

*iGenetics: A Molecular Approach, 3e (Russell/Bose)*  
**Chapter 1 Genetics: An Introduction**

**MATCHING**

**Please select the best match for each term.**

- A) PubMed
- B) OMIM
- C) GenBank
- D) Entrez
- E) BLAST

1) A system for searching several linked databases

Skill: Factual recall

2) A tool to compare nucleotide or protein sequences

Skill: Factual recall

3) A website that provides links to research articles

Skill: Factual recall

4) A database of human genes and disorders

Skill: Factual recall

5) A database of genetic sequences

Skill: Factual recall

Answers: 1) D 2) E 3) B 4) A 5) C

**Please select the best match for each term.**

- A) Gregor Mendel
- B) Barbara McClintock
- C) Boyer and Cohen
- D) Paul Berg
- E) Kary Mullis

6) Developed the polymerase chain reaction  
Skill: Factual recall

7) Constructed the first recombinant DNA molecule  
Skill: Factual recall

8) Cloned the first recombinant DNA molecule  
Skill: Factual recall

9) Conducted breeding experiments with the pea plant  
Skill: Factual recall

10) Discovered transposable elements  
Skill: Factual recall

Answers: 6) E 7) D 8) C 9) A 10) B

**MULTIPLE CHOICE**

- 11) The field of genetics includes
- A) the study of heredity.
  - B) the molecular nature of the genetic material.
  - C) the ways in which genes control life functions.
  - D) the distribution and behavior of genes in populations.
  - E) All of these

Answer: E  
Skill: Factual recall

- 12) Quantitative genetics is
- A) the quantitative study of the activity of a gene.
  - B) the study of the genetic diversity within a large group of individuals of the same species.
  - C) the study of the genetic diversity within members of a number of related species.
  - D) the study of traits that are determined by a number of genes simultaneously.
  - E) the study of the number of characteristics found in an organism.

Answer: D  
Skill: Factual recall

13) Bacteria and Archaea are

- A) eukaryotic.
- B) prokaryotic.
- C) archaeotic.
- D) anucleotic.
- E) proteozoic.

Answer: B

Skill: Factual recall

14) Transposons are

- A) proteins that are stable.
- B) proteins that are unstable.
- C) DNA segments that are stable.
- D) DNA segments that are unstable.
- E) DNA segments that code for proteins.

Answer: D

Skill: Factual recall

15) Genes influence all aspects of life because they

- A) are structural elements of the cell.
- B) regulate movement of proteins.
- C) produce RNA and protein needed for different processes.
- D) localize to the nucleus.
- E) are needed for DNA synthesis.

Answer: C

Skill: Factual recall

16) An ideal organism for a geneticist to use as a study organism would possess which of the following characteristics?

- A) A relatively short life cycle
- B) A large degree of genetic variation among individuals
- C) Matings that produce large numbers of offspring
- D) A well-characterized genetic background, karyotype, etc.
- E) All of these are desirable characteristics

Answer: E

Skill: Factual recall

17) The organism that Mendel used for his experiments was

- A) *E. coli*.
- B) the fruit fly.
- C) maize.
- D) yeast.
- E) the pea plant.

Answer: E

Skill: Factual recall

- 18) A map unit ( $\mu$ ) is
- A) the position of a gene on the chromosome.
  - B) the unit of genetic distance on a chromosome.
  - C) the unit of physical distance on a chromosome.
  - D) equivalent to a nucleotide.
  - E) equal to the number of recombinant progeny.

Answer: B

Skill: Factual recall

- 19) Which of the following is a nematode worm that has been used as a model organism in genetics?

- A) *Drosophila melanogaster*
- B) *Mus musculus*
- C) *Arabidopsis thaliana*
- D) *Caenorhabditis elegans*
- E) *Homo sapiens*

Answer: D

Skill: Factual recall

- 20) In eukaryotic cells, \_\_\_\_\_ are energy-producing organelles that contain DNA.

- A) nuclei
- B) lysosomes
- C) chromosomes
- D) nucleoli
- E) mitochondria

Answer: E

Skill: Factual recall

- 21) The principles of heredity were first established through breeding experiments carried out in \_\_\_\_\_ by Gregor Mendel.

- A) the late 1700s
- B) the 1950s
- C) the 1860s
- D) the early 1900s
- E) the mid-1600s

Answer: C

Skill: Factual recall

- 22) *Tetrahymena* is a

- A) fungus.
- B) protozoa.
- C) green alga.
- D) weed.
- E) bacteria.

Answer: B

Skill: Factual recall

- 23) Eukaryotic chromosomes consist of
- A) DNA alone.
  - B) DNA complexed with protein.
  - C) DNA complexed with RNA.
  - D) DNA complexed with fatty acids.
  - E) DNA complexed with protein and RNA.

Answer: B

Skill: Factual recall

- 24) Translation of RNA into proteins occurs
- A) in the nucleus.
  - B) in the endoplasmic reticulum.
  - C) in the cytoplasm.
  - D) in both the nucleus and the cytoplasm.
  - E) in both the nucleus and the endoplasmic reticulum.

Answer: C

Skill: Factual recall

- 25) The branch of genetics concerned with analyzing the structure and function of genes is
- A) molecular genetics.
  - B) plant genetics.
  - C) transmission genetics.
  - D) population genetics.
  - E) applied genetics.

Answer: A

Skill: Factual recall

#### TRUE/FALSE

- 26) Genetics is central to biology because genes and their functions form the basis of all life processes.

Answer: TRUE

Skill: Factual recall

- 27) There is a sharp divide between basic and applied research.

Answer: FALSE

Explanation: Basic and applied research employ the same information and similar techniques to answer questions.

Skill: Factual recall

- 28) The smooth endoplasmic reticulum has ribosomes attached to it.

Answer: FALSE

Explanation: The rough endoplasmic reticulum has ribosomes attached to it.

Skill: Factual recall

- 29) Centrioles are also called basal bodies.

Answer: TRUE

Skill: Factual recall

30) The centrosomes are a part of the chromosome that help in chromosome movement during mitosis and meiosis.

Answer: FALSE

Explanation: The centrosomes are a region of undifferentiated cytoplasm.

Skill: Factual recall

31) Bacteria and plants both have a rigid cell wall outside the cell membrane.

Answer: TRUE

Skill: Factual recall

32) Membrane-bound nuclei are characteristic of both Archaea and eukaryotes.

Answer: FALSE

Explanation: Membrane-bound nuclei are characteristic of eukaryotes. Archaea, like Bacteria, are prokaryotes.

Skill: Factual recall

33) Genetic maps show the relative location and arrangement of genes on chromosomes.

Answer: TRUE

Skill: Factual recall

34) Archaea are prokaryotes that are often found in inhospitable conditions such as hot springs and salt marshes.

Answer: TRUE

Skill: Factual recall

35) *E. coli* is a rod-shaped bacterium found in the human intestine.

Answer: TRUE

Skill: Factual recall

#### SHORT ANSWER

36) What is the hypothetico-deductive method of investigation?

Answer: The hypothetico-deductive method of investigation consists of observing a phenomenon, forming hypotheses to try and explain the observations, making experimental predictions based on those hypotheses, and finally testing out the predictions by doing specific experiments.

Skill: Factual recall

37) How do mutations help us in understanding the particular functions of a gene?

Answer: Comparing mutants with normal cells gives us an idea as to which life process has been affected. This helps us locate the mutated gene in the specific biochemical pathway for that particular process.

Skill: Conceptual understanding

38) How does the knowledge of complete genomes of different organisms help us in any way?

Answer: Since the function of most genes is conserved to a large degree among different organisms, the knowledge of the genomes of different species helps us compare them, leading to a better understanding of gene functions. This in turn will lead to a better understanding of human genetic diseases and will allow us to develop better cures.

Skill: Factual recall

39) How can a genetic map be used?

Answer: Genetic maps can be used in the process of localizing genes and studying the distribution of genes on chromosomes and in the genome.

Skill: Factual recall

40) What is recombination frequency?

Answer: Recombination frequency is the percentage of recombinant progeny, that is, the percentage of the progeny in which the arrangement of alleles has switched compared to their arrangement in the parents. This is taken to be a measure of the genetic distance between genes and is used to create genetic maps.

Skill: Factual recall

41) Are genetic maps based on the actual distance on chromosomes as measured by nucleotides?

Answer: No. Genetic maps are based on the frequency of recombination between genes. As such, they show relative distances between genes but cannot specify actual distance in terms of nucleotides.

Skill: Conceptual understanding

42) Which organelles besides the nucleus contain their own DNA?

Answer: The mitochondria in eukaryotes and the chloroplasts in plants contain DNA of their own.

Skill: Factual recall

43) The nucleus separates the chromosomes from the rest of the cell. How is the information in the DNA communicated to the cell?

Answer: The nuclear membrane has pores and is permeable to certain molecules. This allows selected materials, like RNA and proteins, to move in and out of the nucleus.

Skill: Factual recall

44) What is recombinant DNA technology?

Answer: Recombinant DNA technology encompasses procedures that allow scientists to join together DNA from two or more different organisms and make many identical copies of them (cloning).

Skill: Factual recall

45) For geneticists, why is it important that genetic variability exist in the population under study?

Answer: Genetic variation in individuals of a population is important for studying the inheritance pattern of those characteristics. If all the members of a population were identical for the trait under study, their progeny would be as well, and it would be impossible to determine how the trait was being passed on to the offspring.

Skill: Conceptual understanding

46) What characteristics does an organism have to possess to be a good genetic model?

Answer: To be a good genetic model, an organism has to have a well-known genetic history, a short life cycle, produce many offspring, be easy to handle, and have genetic variability among the individuals in a population.

Skill: Factual recall

47) Why are genetic databases so important to the study of modern genetics?

Answer: The available information about the genetics of a large number of organisms has increased dramatically in the past few years. As a result, it has become impossible to study, learn, and remember all of it. All this information needs to be stored in such a way that it may be accessed and searched easily. This is done in computer databases that have assumed enormous importance in the study of genetics.

Skill: Factual recall

48) What is the difference between PubMed and OMIM?

Answer: PubMed is a website that is used to access citations and abstracts of journal articles. OMIM is a database of human genes and genetic disorders.

Skill: Factual recall

49) What is the technique that is used to amplify DNA sequences?

Answer: The procedure employed to amplify DNA sequences is called polymerase chain reaction (PCR).

Skill: Factual recall

50) What are the differences between eukaryotes and prokaryotes?

Answer: Eukaryotes possess a nucleus that is separated from the rest of the cell by a double-layered nuclear membrane. Prokaryotes lack a nucleus. Prokaryotes also lack all membrane-bound organelles, such as mitochondria, endoplasmic reticula, and Golgi bodies. Such organelles are present in eukaryotes. Prokaryotes are generally also much smaller than eukaryotes, and are usually unicellular.

Skill: Factual recall