Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**DENTAL BIOCHEMISTRY AND NUTRITION**

 **(D-100)**

 **EXAM II**

 **NOVEMBER 07, 2011**

INSTRUCTIONS

1. Count the pages to make sure you have them all, 1 - 18.

2. Put your name on this page. On the front of the bubble sheet, write your name and bubble it in. Sign the back of the bubble sheet.

3. This page contains data that may help you in answering some of the questions.

4. If you need more space to work or answer problems, please use the back of the exam.

5. The point values of the questions are given for each section. There are **50** questions. The total number of points is 100.

6. Hand your completed exam to one of the Dental Biochemistry faculty members when you have finished.

CONSTANTS AND EQUATIONS

 Alcohol 7 Cal/g

Cal = kcal Fat 9 Cal/g

1 lb = 454 g; 1 kg = 2.2 lbs Carbohydrate 4 Cal/g

 Protein 4 Cal/g

BMR = 24 kcal/kg/day for men

 22 kcal/kg/day for women Protein RDA = 0.8 g/kg/day

Calories required for activity: 3500 kcal deficit to lose 1 lb. Sedentary ≈ 30% of BMR 4000 kcal excess to gain 1 lb.

Moderate (at least 1 hr. jogging/day) ≈ 60% of BMR

Heavy = 100% or more of BMR

 wt. (lbs) X 703

 Body mass index (BMI) =

 height (in.)2

1. Which of the following does **NOT** contribute to the basal metabolic rate?

A. Protein synthesis

B. Gluconeogenesis

\*C. Body movement

D. Ion transport

2. Each of the following can be converted into a fuel that can be oxidized by the brain **EXCEPT**

A. liver glycogen.

\*B. muscle glycogen.

C. muscle protein.

D. adipose tissue triacylglycerol.

E. red blood cell lactate.

3. A patient with an 11:00 appointment asks after an hour how much longer you will be because he is very hungry. In this person, which of the following hormones will most likely be elevated at 12:00 relative to its level at 11:00?

A. Insulin

B. PYY

\*C. Ghrelin

D. Leptin

E. Cholecystokinin

4. Loss of expression of which hormone can lead to early-onset obesity?

A. Insulin

B. NPY

C. Ghrelin

\*D. Leptin

E. Cholecystokinin

5. Perry O’Donnell is a healthy 176 lb dental student who wants to get into a competitive specialty, so he spends his waking hours studying and going to class. His daily energy expenditure is likely to be closest to

 A. 1900 kcal.

 B. 2100 kcal.

 C. 2300 kcal.

 \*D. 2500 kcal.

 E. 2700 kcal.

6. Perry’s diet gives him an average daily intake of 300 grams of carbohydrate, 120 grams of fat, and 100 grams of protein. His daily caloric intake is closest to

 A. 1900 kcal.

 B. 2100 kcal.

 C. 2300 kcal.

 D. 2500 kcal.

 \*E. 2700 kcal.

7. Using the above information, we can conclude that Perry is

 A. in negative nitrogen balance.

B. in positive nitrogen balance.

\*C. eating too much fat.

D. likely to lose weight.

E. None of the above.

8. Sucrose contains

A. fructose and galactose.

\*B. glucose and fructose.

C. glucose and galactose.

D. two galactose units.

E. two glucose units.

9. Insulin greatly stimulates glucose transport into

A. liver.

B. brain.

C. red blood cell.

\*D. muscle.

E. kidney.

10. Decreased levels of fructose-2,6-bisphosphate (F-2,6-BP) in liver will

A. increase glycolysis and gluconeogenesis.

B. decrease glycolysis and gluconeogenesis.

C. increase glycolysis and decrease gluconeogenesis.

\*D. decrease glycolysis and increase gluconeogenesis.

E. have no effect on glycolysis but increase gluconeogenesis.

11. Glycogen degradation requires activation of a series of enzymes in which order?

A. protein kinase A: adenylate cyclase: phosphorylase kinase: phosphorylase

B. adenylate cyclase: protein kinase A: phosphorylase: phosphorylase kinase

\*C. adenylate cyclase: protein kinase A: phosphorylase kinase: phosphorylase

D. phosphorylase kinase: phosphorylase: protein kinase A: adenylate cyclase

E. protein kinase A: adenylate cyclase: phosphorylase: phosphorylase kinase

12. The enzyme glucose 6-phosphatase is active in

A. glycogen synthesis in liver.

B. glycogen degradation in muscle.

\*C. gluconeogenesis in liver.

D. gluconeogenesis in muscle.

E. glycogen synthesis in muscle.

13. Which carbohydrate can be fully or partially digested in the human mouth?

\*A. Amylopectin

B. Dextran

C. Lactose

D. Isomaltose

E. Sucrose

14. Four hours after a high carbohydrate meal, compared to one hour after the meal, blood levels of

A. glucose and glucagon are unchanged.

B. glucose and insulin are high.

C. glucose is high and glucagon is low.

\*D. glucose and insulin are low.

E. glucose is low and insulin is high.

15. After fasting for 3 days, the major source of blood glucose is

\*A. gluconeogenesis in liver.

B. fat mobilization in adipose tissue.

C. glycogenolysis in liver.

D. glycogenolysis in muscle.

E. glucose synthesis from ketone bodies in liver.

16. In the liver, which pair of pathways is more active one hour after a meal

 than 8 hours after a meal?

A. Glycolysis and gluconeogenesis.

B. Glycolysis and glycogenolysis.

C. Glycolysis and β-oxidation of fatty acids.

\*D. Glycolysis and glycogen synthesis.

E. Gluconeogenesis and glycogen synthesis.

17. Conversion of glycogen to glucose requires

A. branching enzyme.

B. protein phosphatase-1.

\*C. glucose 6-phosphatase.

D. glucokinase.

E. aldolase.

18. A 43-year old female with type 1 diabetes has severe periodontal disease and tooth decay. The most reliable measure of her blood glucose levels over the past 3 months is her blood concentration of

A. insulin.

B. glucose.

C. vitamin B12.

D. iron.

\*E. hemoglobin A1c (HbA1c).

19. In the intestine, total absorption of glucose from dietary carbohydrate requires

A. glucagon

B. cAMP.

C. insulin.

\*D. transport of sodium ions.

E. transport of calcium ions.

20. The pentose phosphate pathway

A. produces 5-carbon sugars for nucleotide biosynthesis **ONLY** in the fed state, **NOT** in the fasted state.

\*B. is an alternative pathway for oxidizing glucose.

C. produces ATP.

D. produces NADH.

21. In the human body, UDP-glucuronate can be used to synthesize all of the following **EXCEPT**

A. a water soluble form of bilirubin.

\*B. ascorbic acid.

C. proteoglycans.

D. glycoproteins.

22. In the pathway of fructose assimilation, the enzyme aldolase B produces

A. fructose-6-phosphate

\*B. glyceraldehyde and dihydroxyacetone phosphate.

C. dihydroxyacetone and 1,3-bisphosphoglycerate.

D. dihydroxyacetone phosphate and glyceraldehyde-3-phosphate.

E. glucose-6-phosphate

23. Which of the following compounds is a major product of the action of pancreatic lipase but not of lipoprotein lipase?

A. Fatty acids

\*B. 2-Monoacylglycerol

C. Acetone

D. Cholesterol

E. Cholesterol ester

24. Linoleic acid and linolenic acid

\*A. contain double bonds between carbon-10 and the

terminal () carbon.

B. contain trans double bonds.

C. can be synthesized in humans from palmitate.

D. are short chain fatty acids containing 12 carbon atoms.

E. are monounsaturated fatty acids.

25. Most of the bile salt lithocholate is excreted in the feces because

A. no bile salts can be efficiently reabsorbed in the intestine.

\*B. it is too nonpolar to be reabsorbed.

C. it is a conjugated bile salt.

D. it is too large to be reabsorbed.

E. it has a pKa value lower than 2.

26. The rate-limiting enzyme for the biosynthesis of cholesterol is

A. HMG-CoA synthetase.

\*B. HMG-CoA reductase.

C. 7-alpha-hydroxylase.

1. acetyl CoA carboxylase.

E. Humans cannot synthesize cholesterol, it is essential in our diet.

27. In HDL particles, cholesterol is converted to to cholesterol esters by the enzyme

A. ACAT

\*B. LCAT

C. lipoprotein lipase

D. pancreatic lipase

28. Lipoprotein lipase

\*A. is activated by apoprotein CII.

B. catalyzes the hydrolysis of cholesterol ester to cholesterol.

C. is stimulated by glucagon.

D. converts VLDL to HDL.

29. LDL

A. is synthesized in intestinal epithelial cells.

B. contains very low levels of cholesterol and cholesterol esters, compared to other lipoprotein particles.

C. contains the apoproteins CI, CII, AI, AII, and B-100.

\*D. is taken up by liver and peripheral tissues via endocytosis.

30. The function of biotin in fatty acid synthesis is to

A. serve as a reducing agent.

B. cleave the ester bonds.

C. provide two-carbon units for acyl chain elongation.

\*D. serve as a carrier of activated carbon dioxide.

31. In the fed state,

\*A. fatty acid synthesis is active.

B. triacylglycerol synthesis in the liver in inactive.

C. cholesterol biosynthesis is inactive.

D. fatty acid oxidation is active.

32. Which of the following dietary lipids are protective against heart diseases?

A. Cholesterol

B. Trans fatty acids

\*C. Omega-3 polyunsaturated fatty acids

D. Triacylglycerols

33. A patient is treated with cholestyramine, a resin that binds some of the bile salts in the intestine, causing them to be excreted in the feces rather than recycled to the liver. This treatment will

\*A. stimulate the synthesis of additional LDL receptors.

B. inhibit HMG-CoA reductase.

C. inhibit lipoprotein lipase.

D. increase the formation of oxidized LDL.

34. The triacylglycerols packaged in VLDL

\*A. are mainly synthesized in liver cells.

B. are metabolized by pancreatic lipase.

C. contain one fatty acyl chain per molecule.

D. contain sphingosine.

35. A baby who is born normally later begins to vomit and fails to show normal behavior. The child begins to develop a peculiar odor resembling maple syrup. The child may be suffering from an inherited defect in metabolism of

\*A. valine

B. phenylalanine

C. tryptophan

1. tyrosine

E. threonine

36. Humans can take in creatine in their diet, but also make it using atoms from three amino acids. Which of the following is **NOT** one of those three amino acids?

A. Arginine

\*B. Asparagine

C. Glycine

D. Methionine

37. During a 24 hour fast, the rate of production of urea is expected to

\*A. increase.

B. decrease.

C. remain unchanged.

D. Each of the above occurs among different individuals

38. A weight lifter who is using a homemade completely synthetic diet, involving cornstarch and free amino acids, expects to gain muscle mass. Not having studied biochemistry, he is taking only 16 amino acids, and has left out arginine, leucine, glutamate, and asparagine. Although consuming 4500 calories per day, he begins to lose weight. The absence of which amino acid is causing this?

A. Arginine

\*B. Leucine

C. Glutamate

D. Asparagine

39. In the formation of IMP, which of the following amino acids contributes atoms directly?

A. Arginine

B. Tyrosine/Phenylalanine

C. Methionine

\*D. Glycine

40. A teen-aged dental patient shows strikingly pale gums, suggesting anemia, and you find that her diet is composed mainly of Diet Pepsi and Snickers bars. You make a suggestion that she consume more green foods and orange juice so that

A. she obtains all essential amino acids.

B. she obtains sufficient vitamin B12.

\*C. she obtains sufficient folate.

D. she obtains sufficient nitrogen.

41. The neurotransmitters epinephrine and norepinephrine are made from the amino acid

A. tryptophan.

B. arginine.

\*C. phenylalanine.

D. glutamate.

42. In the liver, amino groups are often transferred between amino acids. Aspartate aminotransferase uses aspartate as a substrate and makes oxaloacetate as one product. What is the other product likely to be?

A. Alanine

B. Pyruvate

\*C. Glutamate

D. Succinate

43. Which one of the following statements concerning trypsin is **NOT** correct?

A. It is an endoprotease.

B. It is secreted by the pancreas.

C. It cleaves after lysine or arginine.

\*D. It activates pepsinogen.

44. The enzyme carbamoyl phosphate synthetase I (CPSI)

A. is activated by PRPP.

\*B. is mitochondrial.

C. uses glutamine as a substrate.

D. produces carbamoyl phosphate for creatine formation.

45. Which of the following amino acids is solely ketogenic in its fate?

A. Methionine

B. Valine

\*C. Leucine

D. Phenylalanine

46. Proteoglycans are distinct from other types of glycoproteins in that they

A. contain both N-linked and O-linked glycosaminoglycans.

B. always exhibit more carbohydrate than protein content.

C. contain long branched carbohydrate structures.

\*D. contain long, unbranched, polyanionic, repeating disaccharide chains.

E. are always associated with epithelial cells, where they provide protection from the outside environment.

47. Elastins

A. are a distinct subclass of collagen protein.

\*B. contain stretchable hydrophobic regions separated by lysine-rich regions where intermolecular crosslinks form.

C. lack the strength of collagen due to the absence of strong cross-links between amino acid residues.

D. have high glycine content but relatively low proline content.

E. contain stretchable hydrophilic regions separated by cysteine-rich regions where intermolecular crosslinks form.

48. Which one of the following statements about integrins is **NOT** correct?

A. Integrins are transmembrane proteins.

\*B. Integrins are heterotrimers composed of ,  and  subunits.

C. Integrins play an essential role in cell motility.

D. Integrins connect the cytoskeleton with the extracellular matrix (ECM).

E. Integrins bind to the sequence Arg-Gly-Asp in ECM proteins.

49. A characteristic unique to collagen is

A. an unusually high number of disulfide bonds.

\*B. a triple helix that requires unusually high proline and glycine content.

C. resistance to compression due to unusually long, unbranched, negatively charged carbohydrate chains.

D. a high degree of hydration due to an unusual abundance of short, negatively charged carbohydrate chains.

50. Matrix metalloproteases

A. are regulated by phosphorylation and dephosphorylation.

B. degrade a class of extracellular matrix proteins called TIMPS.

C. activate procollagen to tropocollagen by removing terminal peptide fragments.

\*D. are sometimes attached to the cytoplasmic membrane to limit their activity to the immediate vicinity of the cell.

E. require iron (Fe2+) for activity.