

# Applied Bioinformatics Course

## Self-test of biology

The correct answer for each question can range from 0 to 4.

- 1) The scientist(s) who invented the binomial nomenclature for naming species of living things (using Latin name for the genus and species name) is/are the ()
  - a. English naturalist Charles Darwin
  - b. Austrian geneticist Gregor Mendel
  - c. Swedish botanist Carl Linnaeus
  - d. American geneticist Thomas Morgan
- 2) The book 'On the Origin of Species' established the basic concept of ()
  - a. natural selection
  - b. survival of the fittest
  - c. variation
  - d. gene
- 3) Based on the results from the pea hybridization experiment, Mendel discovered the ()
  - a. mechanism of evolution
  - b. basic law of genetics
  - c. structure of the chromosome
  - d. shape and structure of cell
- 4) Using fruit fly for genetic experiments, Morgan proposed the ()
  - a. theory of gene
  - b. theory of evolution
  - c. theory of cell
  - d. theory of chromosome
- 5) The double helix model of DNA ()
  - a. is made up of two DNA molecule coiling together in an anti-parallel direction to form a double helix

- b. the skeleton of the double helix is made up of ribonucleic acid and phosphoric acid groups
  - c. nucleic bases pair to each other via hydrogen bonds and are distributed on the exterior of the molecule
  - d. the plane containing the nucleic base is perpendicular to the axis of the helix
- 6) The scientific name for the modern human is ()
- a. Human
  - b. Human being
  - c. *Homo being*
  - d. *Homo sapiens*
- 7) *Arabidopsis thaliana* ()
- a. belongs to the Brassicaceae family
  - b. is a perennial plant
  - c. gene is easily manipulated
  - d. has a wide distribution and a short life cycle
- 8) The human genome ()
- a. contains approximately 3 billion base pairs
  - b. has 23 chromosomes
  - c. the total length of the protein-coding genes is approximately half of the length of the genome
  - d. contains a lot of repeated sequences
- 9) The model organism(s) assigned by the Human Genome Project include(s) ()
- a. Mouse, *Mus musculus*
  - b. Zebrafish, *Danio rerio*
  - c. Baker's yeast, *Saccharomyces cerevisiae*
  - d. Rice, *Oryza sativa*
- 10) Archaea ()
- a. are the oldest bacteria in the evolution status
  - b. lived on the earth more than a billion years ago but are extinct now
  - c. normally live in extreme conditions
  - d. are smaller than bacteria

- 11) The genome of eukaryotes ()
- a. the size of the genome is related to the number of chromosome
  - b. animal genomes are larger than plant genomes
  - c. the numbers of chromosome in animal genomes are greater than that of plant genomes
  - d. the genes from the same family are distributed on the same chromosomes
- 12) The genes of eukaryotes ()
- a. contain at least one intron
  - b. contain at least one exon
  - c. have polyadenylation [poly(A)] signals at the 3'-end
  - d. have a transcription start site at the 5'-end
- 13) The central dogma of molecular biology states ()
- a. DNA is the carrier of genetic information
  - b. RNA is obtained from the transcription of DNA
  - c. mRNA as a messenger will follow the codons to guide the synthesis of proteins
  - d. protein can regulate the replication and transcription of DNA
- 14) The basic unit(s) of a chromosome is/are the ()
- a. nucleosome
  - b. ribosome
  - c. mitochondria
  - d. chloroplast
- 15) The location(s) for protein synthesis is/are the ()
- a. chromosome
  - b. ribosome
  - c. nucleosome
  - d. mitochondria
- 16) The biomolecule(s) that regulate gene transcription is/are ()
- a. transcription factors
  - b. enzymes
  - c. hormones
  - d. microRNAs
- 17) The length of a mature microRNA is ()

- a. >30 nt
- b. <20 nt
- c. 21-24 nt
- d. 25-28 nt

18) The principle(s) of designing a PCR primer include(s) ( )

- a. hairpins cannot be formed between primers
- b. hairpins cannot be formed due to self-folding of primers
- c. the GC content of the primer should be 50-60%
- d. the 3'-end of the primer should have 3 continuous Cs or Gs

19) The guanine nucleotide in a DNA molecule can be expressed by the alphabet ( )

- a. A
- b. C
- c. G
- d. T

20) The pyrimidine in a DNA molecule can be expressed by the alphabet ( )

- a. Y
- b. R
- c. W
- d. S

21) The genetic code has the following characteristic(s) ( )

- a. there are several nucleic bases between two consecutive codons
- b. the codons of animals and plants are different
- c. mitochondria use the same codons as eukaryotic genomes
- d. the same amino acid can be translated by several codons

22) Which of the following is/are the start codon(s) ( )

- a. TGA
- b. AGT
- c. ATG
- d. GAT

23) Which of the following is/are the stop codon(s) ( )

- a. TAA

- b. TGA
- c. TAG
- d. TGG

24) How many codons code for leucine (Leu/L) ( )

- a. 1
- b. 2
- c. 4
- d. 6

25) Which amino acid(s) has/have only one codon ( )

- a. glutamate (Glu/E)
- b. glycine (Gly/G)
- c. Serine (Ser/s)
- d. Tryptophan (Trp/W)

26) Which of the following is/are hydrophobic amino acid(s) ( )

- a. phenylalanine (Phe/F)
- b. methionine (Met/M)
- c. isoleucine (Ile/I)
- d. alanine (Ala/A)

27) The amino acid(s) which have a negatively charged side chain include(s) ( )

- a. serine (Ser/S)
- b. asparagine (Asn/N)
- c. histidine (His/H)
- d. glutamate (Glu/E)

28) Aromatic amino acids include ( )

- a. methionine (Met/M)
- b. tyrosine (Tyr/Y)
- c. arginine (Arg/R)
- d. proline (Pro/P)

29) Which amino acid(s) is/are often found in the active sites of proteins ( )

- a. serine (Ser/S)
- b. valine (Val/V)

- c. histidine (His/H)
  - d. lysine (Lys/K)
- 30) Amino acid(s) that can undergo phosphorylation in protein molecules include(s) ( )
- a. serine (Ser/S)
  - b. threonine (Thr/T)
  - c. histidine (His/H)
  - d. lysine (Lys/K)
- 31) The chemical bond(s) for stable protein secondary structure is/are ( )
- a. peptide bond
  - b. covalent bond
  - c. ionic bond
  - d. hydrogen bond
- 32) The chemical bond(s) that connects neighboring amino-acid residues in the protein primary structure is/are ( )
- a. peptide bond
  - b. covalent bond
  - c. ionic bond
  - d. hydrogen bond
- 33) The chemical bond(s) that connects non-consecutives amino-acid residues in the protein primary structure is/are ( )
- a. disulfide bond
  - b. glycosidic bond
  - c. phospholipid bond
  - d. hydrogen bond
- 34) The classic alpha helix ( )
- a. the amide groups and carboxyl groups on the backbone forms hydrogen bonds
  - b. the direction of the hydrogen bond is perpendicular to the helix axis
  - c. the length of the hydrogen bond is about  $2.8\text{\AA}$
  - d. the side chains are distributed around the helix
- 35) The classic beta sheet ( )
- a. the amide groups and carboxyl groups on the backbone forms hydrogen bonds

- b. there are two possibilities for the direction of the peptide chains, parallel or anti-parallel
  - c. the direction of the hydrogen bond is parallel to the peptide chain
  - d. the side chains are distributed on the top and bottom of the beta sheet
- 36) A mature human insulin molecule ()
- a. is made up of two chains
  - b. the two chains are connected by two pairs of disulfide bonds
  - c. its secondary structures include the alpha helix and beta sheet
  - d. one of the histidine is connected to a zinc ion
- 37) Human hemoglobin has ()
- a. 4 totally identical subunits
  - b. 4 totally different subunits
  - c. 4 subunits with 2 different groups, each group has 2 identical subunits
  - d. 2 subunits and they are different
- 38) The amino acid(s) that covalently bond to the iron ion in center of the heme porphyrin ring in hemoglobin is/are ()
- a. phenylalanine (Phe/F)
  - b. arginine (Arg/R)
  - c. threonine (Thr/T)
  - d. histidine (His/H)
- 39) The human immunoglobulin IgG molecule has ()
- a. two heavy chains and two light chains
  - b. each heavy chain contains 4 domains
  - c. each light chain contains 2 domains
  - d. there are 3 pairs of disulfide bonds between two heavy chains whereas there is a pair of disulfide bond between a heavy chain and a light chain
- 40) The common metal element(s) that act(s) as cofactor for protein molecules include(s) ()
- a. zinc
  - b. selenium
  - c. copper
  - d. cadmium