    B. a complementary enzyme
    C. a restriction enzyme
    D. a methylating enzyme
    E. an endonuclease

12. Since the single stranded ends created by restriction enzymes are complementary to each other, they can be joined together,

    A. even though the source of the DNA is different
    B. even though the source of the DNA is the same
    C. but the "sticky ends" will most likely have to be modified
    D. but the hybridization of the two ends may cause a problem with cloning
    E. only if the subunits have been methylated

13. Two strands of DNA that have been cut by an endonuclease can be sealed together by

A. a polymerase enzyme
B. a ligase enzyme
C. an exonuclease enzyme
D. a protease enzyme
E. a methylase enzyme

14. A search for sequences that are complementary to the desired sequence of a DNA fragment uses a technique called

A. plasmid insertion
B. vector extraction
C. cloning
D. electrophoresis
E. hybridization

15. All of the following involve genetic engineering techniques except

A. cutting and rearranging the DNA
B. using restriction enzymes to cut specific sequences of DNA
C. cloning the genes into the host organism
D. using any cell as a vector
E. only a, b, and c are correct

16. A plasmid must have an origin of replication to allow it to replicate in *E. coli* independently of the chromosome and

A. a phage capable of infecting the *E. coli* bacterium
B. a tissue plasminogen activator
C. multiple cloning sites
D. a selectable marker, usually antibiotic resistance

17. DNA fragments complementary to the DNA being investigated are referred to as

A. rDNA
B. cDNA
C. mDNA
D. tDNA

18. Restriction enzymes are

A. proteases
B. lipases
C. endonucleases
D. exonucleases

19. An enzyme that has been isolated from retroviruses is

A. transverse ligase
B. reverse transcriptase
C. reverse endonuclease
D. recombinant RNAase
E. RNA polymerase

20. Restriction enzymes recognize DNA sequences with

A. many A's
B. parallel nature
C. two fold rotational symmetry
D. many G's
E. with many C's

21. The ends of DNA fragments produced by the same restriction enzyme can be joined together by another enzyme,

A. DNA polymerase
B. DNA methylase
C. DNA synthetase
D. DNA ligase
E. DNA primase

22. Cohen and Boyer created a composite plasmid containing DNA from

A. bacteria and plants
B. bacteria and viruses
C. *E. coli* and *Xenopus laevis*
D. *E. coli* and humans
E. *Xenopus laevis*

23. Vectors are vehicles of transport of foreign DNA fragments into host cells and usually are either a virus or a bacterial

A. plasmid
B. protist
C. yeast
D. plant cell
E. human cell

24. Most genetic engineering experiments include four stages. Which of the following is not one of them?

    A. cleaving the source DNA
    B. production of recombinant DNA
    C. cloning copies of the recombinanats
    D. screening the cloned copies for the desired gene
    E. integration of the entire bacterial chromosome

25. The most common way to follow bacterial transformation with a plasmid is by

    A. manufacturing the bacterial protein
    B. conferring antibiotic resistance
    C. separating the altered cell surface
    D. making the cells immortal
    E. altering the physical appearance of the cells

26. The polymerase chain reaction, more popularly known as PCR, includes which of the following steps?

    A. denaturation of primers and the DNA fragment to be amplified
    B. anealing of primers to the complementary sequences on the DNA
    C. primer extension with DNA polymerase
    D. repeating steps 1-3 in many cycles
    E. all of the above

27. In genetic engineering experiments, a common way of identifying a transformed cell is by using a "probe," which is

    A. a specific complimentary double stranded DNA
    B. a specific complimentary double stranded RNA
    C. a specific complimentary single stranded DNA
    D. a specific complimentary single stranded RNA
    E. none of the above

28. When electrical current is applied during a gel electrophoresis procedure, the DNA fragments are separated by

    A. electrical charge, positive on one side, negatives on the other
    B. the number of poly A tails associated with each one
    C. their response to the staining chemicals used during the procedure
    D. the size of the fragments
    E. the enzyme binding activity sites

29. The technique that was popularized in *Jurassic Park* and by which specific engineered genes which were introduced into cells were amplified for detection is called

A. RFLPs
B. finger printing
C. PCR
D. Southern blotting
E. Western blotting

30. If the Lac Z" gene is functional it produces an enzyme known as _____ , which allows the bacterial cell to metabolize the sugar, X–gal.

A. beta - glucosidase
B. beta - xylosidase
C. gamma - endonuclease
D. alpha - galactosidase
E. beta - galactosidase

31. A commercially significant human protein now produced in bacteria is

A. hemoglobin
B. gamma globulins
C. AZT
D. human insulin
E. HIV vaccine

32. Polymerase Chain Reactions (PCRs) involve three steps. The correct order of those steps is

A. denaturation, annealing of primers, primer extension
B. annealing of primers, denaturation, primer extension
C. primer extension, annealing of primers, denaturation

33. A chimeric plasmid was first created by

A. Watson and Crick
B. Cohen and Boyer
C. McClintock
D. Mullis
E. Southern

34. A plasmid used to carry genes into crop plants is

A. T_i
B. glyphosphate
C. somatotropin
D. recombinant DNA
E. Roundup

35. Crop plants have been protected from certain insects by the addition of a gene for a specific insect toxin from the bacterium

A. *Agrobacterium tumefaciens*
B. *Bacillus thuringiensis*
C. *Herpes simplex*
D. *Pseudomonas*
E. tobacco mosaic

36. An animal growth hormone being produced by genetic engineering is

A. somatotropin
B. interferon
C. vaccinia
D. insulin
E. thyroid hormone

37. Scientists can distinguish between DNA of different individuals, thus making this information useful in criminal investigations. The technique used is called

A. restriction fragment length polymorphisms
B. gene cloning
C. hybridization polymorphisms
D. Southern Blot
E. genetic engineering

38. The development of a subunit vaccine for herpes and hepatitis B has potential in the future. The proposed subunit vaccine would

A. incorporate part of the mRNA of either the herpes or hepatitis B with the cowpox virus
B. incorporate part of the reverse transcriptases of either the herpes or hepatitis B with the cowpox virus
C. incorporate part of the DNA of either the herpes or hepatitis B with the cowpox virus
D. incorporate part of the protein – polysaccharide coat of either the herpes or hepatitis B with the cowpox virus

39. Some of the useful applications of genetic engineering include all of the following except

A. bacteria that can digest oil in an oil spill
B. growing synthetic cotton
C. manufacturing biopolymers
D. using PCR to study ancient fossils
E. to clone the perfect human being

40. Mutations and recombinations are two ways in which DNA can be altered. They are different in that

A. mutations are an actual change in the base sequence of a gene, whereas a recombination is a change in the position of a portion of the genetic message
B. mutations are an actual change in the position of a portion of the genetic message, whereas a recombination is a change in the base sequence of a gene
C. mutations occur because of radiation exposure, while recombination occurs as a result of genes being rearranged because of the radiation
D. mutations result from recombinations within the nucleotides

41. Mutations can be harmful, helpful, or neutral. Natural selection acts on these mutations and selects for the mutation or against the mutation. Thus, organisms that have a mutation that is selected will have their fitness increased, while organisms that have mutations that are selected against will have their fitness decreased. Exactly what is natural selection acting on in the selection process?

A. Natural selection is acting on the DNA directly.
B. Natural selection is acting on the phenotype, which is an expression of the genotype.
C. Natural selection is acting on the genotype directly and therefore not the phenotype.
D. Natural selection is seeking the correct allele combinations so that the species may prosper into the future.

42. The DNA of somatic cells is constantly bombarded with agents from the environment that could cause mutations. Select the correct statement about mutations and somatic cells.

A. Somatic cells can withstand the mutations that might be induced since there are so many cell cycles in a somatic cell's life; thus, the mutation effects will be diluted.
B. Somatic cells are much tougher than gametes and can certainly reduce their exposure to environmental agents that might cause mutations to occur.
C. Somatic cells are in the various organs of organisms and are shielded from the harmful agents that might cause mutations.
D. Somatic cells are not passed on to the next generation; thus, the mutations that occur are kept within the organism.

43. Nitrogen-fixing bacteria live in nodules on roots of certain legumes. These bacteria are able to

A. break the triple bonds between two ammonia molecules (NH_3)
B. break the triple bonds between two nitrogen atoms (N_2)
C. break the triple bonds in a single ammonium radical (NH_4)
D. break the double bonds between the two nitrogen atoms (N_2) and the two oxygen atoms (O_2) in nitrous oxide molecules

44. *Agrobacterium* cannot be used in genetic engineering procedures conducted on cerals such as corn, rice, and wheat because

A. it does not infect these types of plants
B. it does not contain the correct restriction enzymes necessary for insertion
C. its plasmids have been altered to be used only in broadleaf plants
D. it interferes with the nitrogen fixing capabilities of narrow leaf plants

45. Plant scientists have successfully engineered some broadleaf crop plants to be resistant to the application of glyphosate. Glyphosate works by

A. inhibiting an enzyme known as RNA polymerase, which is required for aromatic amino acid production
B. inhibiting an enzyme known as DNA polymerase II, which is required for aromatic amino acid production
C. inhibiting an enzyme known as EPSP synthetase, which is required for aromatic amino acid production
D. inhibiting an enzyme known as EPSP synthetase, which is required for uncoupling the mRNA from ribosomes during protein synthesis

46. An insecticidal protein has been discovered in a bacterium known as

A. *E. coli*
B. *Agrobacterium tumefaciens*
C. *Bacillus thuringinensis*
D. *Aspergillus sp.*

47. Golden rice was genetically engineered by Ingo Potrykus in Switerland by combining genes from other organisms into the genome of common white rice. Which organism from the list below was NOT used?

A. daffodil
B. wild rice
C. beans
D. Agrobacterium
E. Aspergillus

48. DNA restriction enzymes are labeled I and II. Type I restriction enzymes

A. cut one strand at random points along the length of the DNA molecule
B. cut both strands, similar to cutting two pieces of string held close together
C. recognize a specific DNA sequence and cuts only at those sites that start with G
D. act to stimulate multiple cloning sites along the length of the DNA molecule

49. A vector "carries" _____ into a host cell.

A. a recombinant RNA fragment
B. a recombinant DNA molecule
C. an endonuclease
D. glyphosate chains

E. "sticky" ended metabolites of X-gal degradation

50. Match each of the following.

_____A. Autonomous auxiliary DNA circles found in bacteria; easily enter the organism they are found in; used as a vehicle to transport desired foreign genes.	1. sticky ends
_____B. Abbreviation for polymerase chain reaction; used to amplify the desired piece of DNA; recently popularized in the movie *Jurassic Park*.	2. RFLP
_____C. Abbreviation for restriction fragment length polymorphism; analyze the human DNA products after restriction enzyme digestion; "fingerprints."	3. PCR
_____D. Organisms produced by moving genes of one species to another; desired characteristics such as disease resistance or increased size are transferred.	4. plasmids
_____E. Ends of DNA fragments produced by asymmetric cleavage with restriction endonucleases; same ends are produced by the same enzyme irrespective of the source of the DNA.	5. transgenic organisms

Answer Key

No. on Test	Correct Answer
1	genetic
2	restriction endonucleases
3	cloning
4	“sticky”
5	vectors
6	electrophoresis
7	T_i
8	TPA
9	subunit
10	viruses
11	C
12	A
13	B
14	E
15	E
16	D
17	B
18	C
19	B
20	C
21	D
22	C
23	A
24	E
25	B
26	E
27	C
28	D
29	C
30	E
31	D
32	A
33	B
34	A

35	B
36	A
37	A
38	D
39	E
40	A
41	B
42	D
43	B
44	A
45	C
46	C
47	D
48	B
49	B
50	1-D, 2-C, 3-B, 4-E, 5-A