AP Biology Gene Expression/Biotechnology REVIEW

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Gene expression can be
a. regulated before transcription.
b. during transcription.
c. after transcription but before translation.
d. at or after translation.
e. All of the above

____ 2. _____ genes are expressed all of the time.
a. Inducible
b. Repressed
c. Activator
d. Constitutive
e. Clustered

____ 3. Bacterial viruses (phage)
a. can reproduce on their own.
b. require a host cell to replicate.
c. carry out metabolism.
d. have a plasma membrane.
e. are alive.

____ 4. Regulation of gene expression during the phage lytic cycle does *not* include
a. binding of a host RNA polymerase to a viral promoter.
b. stimulation of viral late gene transcription.
c. enhancement of the host's gene transcription.
d. enhancement of viral early gene transcription.
e. down regulation of the host's gene transcription.

____ 5. A retrovirus
a. has a double-stranded DNA genome.
b. has a single-stranded DNA genome.
c. has a double-stranded RNA genome.
d. encodes a reverse transcriptase.
e. integrates its genome directly into the host's genome.

____ 6. Structural genes
a. code for structural proteins.
b. are regulatory regions of DNA.
c. specify the primary structure (amino acid sequence) of proteins.
d. are always constitutively expressed.
e. are absent in eukaryotes.

____ 7. Operons
a. are common in eukaryotes.
b. consist of structural genes only.
c. consist of a promoter, an operator, structural genes, and a repressor gene.
d. consist of a promoter, an operator, and two (or more) structural genes.

e. include inducer genes.

____ 8. A(n) _____ operon is turned off unless needed.
a. repressible
b. constitutive
c. inducible
d. clustered
e. None of the above

____ 9. A(n) _____ operon is turned on unless *not* needed.
a. repressible
b. constitutive
c. inducible
d. clustered
e. None of the above

____ 10. The expression of the *lac* structural genes is _____ when lactose is absent from the culture medium and is _____ when lactose is added because lactose binds to the _____ and inactivates it.
a. low; high; *lac* repressor
b. high; low; *lac* inducer
c. low; high; *lac* promoter
d. high; low; *lac* operator
e. low; high; *lac* operator

____ 11. _____ are present in prokaryotes and bind to and direct the polymerase to specific promoters.
a. Sigma factors
b. Sporulation proteins
c. Reverse transcriptatses
d. Proteases
e. Ribosomes

____ 12. Prokaryotes and eukaryotes differ in transcription in that
a. there are three RNA polymerases in eukaryotes.
b. initiation of transcription is simpler in prokaryotes.
c. structural genes for a pathway are more likely to be clustered in prokaryotes.
d. eukaryotic promoters have a TATA box.
e. All of the above

____ 13. Which of the following statements about RNA polymerase is true?
a. Bacteria use RNA polymerase III to transcribe tRNA and mRNA.
b. Eukaryotes use different RNA polymerases to transcribe rRNA and mRNA.
c. In eukaryotes, RNA polymerase II binds directly to the DNA promoter and initiates transcription.
d. Bacteria contain more regulatory sequences than eukaryotes.
e. Eukaryotes use RNA polymerase III to transcribe ribosomal RNA.

____ 14. In the initiation of the transcription of protein-coding genes in eukaryotes, _____ cannot bind directly to the _____. Initiation requires _____ and other regulatory proteins called "_____."
a. RNA polymerase I; TATA box; TFIID; transcription factors
b. RNA polymerase II; initiation site; TFIID; transcription factors
c. RNA polymerase III; initiation site; TFIID; initiation factors
d. RNA polymerase I; TATA box: initiation factors; TFIID
e. TFIID; RNA polymerase I; initiation site; transcription factors

____ 15. Which of the following are *not* involved in the process of transcription?
a. RNA polymerase
b. Transcription factors
c. Promoters
d. TATA box
e. Ribosomes

____ 16. DNA methylation
a. is important in the development of mammalian embryos.
b. may repress the transcription of genes.
c. involves the modification of the pyrimidine cytosine.
d. is abundant in promoters.
e. All of the above

____ 17. Epigenetics may be defined as changes in the expression of a gene or set of genes by _____ and _____.
a. transcription factors; DNA methylation
b. chromosomal protein alteration; transcription factors
c. DNA methylation; chromosomal protein alteration
d. promoters; DNA methylation
e. promoters; chromosomal protein alteration

____ 18. Which of the following does *not* regulate gene expression after transcription?
a. MicroRNA
b. Translational repressor proteins
c. Modifications to the G cap
d. Alternative splicing
e. All of the above regulate gene expression.

____ 19. An enzyme adds a(n) _____ tag to proteins that are recognized by proteasomes for destruction.
a. methionine
b. lactate
c. ubiquitin
d. phosphate
e. methyl

____ 20. Predict what would happen to the synthesis of the enzyme HMG CoA reductase (an enzyme that catalyzes an initial step in the synthesis of cholesterol) if trichostatin A, a histone deacetylase inhibitor, is added to liver cells.
a. The amount of HMG CoA reductase increases.
b. The amount of HMG CoA reductase decreases.
c. The HMG CoA reductase levels do not change.
d. The HMG CoA reductase undergoes a conformational change and loses function.
e. None of the above

____ 21. "Sticky ends"
a. are produced by the action of all restriction enzymes.
b. form associations with complementary DNA that are very stable.
c. are the result of staggered cuts of DNA by restriction enzymes.
d. must interact with each other in the formation of recombinant DNA.
e. have non-specific base sequences.

____ 22. Restriction enzymes

a. cleave DNA at sequence-specific sites.
b. are called restriction enzymes because they restrict the range of viruses that can attack a bacterial species.
c. do not cut the host bacterium's DNA.
d. are essential tools in molecular biology.
e. All of the above

____ 23. Restriction enzymes
a. cut single-stranded DNA.
b. cut double-stranded DNA at any palindromic sequence.
c. cleave DNA to very small pieces.
d. cleave double-stranded DNA at specific palindromic sequences.
e. have been isolated from just a few species of microrganisms.

____ 24. In gel electrophoresis of DNA fragments,
a. the fragments migrate towards the cathode (negative charge).
b. the fragments are separated based on their charge differences.
c. the fragments are separated on the basis of their sizes.
d. the fragments migrate towards the anode (positive charge) because of the positive charge of the bases.
e. large fragments migrate more quickly than small fragments.

____ 25. The function of DNA ligase in the generation of recombinant DNA is to
a. cut DNA.
b. replicate DNA.
c. unwind DNA.
d. join DNA fragments by the formation of phosphodiester bonds.
e. join DNA fragments noncovalently.

____ 26. Which of the following statements about bacterial antibiotic resistance genes is *false*?
a. They are usually present in the bacterial large circular genome.
b. They were used by Cohen and Boyer in their first recombinant DNA experiments.
c. They are convenient selectable markers.
d. They can confer antibiotic resistance to other prokaryotes.
e. They are importance to medicine.

____ 27. A host cell or organism that contains recombinant DNA is referred to as a _____ cell or organism.
a. transfected
b. transformed
c. transgenic
d. chimeric
e. selectable

____ 28. A plasmid
a. is the bacterial genome.
b. is a small, circular double-stranded DNA molecule that replicates autonomously.
c. is only recombinant.
d. does not code for proteins.
e. is double-stranded RNA.

____ 29. To replicate within the cells of a host, recombinant DNA must either _____ into the host's genome or contain a(n) _____. Otherwise the recombinant DNA would not be replicated, since _____ requires specific sequences to bind to DNA.

a. integrate; origin of replication; DNA polymerase
b. integrate; vector; DNA polymerase
c. recombine; origin of replication; DNA ligase
d. recombine; stop transcription signal; DNA polymerase
e. integrate; stop transcription signal; DNA ligase

____ 30. In recombinant DNA technology, _____ may be used as a selectable marker or reporter gene.
a. *lacZ*
b. the GFP gene
c. *tet*^{r}
d. *amp*^{r}
e. All of the above

____ 31. The Ti plasmid
a. is derived from *E. coli*.
b. replicates in host cells.
c. is useful in introducing foreign DNA into yeasts.
d. is useful in introducing foreign DNA into plants.
e. is of viral origin.

____ 32. cDNA libraries
a. are the same as genomic libraries.
b. include DNA from non-coding sequences.
c. require DNA polymerase to generate.
d. require reverse transcriptase to generate.
e. likely contain all protein-coding genes.

____ 33. What information would you need to design a synthetic gene for a protein to be translated in yeast?
a. Primary structure of the protein and the genetic code
b. Primary structure and secondary structure of the protein, and the genetic code
c. Primary structure of the protein, the genetic code, and promoter sequence
d. Secondary structure of the protein, the genetic code, and promoter sequence
e. Primary structure of the protein and promoter sequence

____ 34. Complementary RNA
a. inhibits transcription.
b. forms hybrids with mRNA to prevent translation.
c. blocks DNA replication.
d. is sense RNA.
e. blocks translation by joining with rRNA.

____ 35. The RNA in RNAi (RNA interference) is
a. single stranded.
b. not made in vivo.
c. relatively stable in cells.
d. capable of binding to specific mRNAs.
e. Both c and d

____ 36. DNA microarrays
a. are used to analyze genomic DNA.
b. determine genes that are transcribed.
c. use oligoribonucleotides as probes.
d. probe noncoding regions of DNA.

e. detect proteins that are translated.

____ 37. Biotechnology may perhaps best be described as
a. a branch of the science of molecular biology.
b. its own scientific discipline.
c. a collection of approaches to the exploitation of living systems to make useful products.
d. an industry to make products useful to medicine.
e. an industry to make products useful to agriculture.

____ 38. Recombinant DNA technology is *least* applicable to which of the following approaches?
a. The analysis of traits determined by multiple genes
b. Overexpression of a particular gene
c. Silencing a particular gene
d. Knocking out a particular gene
e. Targeting a protein to the nucleus

____ 39. Suppose that you wanted to express a protein from animal cells using recombinant DNA technology. Why might you prefer to use yeast as the host rather than *E. coli*?
a. Posttranslational protein processing in yeasts is similar to that in animals.
b. Yeast is a multicellular organism.
c. Yeast has a smaller genome than *E. coli*.
d. Yeast is a prokaryote.
e. Yeast is easier to cultivate than the bacterium.

____ 40. Recombinant DNA technology has produced medically useful products. Most of these products are _____ that are normally present in low amounts in animals and are difficult to _____; _____ vectors are used to obtain these products in large amounts.
a. hormones; purify; expression
b. proteins; purify; expression
c. hormones; detect; plasmid
d. proteins; detect; plasmid
e. proteins; purify; plasmid

____ 41. _____ is the production of pharmaceuticals in farm animals or plants.
a. Pharming
b. Fishing
c. Quality control
d. Manufacturing
e. Gene expression

____ 42. The use of biotechnological approaches for the improvement of crop plants has been more controversial than their use to prepare medically useful products. Why?
a. People eat food that could contain transgenes.
b. Crops are grown outside, and there is a chance that a transgene could escape to other organisms.
c. Herbicide-resistance could spread to weed species.
d. Beneficial insects could be harmed by plants expressing the BT toxin.
e. All of the above

AP Biology Gene Expression/Biotechnology REVIEW
Answer Section

MULTIPLE CHOICE

1. ANS: E PTS: 1 REF: Page 209
   TOP: Concept 11.1 Several Strategies Are Used to Regulate Gene Expression
   SKL: 1. Remembering
2. ANS: D PTS: 1 REF: Page 209
   TOP: Concept 11.1 Several Strategies Are Used to Regulate Gene Expression
   SKL: 1. Remembering
3. ANS: B PTS: 1 REF: Page 210
   TOP: Concept 11.1 Several Strategies Are Used to Regulate Gene Expression
   SKL: 2. Understanding
4. ANS: C PTS: 1 REF: Page 210-211
   TOP: Concept 11.1 Several Strategies Are Used to Regulate Gene Expression
   SKL: 4. Analyzing
5. ANS: D PTS: 1 REF: Page 211
   TOP: Concept 11.1 Several Strategies Are Used to Regulate Gene Expression
   SKL: 4. Analyzing
6. ANS: C PTS: 1 REF: Page 213
   TOP: Concept 11.2 Many Prokaryotic Genes Are Regulated in Operons
   SKL: 1. Remembering
7. ANS: D PTS: 1 REF: Page 213
   TOP: Concept 11.2 Many Prokaryotic Genes Are Regulated in Operons
   SKL: 3. Applying
8. ANS: C PTS: 1 REF: Page 213
   TOP: Concept 11.2 Many Prokaryotic Genes Are Regulated in Operons
   SKL: 1. Remembering
9. ANS: A PTS: 1 REF: Page 213
   TOP: Concept 11.2 Many Prokaryotic Genes Are Regulated in Operons
   SKL: 1. Remembering
10. ANS: A PTS: 1 REF: Page 213-214
    TOP: Concept 11.2 Many Prokaryotic Genes Are Regulated in Operons
    SKL: 2. Understanding
11. ANS: A PTS: 1 REF: Page 215
    TOP: Concept 11.2 Many Prokaryotic Genes Are Regulated in Operons
    SKL: 1. Remembering
12. ANS: E PTS: 1 REF: Page 216
    TOP: Concept 11.3 Eukaryotic Genes Are Regulated by Transcription Factors and DNA Changes
    SKL: 2. Understanding
13. ANS: B PTS: 1 REF: Page 216-217
    TOP: Concept 11.3 Eukaryotic Genes Are Regulated by Transcription Factors and DNA Changes
    SKL: 4. Analyzing
14. ANS: B PTS: 1 REF: Page 216-217
    TOP: Concept 11.3 Eukaryotic Genes Are Regulated by Transcription Factors and DNA Changes
    SKL: 3. Applying
15. ANS: E PTS: 1 REF: Page 216-217

TOP: Concept 11.3 Eukaryotic Genes Are Regulated by Transcription Factors and DNA Changes
SKL: 2. Understanding

16. ANS: E PTS: 1 REF: Page 218-219
TOP: Concept 11.3 Eukaryotic Genes Are Regulated by Transcription Factors and DNA Changes
SKL: 2. Understanding

17. ANS: C PTS: 1 REF: Page 218-220
TOP: Concept 11.3 Eukaryotic Genes Are Regulated by Transcription Factors and DNA Changes
SKL: 1. Remembering

18. ANS: E PTS: 1 REF: Page 221-223
TOP: Concept 11.4 Eukaryotic Gene Expression Can Be Regulated after Transcription
SKL: 2. Understanding

19. ANS: C PTS: 1 REF: Page 223
TOP: Concept 11.4 Eukaryotic Gene Expression Can Be Regulated after Transcription
SKL: 1. Remembering

20. ANS: A PTS: 1 REF: Page 224
TOP: Concept 11.4 Eukaryotic Gene Expression Can Be Regulated after Transcription
SKL: 3. Applying

21. ANS: C PTS: 1 REF: Page 245
TOP: Concept 13.1 Recombinant DNA Can Be Made in the Laboratory
SKL: 2. Understanding

22. ANS: E PTS: 1 REF: Page 245
TOP: Concept 13.1 Recombinant DNA Can Be Made in the Laboratory
SKL: 2. Understanding

23. ANS: D PTS: 1 REF: Page 245
TOP: Concept 13.1 Recombinant DNA Can Be Made in the Laboratory
SKL: 2. Understanding

24. ANS: C PTS: 1 REF: Page 246
TOP: Concept 13.1 Recombinant DNA Can Be Made in the Laboratory
SKL: 2. Understanding

25. ANS: D PTS: 1 REF: Page 247
TOP: Concept 13.1 Recombinant DNA Can Be Made in the Laboratory
SKL: 4. Analyzing

26. ANS: A PTS: 1 REF: Page 247-248
TOP: Concept 13.2 DNA Can Genetically Transform Cells and Organisms
SKL: 2. Understanding

27. ANS: C PTS: 1 REF: Page 248
TOP: Concept 13.2 DNA Can Genetically Transform Cells and Organisms
SKL: 1. Remembering

28. ANS: B PTS: 1 REF: Page 249
TOP: Concept 13.2 DNA Can Genetically Transform Cells and Organisms
SKL: 1. Remembering

29. ANS: A PTS: 1 REF: Page 249
TOP: Concept 13.2 DNA Can Genetically Transform Cells and Organisms
SKL: 4. Analyzing

30. ANS: E PTS: 1 REF: Page 249-251
TOP: Concept 13.2 DNA Can Genetically Transform Cells and Organisms
SKL: 1. Remembering

31. ANS: D PTS: 1 REF: Page 249-250
TOP: Concept 13.2 DNA Can Genetically Transform Cells and Organisms

SKL: 1. Remembering

32. ANS: D PTS: 1 REF: Page 252
TOP: Concept 13.3 Genes and Gene Expression Can Be Manipulated
SKL: 4. Analyzing

33. ANS: C PTS: 1 REF: Page 252-253
TOP: Concept 13.3 Genes and Gene Expression Can Be Manipulated
SKL: 4. Analyzing

34. ANS: B PTS: 1 REF: Page 254
TOP: Concept 13.3 Genes and Gene Expression Can Be Manipulated
SKL: 2. Understanding

35. ANS: E PTS: 1 REF: Page 254
TOP: Concept 13.3 Genes and Gene Expression Can Be Manipulated
SKL: 2. Understanding

36. ANS: B PTS: 1 REF: Page 254-255
TOP: Concept 13.3 Genes and Gene Expression Can Be Manipulated
SKL: 4. Analyzing

37. ANS: C PTS: 1 REF: Page 255
TOP: Concept 13.4 Biotechnology Has Wide Applications SKL: 2. Understanding

38. ANS: A PTS: 1 REF: Page 255-258
TOP: Concept 13.4 Biotechnology Has Wide Applications SKL: 4. Analyzing

39. ANS: A PTS: 1 REF: Page 256
TOP: Concept 13.4 Biotechnology Has Wide Applications SKL: 4. Analyzing

40. ANS: B PTS: 1 REF: Page 256-257
TOP: Concept 13.4 Biotechnology Has Wide Applications SKL: 2. Understanding

41. ANS: A PTS: 1 REF: Page 257-258
TOP: Concept 13.4 Biotechnology Has Wide Applications SKL: 1. Remembering

42. ANS: E PTS: 1 REF: Page 258-261
TOP: Concept 13.4 Biotechnology Has Wide Applications SKL: 4. Analyzing