1. A cell can have no nucleus and a cell can have more than one nucleus?
   a. True
   b. False

2. Where is DNA concentrated?
   a. In air
   b. In our cells
   c. In cellular nuclei
   d. On our skin

3. The human body is typically comprised of how many cells?
   a. 1,000
   b. 250,000,000,000,000
   c. 900,000,000,000
   d. 37,000,000,000,000

4. What percentage of our bodies are comprised of proteins?
   a. 3%
   b. 15%
   c. 5%
   d. 55%

5. What are proteins made out of?
   a. nucleic acids
   b. nucleotides
   c. amino acids

6. Hormones are proteins.
   a. True
   b. False

7. Enzymes are proteins.
   a. True
   b. False

8. DNA are proteins.
   a. True
   b. False

9. Why are proteins the most important life molecules? Select all that apply.
   a. They form the structural parts of the cell
   b. They control all cellular processes including metabolic processes
   c. They control neurological processes
   d. Only living things can make proteins

10. What is a phenotype and what is a genotype?
   a. Genotype is the allelic composition of a gene, and phenotype is any physical or measurable characteristic formed as a result from the genotype

b. Genotype is a genetic test and phenotype is a genetic assessment
c. Genotypes are phenotypes. There is no difference

11. What do the words homozygous and heterozygous describe?
a. phenotypes
b. cells
c. genotypes
d. chromosomes

12. What is a zygote?
a. a type of chromosome
c. an initial cellular mass
b. a penetrating sperm cell
d. a fertilized egg cell

13. How long is the human genome?
a. 3.000.000 bases
b. 3.000.000.000 bases
c. 2.000.000 bases
d. 100.000.000 bases

14. What is a genome?
a. the set of all bases in an organism
b. the unique set of all genes in an organism
c. the set of exons of an organism
d. the unique set of genomic differences between two individuals

15. What is a whole genome?
a. the same as the genome
b. the set of all DNA material from the cellular nucleus
c. set of chromosomes

16. What is the name of the most elementary building block of a DNA molecule?
a. base
c. nucleoside
b. phosphate
d. nucleotide

17. What are the three parts of a nucleotide ...?
a. phosphate group
b. nitrogenous base
c. amino acid
d. pentose sugar

18. List the four bases of the genetic code?
a. C, T, G, A
b. C, M, Y, K
c. C, U, G, A (if we are considering codon table than it is RNA; for DNA it is C, T, G, A)

19. What does the genetic code encode?
a. amino acids
c. RNA
b. proteins
d. cell free DNA

20. What is the name of a unit of code in the genetic code?
a. triplet
b. code
c. frame
d. codon

21. Which two bases are linked by triple hydrogen bonds and which by double hydrogen bonds?
a. A and C are linked by double hydrogen bonds and G and T by triple hydrogen bonds.
b. A and T are linked by triple hydrogen bonds and C and G are linked by double hydrogen bonds.
c. A and T are linked by double hydrogen bonds while C and G are linked by triple bonds.

22. DNA molecules have a direction, what is this direction?
a. Down stream
b. 5' to 3'
c. 3' to 5'
d. Up stream

23. What does this directionality mean?
a. The magnetic field formed during synthesis entails the direction of electrical current that can flow along a DNA molecule.
b. Each nucleotide is attached to its previous nucleotide at the 5' carbon and to its successive nucleotide at the 3' carbon.
c. Quark forces between adjacent carbon atoms influence the flow of synthesis and transcription. At the 5' end, quark forces are the strongest and at the 3' end quark forces are the weakest. Synthesis is always in the direction from strongest quark forces to weakest.

24. What are the elementary states of life of a cell?
a. interphase
c. telophase
b. anaphase
d. mitosis

25. What percentage of time is a cell in interphase?
a. 10%
c. 50%
b. 30%
d. 90%

26. What does the cell not do during interphase?
a. prepares for reproduction
c. copies DNA material
b. metabolic activity
d. divides

27. What is the name of the fundamental unit of chromatin?
a. histone
c. heterochromatin
b. histogram
d. nucleosome

28. How many chromosomes does each somatic cell nucleus in our bodies contain?
a. 46
c. 32
b. 23
d. 10

29. How many of these chromosomes did we inherit from our mother and how many from our father?
a. 23 and 46
b. 22 and 50
c. 23 and 23

30. What word do we use to describe this phenomenon?
a. aneuploidy
c. diploidy
b. haploidy
d. polyploidy

31. How many chromosomes in total make up our autosomal chromosomes?
a. 22
c. 21
b. 23
d. 10

32. Autosomal chromosomes are enumerated from longest to shortest.
a. True
b. False

33. What are the two cell lines in the human body?
a. somatic
b. neural
c. germline
d. autosomal

34. What is the difference between heterochromatin and euchromatin?
a. Euchromatin is active chromatin and heterochromatin is

inactive chromatin

b. Euchromatin is present only in Europeans

c. Heterochromatin is found within the cell nucleus and Euchromatin is found in the cytoplasm

35. What is epigenetics?

a. the study of genome programs within different cells (guessing the answer)

b. the study of ancient genomes

c. the study of bacterial DNA

Epigenetics is the study of how cells control gene activity without changing the DNA sequence. A common type of epigenetic modifications are DNA methylation (attachment of methyl groups to DNA building blocks causing the gene to be turned off or silenced, and no protein is produced from it) and histone modification (addition or removal of methyl groups or acetyl groups influencing how tightly the DNA is wrapped around histones which affects whether a gene can be turned on or off)

36. What are the two tasks that DNA can perform?

a. Replicate itself

b. Transcribe itself

c. Catalyze protein interactions

37. The directions of DNA replication and transcription are always down stream, from 5' to 3'.

a. True

b. False

38. What type of molecular machine is in charge of both synthesizing and transcribing DNA?

a. Kinase

b. Nucleic acids

c. Polymerase

39. Which polymerase molecule is used to synthesize DNA?

a. RNA polymerase

b. DNA polymerase

c. cDNA polymerase

40. Which polymerase molecule is used to synthesize a transcript?

a. DNA polymerase I

b. RNA polymerase II

c. RNA polymerase III

41. Why do "Okazaki fragments" appear on the lagging strand during DNA replication?

a. These fragments appear on the lagging strand, because the downstream (5' - 3') direction of the lagging strand is opposite the direction of helicase's denaturing activity.

b. A deformation in the polymerase molecule that is found on the lagging strand.
c. Lack of free floating nucleotides in the lagging strand vicinity.

42. What is the term used to describe the point on the DNA chain where replication of DNA begins?
a. point of replication
b. **origin of replication**
c. start point

43. We can have hundreds and even thousands of origins of replication on a single chromatin strand.
a. True
b. False

44. The Central Dogma states that....
a. proteins are at the center of life
b. DNA contains a library of instructions on how to make proteins (guessing the answer)
c. Proteins can be used to reverse synthesize original DNA

CRICK, F. Central Dogma of Molecular Biology. Nature 227, 561–563 (1970). https://doi.org/10.1038/227561a0
"The central dogma of molecular biology deals with the detailed residue-by-residue transfer of sequential information. It states that such information cannot be transferred from protein to either protein or nucleic acid."

45. Gene transcription occurs in the cytoplasm.
a. True
b. False

46. Transcript translation occurs in the cytoplasm.
a. True
b. False

47. There are 20 amino acids in the genetic code (22 in total for most organisms).
a. False
b. True

48. A variant in our DNA is the same thing as a mutation.
a. True
b. False

49. There are _____ possible types of variants.
a. 2
c. 3
b. 12
d. 5 - -6

50. There are _____ essential types of mutations.
a. 3
b. 2
c. 5

51. SNPs are SNVs that are present in more than ____% of the population.
a. 10
c. 1
b. 50
d. 2

52. SNVs and SNPs are both point mutations.
a. True
b. False

53. Check the three essential types of mutations.
a. Synonymous
c. Misense
b. Misinterperted
d. Nonsense

54. Write down what are the five - six possible types of DNA variation.
a. INDELs, Translocations, Inversions, SNVs and CNVs
b. Point mutations, SNPs, VNTRs, CNVs, Translocations, INDELs
c. Insertions, Deletions, Transitions, Transversions and point Mutations

55. What kind of RNA molecule is a DNA transcript?
a. messenger RNA, i.e., mRNA
b. noncoding RNA, i.e. ncRNA
c. micro RNA, i.e. miRNA
d. transfer/translate RNA, i.e. tRNA

56. What are the differences between DNA and RNA?
a. DNA is double stranded while RNA is single stranded
b. RNA has one oxygen atom less than DNA
c. DNA uses Thymine, while RNA uses Uracil

57. What do we call a region of DNA that does not code for a protein?
a. junk DNA
b. illiterate DNA
c. non-coding DNA

58. If a CNV or an insertion occurs in a non-coding region of DNA, this will affect all underlying genes.
a. True
b. False

59. When an insertion or a deletion occur within a coding region, the resulting mutation is a _____ mutation.
a. shift
b. frame shift
c. window

60. What are promoters?
a. small trans-acting regulatory regions before a gene that signify where the gene starts.
b. small cis-acting regulatory regions before a gene that signify where the gene starts.
c. promoters are cis-acting regulatory regions that hand off special activator molecules to genes that signal gene enhancers to produce a certain quantity of transcripts

61. What are transcription factors?
a. proteins that bind to promoters
b. proteins that control cellular growth
c. proteins that bind to promoters and signal DNA polymerase to transcribe the gene

62. Enhancers are exclusively cis-acting gene regulatory regions
a. True
b. False

63. Introns are the coding parts of a gene?
a. True
b. False

64. Intron is a shorthand for _____ region.
a. Intertwined
b. Intervening (guessing the answer)
c. Involved

Gilbert, W. Why genes in pieces?. Nature 271, 501 (1978). https://doi.org/10.1038/271501a0
"The notion of the cistron [i.e., gene] ... must be replaced by that of a transcription unit containing regions which will be lost from the mature messenger – which I suggest we call introns (for intragenic regions) – alternating with regions which will be expressed – exons."

65. Exons are "expressed" sequences.
a. True
b. False

66. Alternative splicing means that one gene can code for several different transcripts.
a. True
b. False

67. Which molecule is the subject of splicing?
a. DNA
b. mRNA

68. What molecule is responsible for alternative splicing of mRNA?
a. RECosome
b. RNAse and DNAse
c. Spliceosome

69. What percentage of our DNA sequences do we share with any other human being?
a. 99%
b. 99.9%
c. 99.99%

70. If there are 1,500,000 possible SNPs in a haploid cell of organism X, how many possible configurations of different SNP values exist in a diploid cell of organism X? Note: Remember, germline cells are haploid cells and somatic cells are diploid cells.
a. 2^3,000,000
b. 3,000,000^2
c. 4^3,000,000