13. Which of the following is a purine?
   a) guanine    b) cytosine    c) thymine    d) uracil

20. The three components of a nucleotide are
   a) glucose, a phosphate group, and choline.
   b) an amino acid, a five-carbon sugar, and a phosphate group.
   c) a five-carbon sugar, a heterocyclic amine base and a phosphate group.
   d) a heterocyclic amine base, glycerol, and a fatty acid.

24. Which of the following molecules is not a source of energy?
   a) fats
   b) carbohydrates
   c) ATP
   d) DNA

26. RNA and DNA are different from each other in all but which one of the following ways?
   a) RNA consists of a single strand while DNA has two strands.
   b) RNA contains D-ribose while DNA contains D-2′-deoxyribose.
   c) DNA has a significant number of modified bases while RNA does not.
   d) DNA stores genetic information while RNA processes genetic information.

35. Which of the following terms can be used to refer to a structure of DNA in which the DNA is wrapped around protein cores and tightly coiled?
   a) solenoid
   b) genome
   c) oncogene
   d) nucleotide

44. The biological synthesis of new DNA is termed
   a) translation.
   b) transcription.
   c) conservation.
   d) replication.

49. The sum of all the hereditary material contained in a cell is called
   a) a gene.
   b) a DNA molecule.
   c) a chromosome.
   d) the genome.

50. A gene
   a) contains one DNA molecule.
   b) contains several DNA molecules.
   c) is a segment of a DNA molecule.
   d) is a DNA molecule plus the histone molecules.

51. The human genome contains approximately
   a) one million base pairs.
   b) three billion base pairs.
   c) twenty-three base pairs.
   d) forty-six base pairs.
53. The process of ordinary cell division which occurs in all the cells of the body except the reproductive cells is known as
a) mitosis.
 b) meiosis.
c) budding.
d) fusion.

60. If a segment of DNA consists of TCTAGC, the nucleotide order in the complementary mRNA will be
a) AGAUČG.
b) UAUGCA.
c) AGATCG.
d) TATGGA.

63. What is name of the process in which a strand of DNA is used to produce a strand of RNA?
a) replication
b) translation
c) transcription
d) restriction

72. Each codon is known to contain
a) three nucleotides.
b) one purine base.
c) five nucleotides.
d) two purine bases.

78. Translation refers to the process whereby
a) RNA is synthesized.
b) DNA is reproduced.
c) protein is synthesized.
d) all of these

84. During recombinant DNA procedures, double-stranded DNA is split at specific locations and “sticky ends” are formed. What is the meaning of this phrase “sticky ends”?
a) Unpaired bases are found on the ends of the broken strands.
b) Hydrogen bonds form between bases.
c) One base is substituted for another.
d) Broken peptide bonds between amino acids are formed.

7. Which of the following does not represent a class of nutrients?
a) proteins
b) vitamins
c) nucleic acids
d) carbohydrates

8. Zinc, copper, and cobalt are examples of:
a) vitamins
b) major elements
c) trace elements
d) none of these

9. Which of the following is a good source of polyunsaturated fatty acids?
a) whole milk
b) lamb chops
c) vegetable oil
d) butter

10. Which of the following is a fat soluble vitamin?
   a) Folic acid
   b) Vitamin B₁₂
   c) Vitamin C
   d) Vitamin D

11. The liver can detoxify many harmful substances by reducing them.
   a) True
   b) False

12. A meal of beans and rice provides a complete protein.
   a) True
   b) False

13. The following organelle contains many of a cell's digestive enzymes:
   a) mitochondrion
   b) nucleus
   c) lysosome
   d) peroxisome

14. The most common high energy phosphate bond can be classified as an:
   a) ester
   b) amide
   c) anhydride
   d) alcohol

15. Which of the following does not have a high-energy phosphate bond?
   a) ATP
   b) NADPH
   c) phosphocreatin
   d) 1,3-diphosphoglycerate

16. Which of the following is not found in procaryotes?
   a) nuclear material
   b) endoplasmic reticulum
   c) ribosomes
   d) cell membrane

17. Anabolic reactions usually involve:
   a) carbon oxidation and produce energy from the cell
   b) carbon oxidation and consume cellular energy
   c) carbon reduction and produce energy from the cell
   d) carbon reduction and consume cellular energy

18. Sunlight is the ultimate energy source for metabolism.
   a) True
   b) False

19. The synthesis of glycogen from glucose is known as:
   a) glycogenolysis
   b) gluconeogenesis
c) glycogenesis  
d) the Embden-Myerhof pathway

20. If the glucose level in the body is high, it is called:
a) homeostasis  
b) hyperglycemia  
c) hypoglycemia  
d) glycogenolysis

21. Another name for the citric acid cycle is:
a) Embden-Myerhof pathway  
b) pyruvic acid cycle  
c) Kreb's cycle  
d) glycogenesis

22. When blood-glucose is above a normal level the following condition results:
a) hypoglycemia  
b) hyperglycemia  
c) fasting condition  
d) homeostasis

23. Which of the following is *not* an example of a hormone?  
a) Insulin  
b) Oxytocin  
c) Cortisone  
d) all of the above are hormones

24. Which statement is incorrect?  
a) In humans the brain is almost totally dependent on fatty acids for energy  
b) Under anaerobic conditions contracting muscle relies on glucose for energy  
c) Some organs in humans can use carbohydrates, fats, and amino acids for energy  
d) The liver is responsible for maintaining an approximately constant blood glucose concentration

25. The equation below is an example of:
\[
\begin{align*}
\text{NH}_2 & \quad \text{O} & \quad \text{O} & \quad \text{NH}_2 \\
R\text{CHCOOH} & \quad + & \quad R'\text{CCOOH} & \quad \rightarrow & \quad R\text{C COOH} & \quad + & \quad R'\text{CHCOOH}
\end{align*}
\]
a) transamination  
b) saponification  
c) oxidative deamination  
d) catabolism

26. An individual on a diet, which is high in carbohydrate and low in protein, would probably have a:  
a) negative nitrogen balance  
b) high blood sugar  
c) positive nitrogen balance  
d) low blood sugar

27. Which of the following is the most important nitrogen molecule excreted by mammals?  
a) L-glutamine  
b) urea
c) uric acid
d) ammonia

28. Which statement is correct?
a) On a weight basis, fatty acids are more energy rich than carbohydrates and proteins
b) Amino acids can be converted to carbohydrates and fatty acids
c) Carbohydrates are the human body’s only energy source under anaerobic conditions
d) All the statements listed above are correct.

29. Describe one similarity and one difference between hormones and vitamins.

30. A mRNA has the sequence of codons 5′ CCC|AGA|GCC 3′. If a base substitution in the DNA changes the mRNA codon of AGA to GGA, how is the amino acid sequence affected in the resulting protein? What effect do you predict this might have on the protein function?

31. Explain why people who eat vegetarian diets should consume foods from several different sources.

3. Identify the oxidized form in each of the following pairs.
i) NAD⁺ or NADH
ii) NADP⁺ or NADPH
iii) FADH₂ or FAD