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

**DENTAL BIOCHEMISTRY AND NUTRITION**

 **(D-100)**

 **EXAM II**

 **NOVEMBER 08, 2010**

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 **54** 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

**Section I. TRUE/FALSE (1 point each).**  **Choose A if the statement is TRUE and B if the statement is FALSE.**

1. During fasting, breakdown of muscle glycogen increases blood glucose levels. F

2. During starvation, use of ketone bodies by the brain spares the catabolism of T muscle protein.

3. After a 12 hour fast, liver cells derive most of their energy from metabolism of F glucose as fuel.

4. The sugar alcohol formed by reduction of glucose is sorbitol. T

5. Galactose can be synthesized by the human body. T

6. Lysine hydroxylase and proline hydroxylase are normally found in the F

extracellular matrix.

7. Collagen has a higher percentage of glycine residues than elastin. F

8. Mucins have a higher percentage of serine and threonine residues than T proteoglycans.

Section II. Choose the single best answer or completion (2 points each).

9. In the small intestine, pancreatic lipase converts triacylglycerols to fatty acids and

 A. glycerol.

 B. 1-monoacylglycerol.

 \*C. 2-monoacylglycerol.

 D. diacylglycerol.

 E. cholesterol.

10. The main product generated by the fatty acid synthase complex is

 A. malonate.

 B. malonyl CoA.

 C. arachidonate.

 \*D. palmitate.

 E. citrate.

11. Linoleic acid

 A. is a trans fatty acid.

 \*B. is an essential fatty acid.

 C. is a conjugated bile acid.

 D. is a saturated fatty acid.

 E. is a monounsaturated fatty acid.

12. Statin drugs inhibit

 A. uptake of dietary cholesterol.

 B. re-uptake of bile acids.

 C. synthesis of LDL receptors.

 D. synthesis of HDL in the liver.

 \*E. HMGCoA reductase.

13. LDL receptor

 A. cannot bind IDL.

 \*B. binds LDL via apo-protein B100.

 C. is the site for the action of ACAT.

 D. hydrolyzes triacylglycerols to fatty acids and glycerol.

 E. synthesis is stimulated by cholesterol in the liver.

14. HDL

 \*A. transfers apoprotein CII to chylomicrons and VLDL.

 B. is produced mainly in the brain.

 C. is metabolized by lipoprotein lipase.

 D. has the most triacylglycerol and the least protein among all lipoprotein particles.

 E. is associated with increased risk of atherosclerosis.

15. Fatty acid synthesis from glucose

 \*A. requires biotin.

 B. is active during fasting.

 C. is inhibited by citrate.

 D. is inhibited by high blood glucose levels.

 E. occurs only in adipose tissue.

16. NADPH

 A. is produced by the TCA cycle.

 B. serves as an oxidizing agent to metabolize polyunsaturated fatty acids.

 \*C. is required for the synthesis of cholesterol and fatty acids.

 D. serves as an activated carbon dioxide carrier in carboxylation reactions.

 E. is synthesized only in liver cells and adipocytes.

17. Lipoprotein lipase

 \*A. is activated by apoprotein CII.

 B. circulates in the blood.

 C. is stimulated by glucagon.

 D. converts VLDL to HDL.

1. is most abundant in the liver.

18. What percentage of bile salts is recycled by the liver each day?

 A. 5%

 B. 30%

 C. 50%

 D. 75%

 \*E. 95%

19. Which of the following dietary lipids protects against heart diseases?

 A. Cholesterol

 B. Trans fatty acids

 \*C. Omega-3 polyunsaturated fatty acids

 D. Triacylglycerols

 E. Phosphatidyl inositol

20. The direct product of the reaction of phosphorylase with glycogen is

 A. glucose.

 \*B. glucose-1P.

 C. glucose-6P.

 D. UDP glucose

 E. maltose.

21. In contrast to 1 hour after eating a high carbohydrate meal, 8 hours after eating a high carbohydrate meal, the blood concentration of

 A. glucose is high and glucagon is high.

 B. glucose is low and glucagon is low.

 C. glucose is high and insulin and glucagon are low.

 D. glucose is low and insulin is high.

 \*E. glucose is low and insulin is low.

22. During fasting glycogen synthase is **INACTIVATED** by

 \*A. protein kinase A.

 B. phosphorylase kinase.

 C. phosphodiesterase.

 D. protein phosphatase.

 E. cAMP.

23. A 45-year old male patient with type 2 diabetes with poorly-controlled blood glucose over the past 3 months would be expected to have above normal blood levels of

 A. sucrose.

 B. dextran.

 C. iron.

 D. C peptide.

 \*E. hemoglobin A1c (HbA1c).

24. Decreased levels of fructose-2,6-bisphosphate (F2,6BP) in liver

 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.

25. Transport of glucose into which of the following tissue is insulin-dependent?

 \*A. Adipose

 B. Brain

 C. Intestinal brush border cells

 D. Liver

 E. Red blood cells

26. The enzyme glucose 6-phosphatase is the last step in which two pathways?

 \*A. Glycogenolysis and gluconeogenesis.

 B. Glycogenolysis and glycolysis.

 C. Glycolysis and β-oxidation of fatty acids.

 D. Glycogenolysis and glycogen synthesis.

 E. Gluconeogenesis and glycogen synthesis.

27. Glucose is made in the liver from

 A. linoleic acid.

 B. acetone.

 C. β-hydroxybutyrate.

\*D. glycerol.

E. acetylCoA.

28. Which one of the following enzymes is the overall rate-limiting enzyme of the pathway in which it is active?

 A. Hexokinase.

 B. Pyruvate carboxylase.

 \*C. Fructose 1,6-bisphosphatase.

 D. Phosphoenolpyruvate carboxykinase.

 E. Glucose 6-phosphatase.

29. In the fasting state, glucagon stimulates

 \*A. gluconeogenesis in liver.

 B. triacylgycerol synthesis in adipocytes.

 C. fatty acid synthesis in liver.

 D. glycogen synthesis in muscle.

 E. glucose transport into brain.

30. Re-uptake of glucose from urine forming in the kidney requires

 A. AMP.

 B. cAMP.

 C. insulin.

 \*D. transport of sodium ions.

 E. transport of calcium ions.

31. After fasting for 2 days, the major source of blood glucose is

 \*A. gluconeogenesis in liver.

 B. gluconeogenesis in muscle.

 C. glycogenolysis in liver.

 D. glycogenolysis in muscle.

 E. glucose synthesis from ketone bodies in liver.

32. Pyruvate is the direct product of

 A. glyceraldehyde 3-P dehydrogenase and hexokinase.

 B. enolase and pyruvate kinase.

 C. enolase and hexokinase.

 \*D. pyruvate kinase and lactate dehydrogenase.

 E. phosphoenolpyruvate carboxykinase and hexokinase.

33. Which of the following enzymes is utilized in glycolysis and also in fructose metabolism?

 A. Fructokinase

 B. Pyruvate kinase

 C. Enolase

 \*D. Aldolase B

 E. Triose kinase

34. All of the following are products of the Pentose Phosphate Pathway **EXCEPT**

 A. ribose-5-phosphate.

 \*B. fructose-1,6-bisphosphate.

 C. NADPH.

 D. glyceraldehyde-3-phosphate.

35. The first step in the metabolism of galactose is

A. formation of UDP.

B. reduction to sorbitol.

C. epimerization to glucose.

\*D. formation of galactose 1-phosphate.

E. formation fo galactose 6-phosphate.

36. If an adult is missing tyrosine in their diet, what will happen?

 A. The body will break down muscle protein to scavenge tyrosine.

 B. The body will use more methionine, the precursor of tyrosine.

 C. The body will make more phenylalanine to compensate.

 \*D. The body does not need dietary tyrosine, so there are no adverse consequences.

37. A younger adult female patient who has been seeing you for some time appears in your office for a cleaning and checkup, and you note that her gums are unusually pale. You note that this anemia could be a result of

 \*A. A dietary shortfall of folic acid (folate).

 B. A dietary shortfall of cysteine.

 C. A dietary shortfall of nucleic acids.

 D. A dietary shortfall of vitamin B12.

 E. A dietary excess of banana cream pie.

38. In humans, the metabolism of methionine involves several cofactors/vitamins. Which of the following is **NOT** associated with methionine metabolism?

 A. Pyridoxal phosphate/vitamin B6

 \*B. Niacin/vitamin B3

 C. Vitamin B12

 D. Tetrahydrofolate/folic acid

39. Leucine has an unusual property among amino acids:

 A. It is essential, but only in infants, **NOT** adults.

 \*B. Overall, its carbon atoms cannot be used to form new glucose on a net basis.

 C. It is the only branched chain amino acid that is metabolized in muscle.

 D. It is the only branched chain amino acid that is essential in the human diet.

40. Which of the following amino acids contributes one or more carbon or nitrogen atoms to the synthesis of purines?

 \*A. Glutamine

 B. Phenylalanine

 C. Cysteine

 D. Glutamate

 E. Alanine

41. After 12 hours of fasting, urea synthesis is very active. This is because the body

 \*A. is actively using amino acid carbon skeletons to make glucose, and needs to dispose of waste nitrogen.

 B. is making ketone bodies, which stimulate CPS1 (CPS ammonia).

 C. has high levels of CPSII activity, and is actively forming pyrimidines.

 D. is actively making purine nucleotides, which are the precursors of urea.

42. The amino acids proline and arginine are made in the human body from

 A. histidine.

 B. phenylalanine.

 C. aspartate.

 D. asparagine.

 \*E. glutamate.

43. Epinephrine, an important hormone and neurotransmitter, is made in humans from

 A. histidine.

 \*B. phenylalanine.

 C. tryptophan.

 D. arginine.

 E. glutamate.

44. In humans, the carbon atoms of serine can be derived from a short de novo pathway starting with

 \*A. An intermediate of glycolysis.

 B. An intermediate of TCA (citric acid cycle).

 C. An intermediate in the breakdown of odd-chain fatty acids.

 D. An intermediate in the formation of arginine.

45. In humans, an important step in the biosynthesis of DNA precursors is catalyzed by an enzyme that converts

 A. ribonucleosides to deoxyribonucleosides.

 B. ribonucleoside monophosphates to deoxyribonucleoside monophosphates.

 \*C. ribonucleoside diphosphates to deoxyribonucleoside diphosphates.

 D. ribonucleoside triphosphates to deoxyribonucleoside triphosphates.

46. In humans,

 A. the first protease to work on ingested protein cleaves after lysine or arginine.

 B. the first protease to work on ingested protein is an exoprotease.

 \*C. one gut protease cleaves the zymogen form of many of the other gut proteases.

D. the gut protease that cleaves after arginine and lysine is itself activated by the exoprotease called carboxypeptidase.

47. In humans, creatine is formed by atoms contributed from

 A. glycine, glutamine and asparagine.

 B. aspartate, glutamine and glycine.

 C. arginine, aspartate and glutamine.

 \*D. arginine, glycine and methionine.

1. alanine, glutamine and methionine.

48. Mucins and proteoglycans differ **MOST** in

 A. their overall charge.

 B. their ability to bind water.

 C. the amount of sugar that is attached per protein molecule.

 \*D. the lengths of their respective sugar chains.

 E. the number of branches in their sugar chains.

49. Integrins are located in the

 A. outer mitochondrial membrane.

 B. cytoplasm.

C. smooth endoplasmic reticulum and vesicles of the Golgi apparatus.

 \*D. cytoplasmic membrane.

 E. extracellular matrix.

50. A common property of glycosaminoglycans is

A. a high density of positive charges.

\*B. reversible compressibility.

C. branched sugar chains.

D. a large variety of different sugar residues.

E. a high percentage of glycine and proline.

51. In a normal person, adipocytes produce

 A. leptin during fasting.

 \*B. leptin in the fed state.

 C. ghrelin during fasting.

 D. ghrelin in the fed state.

52. Denise Drill is a healthy 110 lb dental student who spends her waking hours studying and going to class. Her daily energy expenditure is likely to be closest to

 A. 1100 kcal.

 B. 1250 kcal.

 \*C. 1450 kcal.

 D. 1650 kcal.

 E. 2050 kcal.

53. Denise’s diet gives her an average daily intake of 150 grams of carbohydrate, 50 grams of fat, and 110 grams of protein. Her daily caloric intake is closest to

 A. 1100 kcal.

 B. 1250 kcal.

 \*C. 1450 kcal.

 D. 1650 kcal.

 E. 2050 kcal.

54. Using the above information, we can conclude that Denise is

 A. in positive nitrogen balance.

 B. eating too much fat.

 C. not eating enough carbohydrate.

\*D. None of the above.