Gene Expression (Prokaryotic & Eukaryotic)

1. In _____ organisms, the primary function of a gene in a cell is to participate in regulating the body as a whole and not to responding to the cell's immediate environment.

2. The maintenance of a constant environment in a cell is called _____.

3. A bacterial cell takes advantage of changing _____ conditions through control of gene expression.

4. In multicellular organisms, gene _____ is critical for directing development and maintaining homeostasis.

5. Regulatory proteins bind to the _____ surface of the DNA helix, where the edges of the base pairs are exposed in the major groove of DNA.

6. Gene expression is carried out through the use of repressor and activator _____.

7. Eukaryotic cell mRNA transcripts tend to be very _____ and can remain in the cell for hours.

8. In eukaryotic cells, the transcripts encoding regulatory proteins and growth factors are regulated through selective degradation by _____.

9. The activity of individual _____ can readily be detected in chromosome "puffs" through the staining of mRNA.

10. When multiple snRNPs combine to form a larger complex called a _____ the intron loops out and is excised.

11. The most common form of regulation in bacteria and eukaryotes is

    A. transcripitional control
    B. translational control
    C. promotor control
    D. repressor control
    E. operator control

12. Transcriptional control-proteins increase the rate of transcription by binding to

    A. mRNA sequences within the DNA
    B. tRNA sequences within the DNA
    C. operator sequences within the DNA
    D. promotor sequences within the DNA
    E. enhancer sequences within the DNA

13. All regulatory proteins have common DNA binding motifs, which are particular bends in their protein chains that permit them to interlock with the

    A. minor groove of the DNA helix
    B. major groove of the DNA helix
    C. outside groove of the DNA helix
    D. inside groove of the DNA helix
    E. hydrogen bonding groove of the DNA helix

14. Vertebrate cells apparently possess a protein that by binding to clusters of 5-methylcytosine ensures that the bound gene will stay in the "off" position. This control on the role of gene regulation is a result of

    A. translation
    B. enhancer expression
    C. methylation
    D. promotor expression
    E. operator suppression

15. Regulatory proteins shut off transcription by binding to a site immediately in front of the promoter and often even overlapping the promotor. This site is referred to as

    A. the suppressor site
    B. the operator site
    C. the repressor site
    D. the regulatory site
    E. the transcriptional control site

16. Histones are tightly packed into _____, which are located within the DNA.

    A. operons
    B. nucleosomes
    C. clusters of proteins
    D. repressor genes
    E. facilitators sites

17. Which of the following is the hallmark of multicellular organisms?

    A. grow and divide rapidly
    B. cells adjust quickly to outside environment
    C. homeostasis
    D. quickly synthesize amount and type of enzymes according to available nutrients
    E. respond by gene action to oxygen availability

18. Enhansers are the binding sites

A. for the promotors of DNA synthesis
B. for the suppressor factors
C. for the co-activation factors
D. for the mediator factors
E. for the specific transcription factors

19. The most common form of control of gene expression in both the prokaryotic and eukaryotic organisms is

A. RNA processing control
B. translational control
C. protein phosphorylation control
D. transcriptional control
E. mRNA degradation control

20. A nucleosome contains ____ histones within its core.

A. 2
B. 4
C. 6
D. 8
E. 64

21. The basic tool of genetic regulation is the ability of certain proteins to bind to specific

A. regulatory RNA sequences
B. regulatory DNA sequences
C. repressor parts of the gene
D. promoter parts of the gene
E. enzymes of the cell

22. DNA methylation, adding a methyl group to DNA nucleotides, in vertebrates ensures that

A. the gene functions without interruption
B. the protein coded for by that particular gene is immediately available for export, thus speeding up protein synthesis
C. the nucleosome will quickly form, which assists in mRNA formation
D. once that gene is transcribed, the mRNA is saved and used over and over again
E. once a gene is turned off, it will remain off

23. Which of the following is not true about control of gene expression?

A. In bacteria it allows them to adopt to changing environments.
B. In multicellular organisms it is critical for development.
C. In bacteria it allows them to replicate without control.
D. In multicellular organisms it allows them to maintain homeostasis.
E. In multicellular organisms it allows them to function as a whole.

24. For controlling the transcription,

A. RNA polymerase must have access to the DNA helix
B. RNA polymerase must be capable of binding to the gene's promoter
C. proteins binding at other regions on DNA affects the binding of RNA polymerase to promoter to be better or inferior
D. only choices b and c are correct
E. choices a, b, and c are correct

25. RNA polymerase binds to a site on DNA called the

A. operator
B. repressor
C. footprint
D. promoter
E. operon

26. Small RNA molecules, once thought to be of no importance in gene expression contain

A. between 21 to 28 nucleotides
B. exactly 64 nucleotides
C. between 15 and 20 codons
D. between 21 and 64 codons

27. RNA interference, which induces gene silencing in *Drosophila*, is caused by

A. double stranded DNA interference with mRNA
B. double stranded RNA interference with DNA
C. double stranded DNA interference with tRNA
D. double stranded RNA interference with DNA

28. Proteins that bind to regulatory sequences have shapes that fit into the

A. promoter
B. operator
C. operon
D. minor groove of DNA
E. major groove of DNA

29. The DNA-binding proteins of almost all regulatory proteins employ one of a small set of shapes that enable them to fit into the major groove of DNA. These shapes are called

A. structural motifs
B. foot prints
C. operons
D. repressors
E. transcriptional domains

30. All of the following are examples of shapes in regulatory proteins which are used to bind to DNA, except the

A. zinc finger
B. TATA box
C. helix-turn-helix
D. homeodomain
E. leucine finger

31. In gene regulation, negative control is exerted by

A. an activator
B. an operon
C. a promoter
D. a regulator
E. a repressor

32. In gene regulation, a gene is "turned on" by

A. an activator
B. a stimulator
C. a promoter
D. a regulator
E. a repressor

33. A bacterial gene regulatory system is likely to have all of the following except

A. a coding sequence
B. an operator
C. a promoter
D. one or more introns
E. a ribosome recognition site

34. Small RNAs can regulate gene expression. One type called small interfering RNA (siRNA) acts by degrading

A. a particular mRNA after translation
B. a particular tRNA after transcription
C. a particular mRNA after transcription
D. a particular tRNA after translation

35. The *lac* regulatory system is important to bacteria because the sugar lactose

A. cannot be made by bacteria unless the genes are turned on
B. is the most common source of food; enzymes are needed all the time
C. is only rarely available; producing enzymes all the time is costly
D. is incorporated into the nucleic acid of the bacteria
E. switches the system off and on whether lactose is present or not

36. Small RNAs can regulate gene expression. One type called microRNA (miRNA) acts by binding

A. directly to the tRNAs, thus preventing their transport of amino acids to the ribosomes
B. directly to the ribosome, thus preventing transcription
C. directly to the mRNAs, thus preventing their translation into proteins
D. directly to the template DNA strand, thus preventing mRNA production

37. A well-understood transcriptional activator of *E. coli*, which initiates the transcription of genes in non-glucose environments, is called

A. cAMP
B. tryptophan
C. lactose
D. catabolite activator protein (CAP)
E. enhancer

38. Recent work on eukaryotic gene transcription describes two distinct regions on the regulatory proteins. These are

A. regulatory domain
B. DNA-binding domain
C. RNA-binding domain
D. choices a and b
E. choices b and c

39. Eukaryotic transcription requires a variety of factors (proteins). These factors have been placed into two categories. Those categories are

A. basal transcription factors
B. specific transcription factors
C. operon transcription factors
D. choices a and b
E. choices b and c

40. Which of the following must happen for transcription to be initiated?

A. DNA polymerase must have access to the DNA double helix and also must be capable of binding to the gene's promoter.
B. RNA polymerase must have access to the DNA double helix and also must be capable of binding to the gene's promoter.
C. DNA polymerase must have access to the RNA and also must be capable of binding to the gene's promoter.
D. DNA ligase must have access to the DNA double helix and also must be capable of binding to the gene's promoter.
E. DNA kinase must have access to the DNA double helix and also must be capable of binding to the gene's promoter.

41. Certain proteins can bind to specific DNA regulatory sequences by

A. entering the major groove of the DNA and reading the nucleotide base pairs
B. entering the minor groove of the DNA and reading the nucleotide base pairs
C. entering the major groove of RNA and reading the nucleotide base pairs
D. entering DNA's major groove by using DNA polymerase and reading the nucleotide base pairs
E. entering DNA's minor groove by using DNA polymerase and reading the nucleotide base pairs

42. Regulatory proteins can identify specific sequences on the DNA double helix without unwinding the helix. This is accomplished by

A. inserting DNA promoters into either the major groove or the minor groove of the double helix where the edges of the nitrogen bases protrude
B. inserting DNA-binding motifs into the minor groove of the double helix where the edges of the nitrogen bases protrude
C. inserting DNA polymerase into the major groove of the double helix where the edges of the nitrogen bases protrude
D. inserting RNA polymerase into the major groove of the double helix where the edges of the nitrogen bases protrude
E. inserting DNA-binding motifs into the major groove of the double helix where the edges of the nitrogen bases protrude

43. When *E. coli* cells produce the amino acid tryptophan, a cluster of five genes is transcribed together. This cluster of genes is referred to as the

A. trp transcriptional operator
B. trp regulator
C. trp suppressor
D. trp operon
E. trp promoter

44. The proteins necessary for the use of lactose in *E. coli* are collectively called

A. lac regulator
B. lac suppressor
C. lac operon
D. lac promoter
E. lac transcriptional operator

45. Eukaryotic organisms

A. have their transcription occurring in the cytoplasm and translation in the nucleus
B. have their transcription occurring in the nucleus and translation in the cytoplasm
C. have only operons to assist in gene expression
D. carry out protein synthesis only in the presence of the camp molecule
E. use the leucine zipper primarily for the production of the amino acid tryptophan

46. The CAP molecule can attach to the CAP binding site only when

A. the CAP molecule is bound to lactose
B. the CAP molecule is bound to tryptophan
C. the CAP molecule is bound to ATP
D. the CAP molecule is bound to cAMP
E. the CAP molecule is activated by homeodomain DNA binding motif

47. Most eukaryotic genes are composed of exons (short coding sequences) and introns (non-coding sequences). Which of the following statements is correct regarding the primary transcript?

A. The primary transcript is composed of RNA polymerase and associated histones.
B. The primary transcript has the exons removed and the introns retained for translation.
C. The primary transcript is a faithful copy of the entire gene including exons and introns.
D. The primary transcript is a faithful copy of the gene, but the introns have been removed.
E. The primary transcript is a faithful copy, but the exons have been removed.

48. One of the DNA-binding motifs that contains a nearly identical sequence of 60 amino acids in many eukaryotic organisms is known as the

A. non-helical zipper
B. leucine zipper
C. zinc finger
D. homeodomain
E. helix-turn-helix

49. The most common DNA-binding motif is the

A. non-helical zipper
B. leucine zipper
C. zinc finger
D. homeodomain
E. helix-turn-helix

50. Match each of the following.

_____A. A protein that regulates transcription by binding to the operator.	1. operon
_____B. A protein that initiates the transcription of genes that allow the use of non-glucose molecules.	2. repressor
_____C. A cluster of functionally related genes encoded into a mRNA molecule; a mode of prokaryotic gene regulating unit.	3. promoter
_____D. A site of negative genetic regulation; binding by repressor blocks transcription.	4. operator

_____E. A site at the 5' end of a gene to which RNA polymerase attaches to initiate transcription. 5. CAP

Answer Key

No. on Test	Correct Answer
1	multicellular
2	homeostasis
3	environmental
4	expression
5	outside
6	“switches”
7	stable
8	enzymes
9	genes
10	spliceosome
11	A
12	E
13	B
14	C
15	B
16	B
17	C
18	E
19	D
20	D
21	B
22	E
23	C
24	E
25	D
26	A
27	B
28	E
29	A
30	B
31	E
32	A
33	D
34	C

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