

- 9) Which of the following statements regarding the structure of DNA is *false*? 9) _____
A) In a DNA molecule, adenine bonds to thymine and guanine to cytosine.
B) Watson and Crick received a Nobel Prize for their description of the structure of DNA.
C) The DNA molecule has a uniform diameter.
D) The sequence of nucleotides along the length of a DNA strand is restricted by the base-pairing rules.
- 10) The shape of a DNA molecule is most like 10) _____
A) a ladder. B) beads on a string.
C) a twisted rope ladder. D) a set of railroad tracks.
- 11) Which of the following statements regarding a DNA double helix is *always true*? 11) _____
A) The amount of adenine is equal to the amount of cytosine, and the amount of guanine is equal to the amount of thymine.
B) The amount of adenine is equal to the amount of uracil, and the amount of guanine is equal to the amount of cytosine.
C) The amount of adenine is equal to the amount of guanine, and the amount of thymine is equal to the amount of cytosine.
D) The amount of adenine is equal to the amount of thymine, and the amount of guanine is equal to the amount of cytosine.
- 12) DNA replication 12) _____
A) begins when two DNA molecules join together to exchange segments.
B) uses each strand of a DNA molecule as a template for the creation of a new strand.
C) occurs through the addition of nucleotides to the end of the parental DNA molecule.
D) results in the formation of four new DNA strands.
- 13) If one strand of DNA is CGGTAC, the corresponding strand would be 13) _____
A) GCCTAG. B) GCCATG. C) TAACGT. D) GCCAUC.
- 14) The copying mechanism of DNA is most like 14) _____
A) dripping water out of a faucet.
B) carving a figure out of wood.
C) mixing flour, sugar, and water to make bread dough.
D) using a photographic negative to make a positive image.
- 15) When one DNA molecule is copied to make two DNA molecules, the new DNA contains 15) _____
A) 75% of the parent DNA. B) 100% of the parent DNA
C) none of the parent DNA. D) 50% of the parent DNA.
- 16) Multiple origins of replication on the DNA molecules of eukaryotic cells serve to 16) _____
A) create multiple copies of the DNA molecule at the same time.
B) remove errors in DNA replication.
C) assure the correct orientation of the two strands in the newly growing double helix.
D) shorten the time necessary for DNA replication.
- 17) Which of the following enzymes catalyzes the elongation of a new DNA strand? 17) _____
A) helicase B) DNA polymerase
C) ligase D) single-stranded binding protein

- 18) Why does a DNA strand grow only in the 5' to 3' direction? 18) _____
 A) because the DNA molecule only unwinds in the 5' to 3' direction
 B) because DNA polymerase requires the addition of a starter nucleotide at the 5' end
 C) because DNA polymerases can only add nucleotides to the 5' end of the growing molecule
 D) because DNA polymerases can only add nucleotides to the 3' end of the growing molecule
- 19) Which of the following options best depicts the flow of information when a gene directs the synthesis of a cellular component? 19) _____
 A) DNA → RNA → protein
 B) protein → RNA → DNA
 C) DNA → tRNA → mRNA → protein
 D) RNA → DNA → RNA → protein
- 20) The transfer of genetic information from DNA to RNA is called 20) _____
 A) initiation. B) elongation. C) transcription. D) translation.
- 21) The "one gene–one polypeptide" theory states that 21) _____
 A) the synthesis of each enzyme is catalyzed by one specific gene.
 B) the function of an individual gene is to dictate the production of a specific polypeptide.
 C) the synthesis of each gene is catalyzed by one specific enzyme.
 D) the function of each polypeptide is to regulate the synthesis of each corresponding gene.
- 22) Experiments have demonstrated that the "words" of the genetic code (the units that specify amino acids) are 22) _____
 A) nucleotide sequences of various lengths. B) three-nucleotide sequences.
 C) single nucleotides. D) two-nucleotide sequences.
- 23) The directions for each amino acid in a polypeptide are indicated by a codon that consists of _____ nucleotide(s) in an RNA molecule. 23) _____
 A) 2 B) 5 C) 3 D) 4
- 24) We would expect that a 15–nucleotide sequence ending with a stop codon will direct the production of a polypeptide that consists of 24) _____
 A) 5 amino acids. B) 2 amino acids. C) 4 amino acids. D) 3 amino acids.
- 25) In the genetic code, 25) _____
 A) some codons specify more than one amino acid.
 B) many amino acids are specified by more than one codon.
 C) some codons consist of two nucleotides.
 D) some amino acids are not specified by any codons.
- 26) Which of the following enzymes catalyzes the linking together of RNA nucleotides to form RNA? 26) _____
 A) RNA ligase B) tRNA
 C) a ribozyme D) RNA polymerase
- 27) Which of the following occurs when RNA polymerase attaches to the promoter DNA? 27) _____
 A) initiation of a new RNA molecule B) termination of the RNA molecule
 C) initiation of a new polypeptide chain D) elongation of the growing RNA molecule
- 28) _____ marks the end of a gene and causes transcription to stop. 28) _____
 A) A terminator B) Methionine
 C) RNA ligase D) RNA polymerase

- 29) Where do transcription and translation occur in prokaryotic cells? 29) _____
 A) in the nucleus B) in the cytoplasm
 C) on the plasma membrane D) in chromatophores
- 30) Which of the following statements about eukaryotic RNA is *true*? 30) _____
 A) A small cap of extra nucleotides is added to both ends of the RNA.
 B) Exons are spliced together.
 C) Introns are added to the RNA.
 D) The modified RNA molecule is transported into the nucleus.
- 31) Which of the following takes place during translation? 31) _____
 A) the conversion of genetic information from the language of nucleic acids to the language of proteins
 B) the conversion of genetic information from DNA nucleotides into RNA nucleotides
 C) DNA replication
 D) the conversion of genetic information from the language of proteins to the language of enzymes
- 32) Which of the following is a function of a tRNA molecule? 32) _____
 A) recognizing the appropriate anticodons in mRNA
 B) helping to translate codons into nucleic acids
 C) transferring nucleotides to rRNA
 D) joining to only one specific type of amino acid
- 33) Which of the following is *not* needed in order for translation to occur? 33) _____
 A) sources of energy, including ATP B) DNA template
 C) tRNA D) ribosomes
- 34) Which of the following statements about ribosomes is *false*? 34) _____
 A) The ribosomes of prokaryotes and eukaryotes are the same in structure and function.
 B) A ribosome consists of two subunits.
 C) Each ribosome has two binding sites for tRNA.
 D) Subunits of RNA are made of proteins and ribosomal RNA.
- 35) Which of the following statements is *false*? 35) _____
 A) During polypeptide initiation, an mRNA, the first amino acid attached to its tRNA, and the two subunits of a ribosome are brought together.
 B) During the first step of initiation, an mRNA molecule binds to a small ribosomal subunit.
 C) An mRNA molecule transcribed from DNA is shorter than the genetic message it carries.
 D) Translation consists of initiation, elongation, and termination.
- 36) Which of the following options most accurately lists the sequence of events in translation? 36) _____
 A) codon recognition → peptide bond formation → termination → translocation
 B) codon recognition → translocation → peptide bond formation → termination
 C) peptide bond formation → codon recognition → translocation → termination
 D) codon recognition → peptide bond formation → translocation → termination

- 37) Which of the following statements regarding the flow of genetic information is *false*? 37) _____
 A) Eukaryotic mRNA is processed in several ways before export out of the nucleus.
 B) Ribosomes function as factories that coordinate the functioning of mRNA and tRNA.
 C) Polypeptides form proteins that determine the appearance and function of the cell and organism.
 D) Transcription occurs in the cytoplasm of eukaryotic cells.
- 38) Any change in the nucleotide sequence of DNA is called 38) _____
 A) a mutagen. B) a mutation.
 C) a base substitution. D) an anticodon.
- 39) Consider the following sentence: "The dog did not eat." Which of the following variations of this sentence is most like a base substitution mutation? 39) _____
 A) The doe did not eat. B) The did dog not eat.
 C) The dog dog did not eat. D) The dog did not et.
- 40) Consider the following sentence: "The dog did not eat." Which of the following variations of this sentence is most like a reading frame mutation? 40) _____
 A) The dog did dog did not eat. B) The did dog not eat.
 C) The dod idn ote at. D) The did not eat.
- 41) A physical or chemical agent that changes the nucleotide sequence of DNA is called a(n) 41) _____
 A) anticodon. B) mutagen. C) terminator. D) transposon.
- 42) A protein coat enclosing a viral genome is known as a(n) 42) _____
 A) capsid. B) capsule. C) envelope. D) prophage.
- 43) Which of the following features characterizes the lytic cycle of a viral infection? 43) _____
 A) The cycle typically leads to the lysis of the host cell.
 B) The viral genes typically remain inactive once they are inside the host cell.
 C) The cycle typically ends when the host bacterium divides.
 D) The virus reproduces outside of the host cell.
- 44) Which of the following statements is *false*? 44) _____
 A) The lysogenic cycle always occurs inside of host cells.
 B) Sometimes an environmental signal can trigger a switchover from the lysogenic to the lytic cycle.
 C) The lysogenic cycle typically results in the rapid lysis of all infected cells.
 D) Some prophage genes can cause the transformation of a nonpathogenic bacterium into a form that causes human disease.
- 45) Viral DNA incorporated into host cell DNA is known as a(n) 45) _____
 A) phage. B) envelope. C) prophage. D) capsid.
- 46) The envelope of a mumps virus 46) _____
 A) helps the virus enter the cell.
 B) helps the virus insert its DNA into the host cell genome.
 C) is coded by viral genes.
 D) accounts for viral resistance to antibiotics.

- 47) Which of the following statements about herpesviruses is *false*? 47) _____
 A) Herpesviruses may remain latent for long periods of time while inside the host cell nucleus.
 B) Herpesviruses acquire their envelopes from the host cell nuclear membrane.
 C) Herpesviruses reproduce inside the host cell's mitochondria.
 D) Herpesviruses may cause cold sores or genital sores to appear during times of physical or emotional stress.
- 48) Which of the following statements about plant viruses is *false*? 48) _____
 A) Preventing infections and breeding resistant plants can control viral infection in plants.
 B) Once in a plant, a virus can spread from cell to cell through plasmodesmata.
 C) The genetic material in most plant viruses is RNA.
 D) There are many successful ways to rid infected plants of a virus.
- 49) Which of the following statements regarding viral diseases is *false*? 49) _____
 A) AIDS was around for decades before becoming a widespread epidemic.
 B) RNA viruses tend to have an unusually high rate of mutation because their RNA genomes cannot be corrected by proofreading.
 C) New viral diseases often emerge when a virus infects a new host species.
 D) Very few new human diseases have originated in other animals because the genetic differences are too great.
- 50) The 2009 H1N1 flu virus 50) _____
 A) evolved through the genetic reshuffling of viruses that infect humans, birds, and pigs.
 B) killed over 50 million people worldwide.
 C) is an avian flu virus.
 D) is spread by mosquitoes.
- 51) What kind of virus is HIV? 51) _____
 A) a retrovirus
 B) a paramyxovirus
 C) a provirus
 D) a complex virus
- 52) Which of the following enzymes does HIV use to synthesize DNA on an RNA template? 52) _____
 A) RNA polymerase
 B) reverse transcriptase
 C) DNA convertase
 D) ligase
- 53) HIV does the greatest damage to 53) _____
 A) white blood cells.
 B) nervous tissue.
 C) pancreatic cells.
 D) the adrenal glands.
- 54) How do viroids harm the plants that are infected with them? 54) _____
 A) by destroying the root system
 B) by increasing the plants' metabolic rate
 C) by reducing the plants' seed production
 D) by altering the plants' growth
- 55) Which of the following statements about the treatment or prevention for a prion infection is *true*? 55) _____
 A) Preventative vaccines have recently been shown to be effective in preventing prion infections.
 B) There is no known treatment or cure for prion infections.
 C) Antibiotic therapies such as penicillin are very effective cures.
 D) High doses of anti-inflammatory drugs such as ibuprofen reduce the symptoms of prion infections.

- 56) In the 1920s, Frederick Griffith conducted an experiment in which he mixed the dead cells of a bacterial strain that can cause pneumonia with live cells of a bacterial strain that cannot. When he cultured the live cells, some of the daughter colonies proved able to cause pneumonia. Which of the following processes of bacterial DNA transfer does this experiment demonstrate? 56) _____
A) transduction B) conjugation C) transposition D) transformation
- 57) Transduction 57) _____
A) requires DNA polymerase.
B) occurs when a phage transfers bacterial DNA from one bacterium to another.
C) occurs when a bacterium acquires DNA from the surrounding environment.
D) is the direct transfer of DNA from one bacterium to another.
- 58) Conjugation 58) _____
A) occurs when a phage transfers bacterial DNA from one bacterium to another.
B) is the direct transfer of DNA from one bacterium to another.
C) occurs when a bacterium acquires DNA from the surrounding environment.
D) is the result of crossing over.
- 59) Conjugation, transformation, and transduction are all ways that bacteria 59) _____
A) increase their genetic diversity.
B) reduce their DNA content.
C) alter their oxygen requirements.
D) increase the amount of RNA in the cytoplasm.
- 60) A friend accidentally sends an email to you that contains a computer virus from his computer. Without knowing it, you infect your computer with the virus when you open the email. This process of spreading the computer virus using emails is most like which of the following processes? 60) _____
A) transformation B) transduction C) conjugation D) binary fission
- 61) When a bacterial cell with a chromosome-borne F factor conjugates with another bacterium, how is the transmitted donor DNA incorporated into the recipient's genome? 61) _____
A) The donor and recipient DNA are both chopped into segments by restriction enzymes, and a new, composite chromosome is assembled from the fragments.
B) It is substituted for the equivalent portion of the recipient's chromosome by the process of crossing over.
C) It circularizes and becomes one of the recipient cell's plasmids.
D) The genes on the donor DNA of which the recipient does not have a copy are added to the recipient chromosome; the remainder of the donor DNA is degraded.
- 62) In many bacteria, genes that confer resistance to antibiotics are carried on 62) _____
A) transposons. B) R plasmids. C) factors. D) exons.

- 63) Conjugation between a bacterium that lacks an F factor (F⁻) and a bacterium that has an F factor on its chromosome (F⁺) could produce which of the following results? 63) _____
- A) The F⁻ bacterium ends up carrying one or more plasmids from the F⁺ bacterium; the F⁺ bacterium is unchanged.
 - B) The F⁻ bacterium ends up with a recombinant chromosome that carries some genes from the F⁺ bacterium, and the F⁺ bacterium ends up with an unaltered chromosome.
 - C) The F⁺ bacterium ends up with a recombinant chromosome that carries some genes from the F⁻ bacterium, and the F⁻ bacterium ends up with an unaltered chromosome.
 - D) The F⁺ bacterium ends up with a recombinant chromosome that carries some genes from the F⁻ bacterium, and the F⁻ bacterium ends up with a chromosome that lacks those genes.
- 64) Which of the following human activities has contributed to an increase in the number of bacteria having R plasmids? 64) _____
- A) heavy use of antibiotics in medicine and in agriculture
 - B) improper use of restriction enzymes in research and medical facilities
 - C) increased carcinogen exposure from excessive fossil fuel burning
 - D) nitrogen fixation by genetically engineered plants
- 65) The term "gene expression" refers to the 65) _____
- A) fact that each individual of a species has a unique set of genes.
 - B) process by which genetic information flows from genes to proteins.
 - C) fact that individuals of the same species have different phenotypes.
 - D) flow of information from parent to offspring.
- 66) A gene operon consists of 66) _____
- A) a promoter only.
 - B) a regulatory gene only.
 - C) a transcribed gene only.
 - D) transcribed genes, an operator, and a promoter.
- 67) In a prokaryote, a group of genes with related functions, along with their associated control sequences, defines 67) _____
- A) an operon.
 - B) an allele.
 - C) a transposon.
 - D) a locus.
- 68) The *lac* operon in *E. coli* 68) _____
- A) allows the bacterium to resist antibiotics in the penicillin family.
 - B) prevents lactose-utilizing enzymes from being expressed when lactose is absent from the environment.
 - C) coordinates the production of tryptophan-utilizing enzymes when it is present.
 - D) regulates the rate of binary fission.
- 69) Proteins that bind to DNA and turn on operons by making it easier for RNA polymerase to bind to a promoter are called 69) _____
- A) regulators.
 - B) operators.
 - C) repressors.
 - D) activators.
- 70) The *lac* operon of *E. coli* is _____ when the repressor is bound to lactose. 70) _____
- A) inactive
 - B) active
 - C) unregulated
 - D) cloned

- 79) The tortoiseshell pattern on a cat 79) _____
 A) is a result of alleles on the Y chromosome.
 B) is the result of a homozygous recessive condition.
 C) results from X chromosome inactivation.
 D) usually occurs in males.
- 80) Both prokaryotic and eukaryotic cells use _____ to turn certain genes on or off. 80) _____
 A) RNA transcriptase B) proteins
 C) nucleosome packing D) intron segments
- 81) Enhancers are 81) _____
 A) required to facilitate the binding of DNA polymerases.
 B) adjacent to the gene that they regulate.
 C) DNA sequences to which activator proteins bind.
 D) required to turn on gene expression when transcription factors are in short supply.
- 82) Silencers 82) _____
 A) bind to promoters to promote the start of transcription.
 B) bind to activators to inhibit the start of transcription.
 C) bind to enhancers to promote the start of transcription.
 D) bind to DNA sequences and inhibit the start of transcription.
- 83) RNA splicing involves the 83) _____
 A) removal of introns from the molecule.
 B) addition of a nucleotide "tail" to the molecule.
 C) removal of exons from the molecule.
 D) addition of a nucleotide "cap" to the molecule.
- 84) The coding regions of a gene (the portions that are expressed as polypeptide sequences) are called 84) _____
 A) redundant coding sections. B) exons.
 C) introns. D) proto-oncogenes.
- 85) Which of the following permits a single gene to code for more than one polypeptide? 85) _____
 A) alternative RNA splicing
 B) retention of different introns in the final version of the different mRNA strands
 C) genetic differentiation
 D) addition of different types of caps and tails to the final version of the mRNA strands
- 86) Small pieces of RNA that can regulate translation of mRNA are called 86) _____
 A) miniRNA. B) microRNA. C) monoRNA. D) minuteRNA.
- 87) miRNA can be used by 87) _____
 A) researchers to artificially turn on gene expression.
 B) viruses to stop the production of new proteins.
 C) cells to prevent infections from double-stranded RNA viruses.
 D) researchers to induce the production of more mRNA.
- 88) All of the following mechanisms are used to regulate protein production *except* 88) _____
 A) protein activation. B) DNA editing.
 C) the breakdown of mRNA. D) protein breakdown.

- 89) Which of the following mechanisms of controlling gene expression occurs outside of the nucleus? 89) _____
 A) RNA splicing B) translation
 C) DNA packing/unpacking D) adding a cap and tail to RNA
- 90) Which of the following statements about fruit fly development is *false*? 90) _____
 A) Cascades of gene expression routinely direct fruit fly development.
 B) The location of the head and tail ends of the egg is primarily determined by the location of sperm entry during fertilization.
 C) Homeotic genes regulate batteries of other genes that direct the anatomical identity of body parts.
 D) One of the earliest development events is the determination of the head and tail ends of the egg.
- 91) A homeotic gene 91) _____
 A) represses gene transcription and promotes mRNA translation.
 B) is found only in adult somatic cells.
 C) determines which end of the egg will become the head and which end will become the tail.
 D) serves as a master control gene that functions during embryonic development by controlling the developmental fate of groups of cells.
- 92) Which of the following statements about microarrays is *false*? 92) _____
 A) Microarrays use fluorescently labeled cDNA molecules to identify particular genes expressed at a particular time.
 B) Microarrays use tiny portions of double-stranded RNA fragments from a large number of genes.
 C) Microarrays are used to determine which genes are active in different tissues or in tissues of different states of health.
 D) Microarrays enable scientists to determine the activity of thousands of genes at once.
- 93) In multicellular organisms, the coordination of cellular activities relies on 93) _____
 A) operons.
 B) the availability of certain "key" nutrients as cells divide.
 C) cell-to-cell signaling and signal transduction pathways.
 D) cell receptors that detect transcription factors.
- 94) To initiate a signal transduction pathway, a signal binds to a receptor protein usually located in the 94) _____
 A) ER. B) nucleus.
 C) plasma membrane. D) cytoplasm.
- 95) Transcription factors attach to 95) _____
 A) DNA. B) plasma membrane receptors.
 C) signal molecules. D) mRNA.
- 96) A signal outside a cell triggers changes in the transcription and translation inside the cell through 96) _____
 A) signal transduction pathways. B) protein breakdown.
 C) protein activation. D) post-translational editing.

- 97) Yeast are able to communicate with each other 97) _____
A) by close cell-to-cell contact.
B) through chemical signaling.
C) with pseudopodia.
D) only if they can touch each other and have merged cell walls.
- 98) Signal transduction pathways 98) _____
A) are mechanisms of communication that probably evolved in ancient prokaryotes.
B) are limited for use in sexual identification.
C) originally evolved in vertebrates.
D) are found strictly in multicellular organisms, which require cell-to-cell communication.
- 99) In plants, most differentiated cells retain 99) _____
A) only a tiny fraction of their original set of genes.
B) a complete set of their genes, and retain the ability to express those genes under certain circumstances.
C) a complete set of their genes, but lose the ability to express most of those genes.
D) the ability to dedifferentiate, but then cannot return to their original differentiated state.
- 100) Why can some plants be cloned from a single cell? 100) _____
A) Plant cells can produce genes to replace those lost during development.
B) Plant cells do not differentiate even when mature, so any cell can grow into an entire plant.
C) Plant cells are capable of self-renewal by utilizing cellular components from adjacent cells.
D) Plant cells can dedifferentiate and give rise to all of the specialized cells required to produce an entire plant.
- 101) Which of the following processes occurs when a salamander regenerates a lost limb? 101) _____
A) The homeotic genes of the regenerating cells turn off.
B) A new salamander develops from the lost limb.
C) Certain cells in the limb dedifferentiate, divide, and then redifferentiate to form a new limb.
D) Oncogenes that cause accelerated cell division are turned on.
- 102) The cloning of Dolly the sheep 102) _____
A) demonstrated that the nuclei from differentiated mammalian cells can retain their full genetic potential.
B) demonstrated, for the first time, that eggs are haploid and body cells are diploid.
C) demonstrated that differentiated cells contain only a fraction of their full genetic potential.
D) revealed that cloned mammals most resemble the egg donor.
- 103) The use of cloning to produce special embryonic stem cells is called 103) _____
A) reproductive cloning. B) regenerative cloning.
C) transplantational cloning. D) therapeutic cloning.
- 104) Which of the following mammals has not yet been cloned and brought through the complete gestation cycle? 104) _____
A) pig B) human C) cow D) cat

- 105) Which of the following possible uses of reproductive cloning is still considered by most to be an unresolved ethical issue? 105) _____
- A) the reproductive cloning of humans
 - B) cloning mammals for the production of potentially valuable drugs
 - C) the production of genetically identical animals for experimentation
 - D) the production of organs in cloned pigs for transplant into humans
- 106) Which of the following statements regarding stem cells is *false*? 106) _____
- A) Adult stem cells are present in adult tissues.
 - B) Adult stem cells are partway along the road to differentiation.
 - C) Adult, but not embryonic, stem cells can be grown in laboratory culture.
 - D) Embryonic stem cells can give rise to all the different specialized cells in the body.
- 107) Adult stem cells have limited therapeutic potential 107) _____
- A) because they are fully differentiated.
 - B) because their developmental potential is limited to certain tissues.
 - C) due to their excessive numbers in tissues.
 - D) because they lack a complete set of genes.
- 108) A gene that can cause cancer when present in a single copy in a cell is called a(n) 108) _____
- A) enhancer gene.
 - B) proto-oncogene.
 - C) carcinogen.
 - D) oncogene.
- 109) Which of the following statements about proto-oncogenes is *false*? 109) _____
- A) A mutation in a tumor-suppressor gene can stop cell division immediately.
 - B) Many proto-oncogenes code for growth factors.
 - C) A mutation must occur in a cell's DNA for a proto-oncogene to become an oncogene.
 - D) Proto-oncogenes are normal genes with the potential to become oncogenes.
- 110) Which of the following is *not* a factor that contributes to normal cells becoming cancerous? 110) _____
- A) one or more of the cell's genes being removed by a virus
 - B) damage to a tumor-suppressor gene
 - C) the conversion of a proto-oncogene to an oncogene
 - D) excessive replication of proto-oncogenes
- 111) Cancer of the colon is caused by 111) _____
- A) a single gene mutation.
 - B) several somatic cell mutations.
 - C) the proto-oncogene, *lac*.
 - D) exposure of colon cells to a mutagen.
- 112) The development of colon cancer occurs slowly, and colon cancer is more frequently seen in the elderly than the young. This is most likely because 112) _____
- A) cancer cells have to wait until new blood vessels grow into the area, which takes much time.
 - B) four or more somatic mutations must occur to give rise to the cancer, which takes time.
 - C) cancer cells don't have mitochondria, so they grow slowly.
 - D) most cancer mutations interfere with mitosis, so cell division occurs more slowly.

- 113) Mutations in the proto-oncogene *ras* and the tumor suppressor gene *p53* 113) _____
A) disrupt normal regulation of the cell cycle.
B) can enhance further mutations, which can develop into cancer.
C) increase protein synthesis by the cell.
D) can improve the chance of avoiding cancer as one ages.
- 114) Mutations in the *p53* gene can lead to cancer by 114) _____
A) increasing the production of growth hormones, which trigger faster cell cycles.
B) causing the production of a faulty protein that is no longer able to inhibit cell division.
C) promoting the expression of mRNA that can interact with DNA, resulting in new mutations.
D) causing the production of excessive amounts of relay proteins.
- 115) The carcinogen known to cause the most cases and types of cancer is 115) _____
A) alcohol. B) ultraviolet light.
C) tobacco. D) plutonium.
- 116) Which of the following statements regarding cancer risk factors is *false*? 116) _____
A) X-rays and ultraviolet radiation are two of the most potent carcinogens.
B) Factors that alter DNA and make cells cancerous are called carcinogens.
C) Mutagens are usually not carcinogens.
D) Eating 20–30 grams of plant fiber daily and reducing the intake of animal fat can reduce your risk of developing colon cancer.
- 117) Biotechnology 117) _____
A) has been around since the dawn of civilization.
B) is generally considered more harmful than valuable to society.
C) is a modern scientific discipline that has existed for only a few decades.
D) is strictly concerned with the manipulation of DNA.
- 118) When DNA from two sources is combined into one single piece of DNA, it is known as 118) _____
A) cloned DNA. B) a vector.
C) a plasmid. D) recombinant DNA.
- 119) The production of multiple identical copies of gene-sized pieces of DNA defines 119) _____
A) tissue culturing. B) clonal selection.
C) plasmid transformation. D) gene cloning.
- 120) In the process of human gene cloning using plasmids, the bacterial plasmid 120) _____
A) is used to insert the human gene into the bacterial chromosome.
B) functions as a vector.
C) is the source of the gene to be cloned.
D) is cultured inside the human cell, which contains the gene to be cloned.
- 121) DNA ligase binds 121) _____
A) polymerase to the promotor. B) nucleotides together.
C) exons together. D) an intron to an exon.

- 122) When plasmids are used to produce a desired protein, 122) _____
 A) the desired gene is inserted into the plasmid and the plasmid is returned to the bacterium by transformation.
 B) the bacterial genome and plasmid are inserted into the genome of the cell containing the desired gene (often the cell of a plant or animal).
 C) the plasmids multiply and produce the protein outside of the bacterium.
 D) the plasmids are inserted into the bacterial chromosome.
- 123) _____ are a major source of restriction enzymes. 123) _____
 A) Archaea B) Parietal cells C) Bacteria D) Chief cells
- 124) Restriction enzymes 124) _____
 A) cut DNA at specific sites. B) bind together strands of DNA.
 C) edit proteins. D) stop transcription.
- 125) Restriction enzymes specifically recognize and cut short sequences of DNA called 125) _____
 A) short terminal repeats. B) sticky ends.
 C) restriction sites. D) promoter sequences.
- 126) "Sticky ends" are 126) _____
 A) produced by PCR.
 B) DNA fragments with single-stranded ends.
 C) always long sequences of a single nucleotide.
 D) produced by the action of DNA ligase.
- 127) The feature of "sticky ends" that makes them especially useful in DNA recombination is their 127) _____
 ability to
 A) bind to DNA and thereby activate transcription.
 B) form hydrogen-bonded base pairs with complementary single-stranded stretches of DNA.
 C) allow plasmids to attach to the main bacterial chromosome.
 D) bind to ribosomes and thereby activate translation.
- 128) After DNA fragments with matching sticky ends are temporarily joined by complementary 128) _____
 base-pairing, the union can be made permanent by the "pasting" enzyme
 A) DNA polymerase. B) DNA helicase.
 C) covalentase. D) DNA ligase.
- 129) The _____ approach to gene cloning employs a mixture of fragments from the entire genome of 129) _____
 an organism and results in the production of thousands of different recombinant plasmids.
 A) V-protein B) Ti C) shotgun D) AK-47
- 130) A collection of DNA fragments obtained from the genome of one organism, inserted by 130) _____
 recombinant DNA techniques into the genome of a host organism (one fragment per host genome),
 and maintained there is called a
 A) DNA file. B) genomic library.
 C) DNA collection. D) gene bank.
- 131) Genomic libraries can be constructed using either bacterial plasmids or what other vector? 131) _____
 A) ribosomes B) tRNA
 C) bacteriophages D) human chromosomes

- 132) The enzyme that converts information stored in their RNA to information stored in DNA is 132) _____
A) reverse transcriptase. B) RNA polymerase.
C) DNA ligase. D) a restriction enzyme.
- 133) A cDNA library differs from a genomic library in that 133) _____
A) cDNA libraries only contain information from genes that have been transcribed.
B) the cDNA was constructed from introns only.
C) genomic libraries are only stored in bacterial cells.
D) cDNA libraries are more stable.
- 134) An advantage of using reverse transcriptase to prepare a gene for cloning is that 134) _____
A) the resulting DNA strand will lack exons.
B) reverse transcriptase is more efficient than DNA polymerase.
C) reverse transcriptase is more efficient than RNA polymerase.
D) the resulting DNA strand will lack introns.
- 135) A nucleic acid probe is 135) _____
A) a plasmid that recognizes a specific DNA sequence.
B) an enzyme that locates a specific restriction site on RNA.
C) a piece of radioactively labeled DNA that is used to locate a specific gene.
D) a virus that transfers DNA to a recipient cell.
- 136) Which of the following statements about nucleic acid probes is *false*? 136) _____
A) A nucleic acid probe can be used to find a specific gene.
B) A nucleic acid probe binds to a complementary sequence in the gene of interest.
C) A nucleic acid probe is usually labeled with a radioactive isotope or fluorescent tag to help identify its location.
D) A nucleic acid probe is a double-stranded section of DNA.
- 137) The type of recombinant bacteria most often used to mass-produce genes is 137) _____
A) *Escherichia coli*. B) *Pseudomonas aeruginosa*.
C) *Agrobacterium tumefaciens*. D) *Saccharomyces cerevisiae*.
- 138) The only recombinant cells that can correctly attach sugars to proteins to form glycoprotein products are 138) _____
A) yeast cells. B) mammalian cells.
C) *E. coli* cells. D) algal cells.
- 139) The advantage of being able to clone the gene for human insulin is that 139) _____
A) human insulin is less likely to cause harmful side effects than cow, pig, or horse insulin.
B) using human insulin increases the probability that, in the future, the person suffering from diabetes can be weaned from a dependence on insulin.
C) cow, pig, or horse insulin cannot keep a diabetic alive for more than three months.
D) there are too few cows, pigs, and horses to provide an adequate supply of their insulin.
- 140) A vaccine works by 140) _____
A) stimulating the immune system. B) inhibiting bacterial replication.
C) inhibiting viral replication. D) preventing the translation of mRNA.

- 141) Which of the following statements about DNA technology is *false*? 141) _____
 A) DNA technology is now used to create cells that can identify and kill cancer cells.
 B) DNA technology is now used to produce vaccines that are harmless mutants of a pathogen.
 C) DNA technology is now used to mass-produce human insulin.
 D) DNA technology is now used to mass-produce human growth hormone.
- 142) Golden rice is golden in color because it is rich in 142) _____
 A) vitamin C. B) beta-carotene.
 C) chromium picolinate. D) vitamin A.
- 143) A transgenic animal is 143) _____
 A) an animal in which a genetic defect has been corrected using recombinant DNA therapy.
 B) an animal containing a gene from another organism, typically of another species.
 C) an animal containing genes from three or more species.
 D) an animal that is the first of its kind to bear a particular allele.
- 144) Which of the following genetically modified organisms has *not* been developed by genetic engineers (at least, not yet)? 144) _____
 A) Transgenic pig with a roundworm gene that allows them to make more omega-3 fatty acids
 B) Transgenic corn with the gene for human insulin
 C) Transgenic salmon with a growth hormone gene that allows them to grow more quickly
 D) Transgenic rice with genes for milk proteins
- 145) Which of the following has *not* been a significant issue in the creation of genetically modified (GM) organisms? 145) _____
 A) the fact that some plants carrying genes from other species might represent a threat to the environment
 B) the fact that the protein products of transplanted genes might lead to allergic reactions
 C) the fact that GM organisms cannot be modified to prevent them from reproducing once they pass beyond the experimental stage
 D) the fact that rogue microbes might transfer dangerous genes into other organisms
- 146) In order for gene therapy to be permanent, 146) _____
 A) the normal gene must first be treated with UV radiation to ensure noninfectivity.
 B) the normal gene must be transferred to somatic cells that can continuously multiply.
 C) the normal gene must be added to the germ line cells.
 D) the defective gene must first be removed from all somatic cells.
- 147) Genetically modifying _____ cells may directly affect future generations. 147) _____
 A) basal B) T C) somatic D) germ
- 148) What is the preferred name of the technique used to determine if DNA comes from a particular individual? 148) _____
 A) DNA profiling B) DNA fingerprinting
 C) DNA scrutiny D) DNA outline

- 149) If you commit a crime, you need to make sure that you do not leave even the smallest speck of blood, hair, or other organic matter from your body. If you do, the DNA in this material can be amplified by _____, subjected to genetic analysis, and used to identify you as the perpetrator of the crime. 149) _____
- A) blotting
B) RFLP
C) PCR
D) reverse transcriptase
- 150) The polymerase chain reaction relies upon unusual, heat-resistant _____ that were isolated from bacteria living in hot springs. 150) _____
- A) restriction enzymes
B) DNA polymerase molecules
C) phages
D) plasmids
- 151) Gel electrophoresis sorts DNA molecules on the basis of their 151) _____
- A) solubility in the gel.
B) ability to bind to mRNA.
C) nucleotide sequence.
D) size.
- 152) During the process of electrophoresis, the _____ functions like a molecular sieve, separating the samples according to their size. 152) _____
- A) positively charged electrode
B) negatively charged electrode
C) gel
D) sample mixture
- 153) Which of the following statements regarding repetitive DNA is *false*? 153) _____
- A) Repetitive DNA is usually repeated multiple times in the genome.
B) Repetitive DNA is usually found between genes.
C) Repetitive DNA can show great variation among individuals.
D) Repetitive DNA is identical in all humans.
- 154) What is the current standard tool used for DNA profiling by forensic scientists? 154) _____
- A) DNA microarrays
B) Gel electrophoresis
C) STR analysis
D) PCR
- 155) What is the smallest number of cells needed to perform a successful DNA profile? 155) _____
- A) 1,000
B) 1
C) 20
D) 200
- 156) Which of the following pieces of evidence would be considered the best for establishing biological relatedness? 156) _____
- A) a very close match in the DNA profile
B) birth certificates
C) pictures from family reunions
D) testimony from relatives
- 157) When genetic variation in one nucleotide is found in at least 1% of the population, it is known as 157) _____
- A) recombinant DNA.
B) single nucleotide polymorphism.
C) short tandem repeats.
D) variable DNA.
- 158) Which of the following statements about genome sequencing is *false*? 158) _____
- A) The genome of a mouse has been sequenced.
B) The genomes of over 1,000 species have been completely or almost completely sequenced.
C) Most of the genomes that have been sequenced to date are eukaryotes.
D) The first eukaryotic organism to have its genome sequenced was yeast.

- 159) Which of the following statements about genomics is *false*? 159) _____
A) DNA technology limits genomic studies to prokaryotes.
B) Whole sets of genes and their interactions are studied in the field of genomics.
C) Genes from different species that have analogous sequences suggest similar function.
D) The first complete genome to be sequenced was a prokaryote.
- 160) Approximately what percentage of human DNA is noncoding? 160) _____
A) 98.5% B) 49% C) 99.9% D) 79%
- 161) The type of repetitive DNA composed of sequences of large repeated units is often associated with 161) _____
A) transposable elements. B) diseases of the nervous system.
C) sex-linked genes. D) transcription factors.
- 162) Segments of eukaryotic DNA that can move or be copied from one site to another in the genome are called 162) _____
A) vectors. B) transposable elements.
C) exons. D) plasmids.
- 163) Which of the following statements regarding DNA is *false*? 163) _____
A) Current estimates are that there are 20,000 genes in the human genome.
B) Scientists think that the typical human gene specifies just one polypeptide.
C) Telomeres seem to have a structural function.
D) Long stretches of repetitive DNA are prominent at centromeres and ends of chromosomes.
- 164) Why is the whole-genome shotgun method currently the tool of choice for analyzing genomes? 164) _____
A) Multiple genomes can be analyzed simultaneously.
B) It is very labor-intensive.
C) It is fast and inexpensive.
D) It is extremely accurate.
- 165) Which of the following statements regarding proteomics is *correct*? 165) _____
A) Proteomics is the study of protein interaction within a cell.
B) Proteomics is the systematic study of the full set of proteins encoded by a genome.
C) Proteomics and genomics allow scientists to study life in an ever-increasing reductive approach.
D) Proteomics involves the complete analysis of the prokaryotes.
- 166) The number of proteins in humans 166) _____
A) is approximately equal to the number of genes.
B) cannot be determined because the human genome is too complex.
C) is much greater than the number of genes.
D) is less than half the number of genes.
- 167) Genome sequence analysis suggests that Neanderthals 167) _____
A) frequently interbred with humans.
B) at least sometimes had pale skin and red hair.
C) could not speak.
D) are more closely related to chimpanzees than humans.

168) Approximately what percentage of the human genome is identical to that of a chimpanzee?
A) 98.8% B) 92.0% C) 62.3% D) 50.0%

168) _____

Answer Key

Testname: LEH MOLECULAR GENETICS AND BIOTECHNOLOGY

- 1) A
- 2) C
- 3) B
- 4) D
- 5) B
- 6) C
- 7) A
- 8) A
- 9) D
- 10) C
- 11) D
- 12) B
- 13) B
- 14) D
- 15) D
- 16) D
- 17) B
- 18) D
- 19) A
- 20) C
- 21) B
- 22) B
- 23) C
- 24) C
- 25) B
- 26) D
- 27) A
- 28) A
- 29) B
- 30) B
- 31) A
- 32) D
- 33) B
- 34) A
- 35) C
- 36) D
- 37) D
- 38) B
- 39) A
- 40) C
- 41) B
- 42) A
- 43) A
- 44) C
- 45) C
- 46) A
- 47) C
- 48) D
- 49) D
- 50) A

Answer Key

Testname: LEH MOLECULAR GENETICS AND BIOTECHNOLOGY

- 51) A
- 52) B
- 53) A
- 54) D
- 55) B
- 56) D
- 57) B
- 58) B
- 59) A
- 60) B
- 61) B
- 62) B
- 63) B
- 64) A
- 65) B
- 66) D
- 67) A
- 68) B
- 69) D
- 70) B
- 71) B
- 72) D
- 73) B
- 74) A
- 75) D
- 76) D
- 77) C
- 78) D
- 79) C
- 80) B
- 81) C
- 82) D
- 83) A
- 84) B
- 85) A
- 86) B
- 87) C
- 88) B
- 89) B
- 90) B
- 91) D
- 92) B
- 93) C
- 94) C
- 95) A
- 96) A
- 97) B
- 98) A
- 99) B
- 100) D

Answer Key

Testname: LEH MOLECULAR GENETICS AND BIOTECHNOLOGY

- 101) C
- 102) A
- 103) D
- 104) B
- 105) A
- 106) C
- 107) B
- 108) D
- 109) A
- 110) A
- 111) B
- 112) B
- 113) A
- 114) B
- 115) C
- 116) C
- 117) A
- 118) D
- 119) D
- 120) B
- 121) B
- 122) A
- 123) C
- 124) A
- 125) C
- 126) B
- 127) B
- 128) D
- 129) C
- 130) B
- 131) C
- 132) A
- 133) A
- 134) D
- 135) C
- 136) D
- 137) A
- 138) B
- 139) A
- 140) A
- 141) A
- 142) B
- 143) B
- 144) B
- 145) C
- 146) B
- 147) D
- 148) A
- 149) C
- 150) B

Answer Key

Testname: LEH MOLECULAR GENETICS AND BIOTECHNOLOGY

- 151) D
- 152) C
- 153) D
- 154) C
- 155) C
- 156) A
- 157) B
- 158) C
- 159) A
- 160) A
- 161) A
- 162) B
- 163) B
- 164) C
- 165) B
- 166) C
- 167) B
- 168) A