

BMB 514 — Exam II — October 11, 2004**Tear off and keep this for your record of your answers.**

ANSWER GRID

Version of the Exam: 1A

1.		6.		11.		16.		21.		26.	
2.		7.		12.		17.		22.		27.	
3.		8.		13.		18.		23.		28.	
4.		9.		14.		19.		24.		29.	
5.		10.		15.		20.		25.		30.	

Print Name _____
Circle one: CHM COM

BMB 514 — Exam II — October 11, 2004

BEFORE you begin the exam, please complete the following information on your response sheet:

- (a) your name and signature
- (b) your student number (PID)
- (c) your college — in the area under **SECTION:** mark **001** for CHM student
mark **002** for COM student
- (d) your version of the exam is **1A** – mark this in the area under **FORM**

- There are 30 questions on this exam. For each question, mark the letter corresponding to what you consider is the **BEST** answer on the response sheet provided.
- When you leave the exam room, please turn in your **RESPONSE SHEET** and your **EXAM** to the proctors standing by the doors **INSIDE** the auditorium. Once you exit the auditorium, please **DO NOT** return until we have reopened the doors (~8:45 a.m.).
- There will be answer keys to this exam outside A-133 Life Sciences after the exam is completed. You may wish to copy your responses from the response sheet onto the answer grid on the first page of this exam so that you can check your results. You can tear off the first page and take it with you.
- You have 60 minutes to complete this exam. We will close the exam promptly at 8:30 a.m. Once we withdraw the boxes for the response sheets from the doors, no additional response sheets will be accepted.
- Do well and good luck.

1. Which of the following statements about carbohydrates is **FALSE**?
 - A. Carbohydrate digestion does not occur in the stomach.
 - B. Cellulose is not digested because we lack β 1,4-glucosidase.
 - C. Digoxin inhibits the uptake of fructose by blocking the Na^+ - K^+ ATPase.
 - D. Maltases, sucrases and isomaltases are attached to intestinal mucosal cells.
 - E. A genetic defect in lactase can lead to water retention in the gut and diarrhea.

2. Which of the following statements about glycolysis is **TRUE**?
 - A. It creates a net yield of 4 moles of ATP per mole of glucose consumed.
 - B. Hexokinase catalyzes the committed step of glycolysis.
 - C. Under anaerobic conditions, glycolysis produces 1 mole of lactate per mole of glucose.
 - D. Phosphofructokinase is allosterically regulated by an isomer of fructose 1,6-bisphosphate.
 - E. Glucokinase is inhibited by glucose-6-phosphate.

3. Which of the following statements **incorrectly** describes the reaction catalyzed by glyceraldehyde 3-P dehydrogenase?
 - A. Produces one mole of NAD^+ per mole of glyceraldehyde 3-phosphate consumed
 - B. Is an example of substrate level phosphorylation
 - C. Involves the formation of a thiohemiacetal on the enzyme
 - D. Oxidation plays a critical role in the formation of the high energy intermediate
 - E. It is a highly reversible process

4. Which of the following **correctly** describes the enzymes and reactions involved in the entry of carbons from fructose into the glycolytic pathway?
 - A. Fructokinase is inhibited by fructose-6-phosphate.
 - B. Fructose intolerance is primarily caused by a defective fructose-1-P aldolase.
 - C. The liver damage caused by fructose intolerance is due to accumulation of NADH.
 - D. Fructose can effectively compete with glucose for hexokinase.

5. The conversion of two moles of pyruvate into 1 mole of glucose requires all of the following **EXCEPT**?
 - A. malate dehydrogenase activity in 2 different cellular compartments
 - B. 2 moles of GTP
 - C. An oxaloacetate transporter in the mitochondrial membrane
 - D. Biotin
 - E. low levels of fructose 2,6-bisphosphate

6. Which of the following statements about the pyruvate dehydrogenase complex (PDH) is **TRUE**?
- A. The complex will be in a phosphorylated state following a carbohydrate rich meal.
 - B. Pyruvate inhibits PDH activity.
 - C. NADH inhibits PDH activity.
 - D. The reaction consumes one mole of CO₂.
 - E. Acetyl CoA increases PDH activity.
7. Which of the following **CORRECTLY** describes the conversion of pyruvate to oxaloacetate during gluconeogenesis?
- A. ATP is a negative effector.
 - B. Acetyl CoA is a positive effector.
 - C. NADH is a cofactor for the reaction.
 - D. The enzyme utilizes a lipoic acid to create a long arm.
 - E. Produces 1 mole of ATP per mole of pyruvate converted.
8. Which of the following **INCORRECTLY** describes the mitochondrial structure and/or function?
- A. Contains multiple copies of a genome inherited from your mother
 - B. Contains two membranes with different permeability characteristics.
 - C. The outer membrane contains voltage gated anion channels
 - D. The inner membrane contains the proteins necessary to the electron transport chain
 - E. The ATP produced by Complex V (ATP synthase) is directly released into the intermembrane space
9. Which of the following **INCORRECTLY** describes the conditions and/or the enzyme complex necessary for the following reaction:
- $$\text{Pyruvate} + \text{NAD}^+ + \text{HSCoA} \rightarrow \text{Acetyl CoA} + \text{NADH} + \text{CO}_2$$
- A. Involves three separate enzymes and 5 cofactors
 - B. Utilizes FAD and NAD to regenerate the oxidized form of lipoic acid
 - C. Arsenic inhibits by binding to lipoic acid
 - D. Pyruvate decarboxylase (Enzyme 1) utilizes thiamine pyrophosphate as a carrier of hydrogen
 - E. The acetyl-CoA is released from dihydrolipoyl transacetylase (Enzyme 2).

10. Which of the following statements about the TCA cycle is **TRUE**?
- A. Increased level of FADH_2 inhibits succinate dehydrogenase
 - B. The reaction catalyzed by succinate dehydrogenase produces GTP
 - C. Citrate synthase is positively regulated by ATP
 - D. Only two steps produce NADH
 - E. Isocitrate dehydrogenase produces one mole of ATP
11. Which enzyme of the TCA cycle would be directly affected by a diet that lacks thiamine?
- A. succinate dehydrogenase
 - B. malate dehydrogenase
 - C. α -ketoglutarate dehydrogenase
 - D. citrate synthase
 - E. fumarase
12. Moving NADH into the mitochondria from the cytosol involves two shuttles; which of the following statement about the Malate-Aspartate Shuttle is **FALSE**?
- A. A transaminase is necessary for its function
 - B. Does not shuttle NADH directly
 - C. Requires two isozymes of malate dehydrogenase to function properly
 - D. It is irreversible
13. The electron transport chain (ETC) is comprised of four complexes. Which of the following statements **INCORRECTLY** describes the ETC and its complexes?
- A. Complex I uses FMN as a cofactor
 - B. Complex II does not pump protons
 - C. Complex IV produces reduced Coenzyme Q (QH_2)
 - D. Complex IV is the only complex that uses copper as a cofactor
 - E. The entire ETC is inhibited by a high proton concentration in the intermembrane space

14. A patient is brought into the emergency room near death. You have determined that he has been exposed to a mitochondrial poison. His life depends on determining to what poison he has been exposed. You quickly determine that his mitochondria are not making ATP nor utilizing O_2 . Addition of 2,4 DNP does not restore oxygen consumption and he has a build up of reduced Coenzyme Q (QH_2) with little reduced cytochrome c. What poison caused the patient's condition?
- A. Amytal
 - B. Hydrogen Sulfide
 - C. Carbon monoxide
 - D. Antimycin
 - E. Oligomycin
15. The P/O ratio describes what aspect of mitochondrial function?
- A. relationship between NADH produced and cytochrome oxidase function
 - B. The activity of Complex IV in the presence of oxygen versus the absence of oxygen
 - C. The ratio of ATP produced over the amount of oxygen consumed
 - D. The ratio of phosphate consumed over the amount of NADH consumed
16. Which of the following **CORRECTLY** describes the pentose phosphate pathway
- A. Produces NADPH during the non-oxidative phase
 - B. glucose-6-phosphate dehydrogenase catalyzes the committed step
 - C. Produces 4 moles of NADPH per mole of glucose-6-phosphate converted to pentose-5-phosphate
 - D. Cannot produce ribose-5-phosphate without producing NADPH
17. A patient with a genetic defect in glucose-6-phosphate dehydrogenase wants to take a trip to Africa and is required to take mefloquine (an antimalarial drug) prior to obtaining her visa. Two nights after starting her mefloquine, she has a special meal of fava beans and liver. Soon after finishing the meal she collapses and is rushed into the emergency room where she is diagnosed with severe hemolytic anemia. What of the following best describes a likely cause of her anemia?
- A. The mefloquine is inhibiting her electron transport chain and she has run out of ATP
 - B. inability to maintain NADPH within her RBCs following the oxidative stress of mefloquine and fava beans
 - C. inability to maintain a pool of reduced glutathione because of the genetic defect and high oxidative power of the mefloquine and fava beans
 - D. B and C
 - E. None of the above

18. Which of the following **INCORRECTLY** describes the synthesis of glycogen?
- A. requires a 'primer' glycogen molecule
 - B. Glycogen synthase catalyzes the formation of a 1,6 glycosidic bond
 - C. Requires ATP to maintain proper UTP levels
 - D. A pyrophosphatase drives the synthesis of UDP glucose by removing the product, PP_i
19. The reciprocal regulation between glycogen synthase and glycogen phosphorylase involves which of the following?
- A. Biological amplification
 - B. cAMP production
 - C. protein kinases
 - D. A and C
 - E. all of the above
20. Which of the following best describes the glycogen stores of a patient with Von Gierke's disease (glucose 6-phosphatase deficiency)?
- | | <u>Amount</u> | <u>Branching</u> |
|----|----------------------|-------------------------|
| A. | higher than normal | normal branching |
| B. | normal | short outer branches |
| C. | Lower than normal | normal branching |
| D. | higher than normal | very long branches |
| E. | higher than normal | short outer branches |
21. In which of the following pathways is CO_2 first incorporated to form a 3 carbon CoA derivative and later released to drive the reaction,
- A. β oxidation
 - B. cholesterol synthesis
 - C. fatty acid synthesis
 - D. ketone body synthesis



22. The pathway shown above represents the process of fatty acid oxidation, where the Letters (A-E) represent enzymes catalyzing steps (arrows) in the pathway. Which of the letters is **incorrectly** matched with the enzyme or reaction it represents?
- acetyl CoA synthetase
 - FAD-dependent dehydrogenase
 - hydratase
 - NAD-dependent dehydrogenase
 - β -ketothiolase
23. You are trying a low carbohydrate/high fat diet and have succeeded in developing mild ketosis. In this state you would expect
- the rate of fatty acid synthesis to be high.
 - gluconeogenesis to be proceeding at a significant rate in the liver.
 - the rate of glycolysis to be high.
 - triglycerides to be rapidly synthesized and stored.
 - cholesterol synthesis to be occurring at a high rate.
24. Fatty acid synthesis from acetyl CoA requires
- export of malate from the mitochondria
 - conversion of acetyl CoA to acetoacetyl CoA by β ketothiolase
 - biotin as a cofactor for acetyl CoA carboxylase
 - NADH
 - HMG CoA reductase
25. Cholesterol synthesis occurs in the cytoplasm of most cells. Which of the following statements **INCORRECTLY** describes the process:
- the first three steps are the same as the first three steps of ketone body synthesis
 - utilizes 18 acetyl CoA and 18 ATP as well as NADPH
 - is stimulated by insulin
 - is stimulated by cholic acid as a positive effector of HMG CoA reductase
 - is inhibited by cholesterol as a negative influence in HMG CoA reductase synthesis

26. Lipid soluble vitamins have all the following features **EXCEPT**
- A. Obstruction of the bile duct can result in malabsorption and deficiency.
 - B. They are stored in fat tissue and high doses can be toxic.
 - C. They are very readily degraded through cooking.
 - D. Many have complex functions not yet fully understood.
27. Polyunsaturated fats are often used to make margarine, but may be treated with reducing agents to “hydrogenate” them. This process
- A. makes them more liquid.
 - B. makes them easier to metabolize.
 - C. creates more ‘trans’ double bonds which tend to increase cholesterol levels.
 - D. converts ω -3 fatty acids into ω -6 fatty acids.
 - E. makes them more unsaturated
28. A patient with carnitine deficiency is in a fasting state, but does not produce ketone bodies because:
- A. gluconeogenesis will not occur in the absence of carnitine.
 - B. lipids will not be mobilized from fat tissue.
 - C. ketone bodies are only produced in diabetics.
 - D. fatty acids can’t get into the mitochondria to allow ketone body synthesis.
29. Synthesis of phospholipid and triglyceride
- A. occur by identical pathways except for a single last step.
 - B. have a common ‘backbone’, serine, used for fatty acid attachment.
 - C. are stimulated by insulin activation of acyl transferase.
 - D. occurs only in adipose tissue.
30. Cholesterol is an essential lipid whose synthesis is highly regulated. However, many individuals have problems due to excess cholesterol in circulation. “Statins” are a class of drugs that successfully lower cholesterol by
- A. inhibiting cholesterol synthesis at HMG CoA synthase.
 - B. promoting cholesterol degradation.
 - C. competitively inhibiting conversion of HMG CoA to mevalonate.
 - D. inhibiting uptake of dietary cholesterol in the gut.

BMB 514
Exam II
October 11, 2004

ANSWER KEY

Version of the Exam: 1A

1.	C	6.	C	11.	C	16.	B	21.	C	26.	C
2.	D	7.	B	12.	D	17.	D	22.	A	27.	C
3.	A	8.	E	13.	C	18.	B	23.	B	28.	D
4.	B	9.	D	14.	D	19.	E	24.	C	29.	C
5.	C	10.	A	15.	C	20.	A	25.	D/A	30.	C