These review questions are for Bio 1 Genomes topic. The questions were adapted from several sources, including the textbook's review questions.

1) Which of the following defines a genome?
A) a representation of a complete set of a cell's polypeptides
B) the complete set of an organism's polypeptides
C) the complete set of a species' polypeptides
D) a karyotype of all the chromosomes in a diploid cell
E) the complete set of an organism's genes and non-gene DNA

2) Which of the following statements about the DNA in one of your brain cells is true?
A) Most of the DNA codes for protein.
B) The majority of genes are likely to be transcribed.
C) Each gene lies immediately adjacent to an enhancer.
D) Many genes are grouped into operon-like clusters.
E) It is the same as the DNA in one of your heart cells.

3) Muscle cells differ from nerve cells mainly because they...
A) express different genes.
B) contain different genes.
C) use different genetic codes.
D) have unique ribosomes.
E) have different chromosomes.

4) Several different hemoglobin genes are expressed in humans, but these different hemoglobin genes are expressed at different times in development (such as fetal and adult forms of hemoglobin). What mechanism most likely accounts for this?
A) Old genes are removed and new genes are produced throughout the life span of an organism.
B) Alternative splicing of just one hemoglobin gene.
C) Different activators proteins are present in blood cells at different times during development.
D) Differential translation of mRNAs (using developmental alternations in the genetic code).
E) Different chromosomes are present in blood cells at different times during development.

5) In eukaryotes, proteins bind to enhancers, which may be a long distance from the promoter of a gene. These proteins...
A) Alter the sequence of the DNA between the enhancer and promoter
B) Do **not** interact with the transcription factors and the RNA polymerase
C) Can interact with the transcription factors and the RNA polymerase

by the DNA being bent
D) Can interact with the transcription factors and the RNA polymerase
by splicing out the DNA between the enhancer and the promoter

6) In eukaryotes, general transcription factors...
A) are what causes differential gene expression
B) usually bind to a sequence element within the promoter such as the TATA box.
C) inhibit RNA polymerase binding to the promoter and begin transcribing.
D) usually lead to a high level of transcription even without additional specific transcription factors.
E) bind to sequences just after the start site of transcription.

7) The functioning of enhancers is an example of...
A) transcriptional control of gene expression.
B) a post-transcriptional mechanism to regulate mRNA.
C) the stimulation of translation by initiation factors.
D) post-translational control that activates certain proteins.
E) a eukaryotic equivalent of prokaryotic operons (several genes co-regulated by one promoter).

8) During interphase, most of the chromosomal DNA is not tightly wound on histones, but a small amount of the DNA is tightly wound on histones. The DNA that is tightly wound on histones during interphase is called...
A) Euchromatin
B) Heterochromatin
C) Methylchromatin
D) Repressor chromatin
E) Tandem chromatin

9) Which of the following statements correctly describes the two types of chromatin?
A) Heterochromatin is composed of DNA, whereas euchromatin is made of DNA and RNA.
B) Both heterochromatin and euchromatin are found in the cytoplasm.
C) Heterochromatin is highly condensed, whereas euchromatin is less compact.
D) Euchromatin is not transcribed, whereas heterochromatin is transcribed.
E) Only euchromatin is visible under the light microscope.

10) Two methods that eukaryotic cells use to repress transcription by changing the DNA are...
A) DNA methylation and increase in histone number
B) DNA degradation and histone methylation.

C) DNA degradation and DNA methylation.
D) DNA methylation and histone modification.
E) Histone degradation and DNA degradation

11) If you were to observe the activity of methylated DNA, you would expect it to...
A) be replicating nearly continuously.
B) be unwinding in preparation for protein synthesis.
C) have turned off or slowed down the process of transcription.
D) be very actively transcribed and translated.
E) induce protein synthesis by not allowing repressors to bind to it.

12) A researcher found a method she could use to manipulate methylation in cells. One of her colleagues suggested she try increased methylation of C nucleotides in the DNA. Which of the following results would she most likely see?
A) increased chromatin condensation
B) decreased chromatin condensation
C) abnormalities in the double helix shape
D) decreased binding of histones
E) inactivation of genes

13) Which of the following is an example of post-transcriptional control of gene expression?
A) the addition of methyl groups to cytosine bases of DNA
B) the binding of transcription factors to a promoter
C) the removal of introns and alternative splicing of exons
D) gene amplification contributing to cancer
E) the folding of DNA to form heterochromatin

14) Which of the following is most likely to have a small protein called ubiquitin attached to it?
A) a protein in the cytoplasm that is no longer required
B) a cell surface protein that is required for transport of glucose into the cell
C) an mRNA that is leaving the nucleus to be translated
D) an enzyme that is used for the Krebs cycle
E) an mRNA produced by an egg cell that will be retained until after fertilization

15) Within a cell, an mRNA for protein X exits the nucleus and arrives in the cytoplasm. The amount of protein X that is made using that particular mRNA molecule depends partly on...
A) the degree of DNA methylation of the gene.
B) the rate at which the mRNA is degraded.

C) the presence of certain transcription factors.
D) the number of introns present in the mRNA.
E) the types of ribosomes present in the cytoplasm.

16) A researcher introduces double-stranded RNA into a culture of mammalian cells. Use this scenario to answer the question below.

Within the few minutes after placing the double-stranded RNA into the cell, the researcher sees that the cells still contain the intact RNA. After 3 hours, she is not surprised to find that...
A) Dicer enzyme has reduced it to smaller pieces of RNA
B) the RNA is fully degraded into individual nucleotide monomers
C) the double-stranded RNA replicates itself.
D) the double-stranded RNA inserts into a viral capsid.
E) the double-stranded RNA binds to tRNAs to prevent translation.

17) A researcher introduces double-stranded RNA into a culture of mammalian cells. After a few hours, she finds that Dicer enzyme has broken down the double stranded RNA into many smaller pieces of RNA. Use this scenario to answer the question below.

She finds that the smaller pieces of RNA do something inside the cell. What exactly do the smaller pieces of RNA do?
A) attach to histones in the chromatin
B) bind to complementary regions of specific mRNAs
C) bind to Dicer enzymes to destroy other double stranded RNAs
D) activate alternative splicing in the cell
E) bind to non-complementary RNA sequences

18) A researcher introduces double-stranded RNA into a culture of mammalian cells. After a few hours, she finds that Dicer enzyme has broken down the double stranded RNA into many smaller pieces of RNA. Use this scenario to answer the question below.

What will be the overall effect of the small pieces of RNA in the cell?
A) The cell will make more RNA to replace the RNA that Dicer has degraded.
B) The cell will produce RNA viruses.
C) The amount of protein translated from certain mRNAs is reduced.
D) The amount of RNA is multiplied by its own replication.
E) The cell's translation ability is entirely shut down.

19) A researcher introduces double-stranded RNA into a culture of mammalian cells. After a few hours, she finds that Dicer enzyme has broken down the double stranded RNA into many smaller pieces of RNA. These smaller pieces of RNA bind to and reduce

the translation of certain mRNAs in the cytoplasm.

The small pieces of RNA that she caused to be in the cell are known as...
A) mRNA and tRNA
B) tRNA and template RNA
C) Template RNA and siRNA
D) siRNA and miRNA

20) A researcher introduces double-stranded RNA into a culture of mammalian cells. After a few hours, she finds that Dicer enzyme has broken down the double stranded RNA into many smaller pieces of RNA. These smaller pieces of RNA bind to and reduce the translation of certain mRNAs in the cytoplasm.

The phenomenon described in the above paragraph is called...
A) RNA interference.
B) RNA obstruction.
C) RNA blocking.
D) RNA targeting.
E) RNA disposal.

21) Which of the following best describes siRNA?
A) a short RNA strand that can bind to and reduce translation of certain mRNAs
B) a single-stranded RNA that can, where it has internal complementary base pairs, fold itself into cloverleaf patterns
C) a double-stranded DNA that is formed by cleavage of hairpin loops in a larger precursor
D) a portion of rRNA that allows it to bind to several ribosomal proteins in forming large or small subunits
E) an enzyme,, also known as Dicer, that can degrade other mRNA sequences

22) One way scientists hope to use the recent knowledge gained about siRNAs lies with the possibilities for their use in medicine. Of the following scenarios for future research, which would you expect to gain most from siRNA research?
A) exploring a way to turn on the expression of pseudogenes
B) targeting siRNAs to disable the expression of an allele associated with autosomal recessive disease
C) targeting siRNAs to disable the expression of an allele associated with autosomal dominant disease
D) looking for a way to introduce viruses to human cells

23) Which of the following describes the function of an enzyme known as Dicer?
A) It degrades single-stranded DNA into individual nucleotides.

B) It degrades single-stranded mRNA into individual nucleotides.
C) It degrades any mRNA with no poly-A tail.
D) It breaks down double-stranded RNAs into smaller RNA molecules that can block translation.
E) It chops up single-stranded DNAs from infecting viruses.

24) Which of the following is **not** true about the human genome?
A) Humans have around 25,000 genes.
B) The number of proteins expressed by the human genome is more than the number of its genes.
C) Most human DNA consists of genes for proteins.
D) The human genome has a large amount of transposable elements compared to other species.

25) What percent of our genome is non-functioning genes (gene fragments, mutated genes, and other pseudogenes)?
A) 0% (all genes are functional)
B) 2%
C) 5%
D) 24%
E) 44%

26) What is tandem repeat DNA?
A) The identical genes (but not identical alleles) on homologous chromosomes.
B) The identical genes (with identical alleles) on sister chromatids.
C) Many repeats of a simple DNA sequence in a row.
D) The genes in an operon that cluster together on the chromosome.
E) A gene that is translated more than once by ribosomes.

27) In lecture, we learned that large amounts of tandem repeat DNA is found...
A) In introns
B) In prokaryotic chromosomes
C) In the mitochondrial and/or chloroplast chromosome.
D) At the telomeres (the ends) of the chromosome.
E) In promoter and enhancer sequences.

28) In lecture, we learned that large amounts of tandem repeat DNA is found...
A) In introns
B) In prokaryotic chromosomes
C) In the mitochondrial and/or chloroplast chromosome.
D) In promoter and enhancer sequences.

E) In the centromere region of the chromosome.

29) What percent of our genome is tandem repeat DNA?
A) 0% (Tandem repeat DNA is found only in prokaryotes)
B) 2%
C) 5%
D) 24%
E) 44%

30) One of the characteristics of retrotransposons is that...
A) they code for an enzyme that synthesizes DNA using an RNA template.
B) they are found only in animal cells.
C) they generally move by the original copy of the retrotransposon being cut out from the chromosome.
D) they are most active at night.
E) they only move when an active retrovirus infects the host cell.

31) The Alu sequence, which accounts for about 10% of the human genome, is an example of...
A) A tandem repeat sequence
B) A partial retrotransposon sequence.
C) A mutated eukaryotic gene
D) A transposon.

32) The Alu sequence, which accounts for about 10% of the human genome, is an example of...
A) A tandem repeat sequence
B) A SINE.
C) A transposon.
D) A gene that encodes functioning reverse transcriptase enzyme.

33) The Alu sequence is not capable of moving or copying itself in the genome. How then is Alu moved and copied?
A) By unequal crossing over in meiosis.
B) Using the reverse transcriptase enzyme of active retrotransposons.
C) By imitating an intron and being duplicated by RNA polymerase II.
D) By imitating an exon and being duplicated by RNA polymerase II.
E) It encodes enzymes that are able to copy and splice itself within the genome.

34) What is the best description of pseudogenes?

A) They are genes that encode non-translated RNA, such as ribosomal RNA or transfer RNA.
B) They are similar in sequence to functioning genes but have accumulated mutations to such a degree that they are not expressed.
C) They are functioning duplicates of genes.
D) They are genes that encode siRNA, which interferes with other genes.
E) They move from one location in the genome to another (transposable elements).

35) A multigene family is composed of...
A) multiple genes whose products must be coordinately expressed (an Operon)
B) genes whose sequences are very similar and that probably arose by gene duplication.
C) the many tandem repeats such as those found in centromeres and telomeres.
D) a gene whose exons can be spliced in a number of different ways.
E) a highly conserved gene found in a number of different species.

36) In humans, the embryonic and fetal forms of hemoglobin have a higher affinity for oxygen than that of adults. This is due to...
A) non-identical genes that produce different versions of globins during development.
B) identical genes that generate many copies of the ribosomes needed for fetal globin production.
C) pseudogenes, which interfere with gene expression in adults.
D) the attachment of methyl groups to cytosine following birth, which changes the type of hemoglobin produced.
E) histone proteins changing shape during embryonic development.

37) Two eukaryotic proteins have one domain in common but are otherwise very different. Which of the following processes is most likely to have contributed to this similarity?
A) gene duplication
B) RNA splicing
C) exon shuffling
D) histone modification
E) random point mutations

38) Transposable elements can cause exon shuffling when...
A) the transposable elements affect alternative splicing of mRNA
B) two transposable elements flank an exon and carry it with them when they move.
C) a transposable element inserts itself inside an exon.
D) the spliceosome mistakes a transposable element for an exon.
E) the spliceosome mistakes a transposable element for an intron.

39) In eukaryotes, activator proteins bind to enhancer sequences (also known as control element sequences) in the DNA. What other type of protein can also bind to the enhancer sequences?
A) General transcription factors
B) Ribosomes
C) Spliceosomes
D) snRNPs
E) Repressor proteins

40) Which number is closest to the total number of genes in the human genome?
A) 2,500
B) 25,000
C) 10,000
D) 100,000
E) 46

Answers to review questions:

1) E
2) E
3) A
4) C
5) C
6) B
7) A
8) B
9) C
10) D
11) C
12) E
13) C
14) A
15) B
16) A
17) B
18) C
19) D
20) C
21) A
22) C
23) D
24) C

25) B
26) C
27) D
28) E
29) D
30) A
31) B
32) B
33) B
34) B
35) B
36) A
37) C
38) B
39) E
40) B