Biochemistry 694:301
Third Test Dr. Deis
Tue. Nov. 20, 2001

Name_____
last 5 digits of I.D. Num _____
Row Letter ____ Seat Number _____

This exam consists of two parts. Part I is multiple choice. Each of these 25 questions is worth two points. Answer the Part I questions on this sheet, below. Answer the Part II questions on the question pages.

Please use BLOCK CAPITAL letters like this --- A, B, C, D, E. Not lowercase!

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

GRADE:

Part I Total _____

Part II:

- II-1 _____
- II-2 _____
- II-3 _____
- II-4 _____
- II-5 _____

Part II Total _____

Total, I & II _____

1. Which compound allosterically decreases the activity of Isocitrate DH?
   A. ATP
   B. ADP
   C. cAMP
   D. F2,6 BP
   E. Citrate

2. Succinate DH occurs where?
   A. mito matrix
   B. mito inner membrane
   C. cytoplasm
   D. outer membrane
   E. lumen of endoplasmic reticulum

3. How many "~P" or "ATP" are produced by the oxidation of one mole of Pyruvate in respiring mitochondria?
   A. 2
   B. 6
   C. 10
   D. 12.5
   E. 30

4. In the mechanism for the Pyruvate DH Complex, what re-oxidizes Dihydrolipoamide to Lipoamide?
   A. NADPH
   B. NAD+ only
   C. FAD only
   D. FAD and NAD+
   E. none of the above

5. Acetyl CoA labeled at C-1 is introduced into the Citric Acid Cycle. Where does the carbon show up in alpha-Ketoglutarate during the *first* turn of the cycle?
   A. C-1
   B. C-2
   C. C-3
   D. C-4
   E. C-5

6. The Fe_4S_4 Iron Sulfur Cluster is shaped like a
   A. sphere
   B. doughnut
   C. triangle
   D. baseball diamond
   E. cube

7. Compared with cytochromes, iron sulfur clusters are
   A. higher in energy, evolutionarily older
   B. higher in energy, evolutionarily younger
   C. lower in energy, evolutionarily older
   D. lower in energy, evolutionarily younger
   E. none of the above

8. A "Racker's Knob" consists of the F_1 "knob" and the transmembrane F_o. The movement of protons inward through the Racker's Knobs causes rotation of
   A. F_1 only
   B. F_o only
   C. F_1 and F_o
   D. neither
   E. alpha and beta subunits of F_1

9. The existence of the ATP-ADP shuttle was proven when a specific inhibitor was discovered – the inhibitor is
   A. Bungarotoxin
   B. Atractyloside
   C. Amytal
   D. Cyanide
   E. Antimycin A

10. During the Q-cycle in mitochondria, "inward facing" Q is reduced to QH_2 by interacting directly with what?
    A. cytochrome c
    B. Rieske FeS
    C. cytochrome c_1
    D. b_H
    E. b_L
    F. none of the above

11. The genetic disease Wernicke-Korsakoff Syndrome was described in a handout and in class. It can cause brain damage, and results from weak binding between
    A. Transketolase and TPP
    B. Transaldolase and TPP
    C. G6PDH and $NADP^+$
    D. Glycogen and Phosphorylase a
    E. none of the above

12. If we run five molecules of hexose (Fru-6-P or Glu-6-P) through the oxidative branch of the Pentose Phosphate Pathway, we will get
    A. 5 Rib-5-P and 5 NADPH
    B. 5 Rib-5-P and 10 NADPH
    C. 6 Rib-5-P
    D. 6 Rib-5-P and 5 NADH
    E. 6 Rib-5-P, 5 NADPH, 5 NADH

13. The mechanism of Transketolase depends on a covalent connection between substrate and
    A. lysine
    B. cysteine
    C. glucose
    D. trans-fatty acids
    E. TPP

14. A deficiency of G6PDH can lead to
    A. Pamaquine induced hemolytic anemia
    B. Wernicke-Korsakoff Syndrome
    C. Diabetes
    D. a Selenium deficiency
    E. all of the above

15. Why is G6Pase a "dangerous" enzyme?
    A. it forms peroxides
    B. uses up NADPH
    C. wastes energy, lets glucose leave the cell
    D. makes holes in membranes
    E. it's radioactive

16 Glycogen Synthase lengthens the chain of glycogen by reacting with
    A. Glucose-1-P
    B. Glucose-2-P
    C. Glucose-6-P
    D. UDP-Glucose
    E. UDP-Galactose

17. You can exhaust your supply of muscle glycogen by
    A. smoking a cigar
    B. walking to class
    C. weight training one hour
    D. taking a final exam
    E. running a marathon

18. A glycogen molecule has hundreds or thousands of non reducing ends, and
    A. hundreds of non-reducing ends
    B. one non-reducing end, free to react
    C. one non-reducing end, attached to UDP
    D. one non-reducing end, attached to Glycogenin

19. A patient with cirrhosis of the liver who states that he never drinks alcohol is biopsied. When the glycogen biopsy is analyzed in the lab, breakdown with the normal enzymes yields 95% Glucose-1-P and only 5% Glucose. Which Glycogen Storage Disease does the patient have?
    A. I lack of G6Pase
    B. III lack of Debranching Enz.
    C. IV lack of Branching Enz.
    D. V phosphorylase defic.
    E. none of the above

20. During glycogen synthesis, the "Branching" enzyme moves how many glucose residues from the main chain to form a branch?
    A. 1
    B. 3
    C. 7
    D. 11
    E. 25

21. The complete oxidation of a molecule of Palmitate (16:0) in respiring mitochondria would cause a net gain of how many ATP?
    A. 131
    B. 129
    C. 108
    D. 106
    E. 38

22. The Reductase used during catabolism of Δ-even fatty acids adds hydrogens at positions:
    A. 1 and 2
    B. 2 and 3
    C. 3 and 4
    D. 4 and 5
    E. 2 and 5

23. The fatty acid 20:3 cis Δ^{11}, Δ^{14}, Δ^{17}, was derived from a common dietary fatty acid. By comparing ω numbers we can deduce that the metabolic source for this fatty acid is probably:
    A. palmitic
    B. oleic
    C. linoleic
    D. linolenic
    E. none of the above

24. During fatty acid synthesis, a _____ double bond is reduced by the cofactor _____
    A. cis, $FADH_2$
    B. trans, $FADH_2$
    C. cis, NADPH
    D. trans, NADPH
    E. cis, NADH
    F. trans, NADH

25. After this exam I will
    A. laugh
    B. cry
    C. drink
    D. sleep
    E. cannot tell from data provided

Answer these questions here on the question pages.

1. a. Show how Oxaloacetate would be converted into Succinyl CoA by the enzymes of the Citric Acid Cycle, starting with Citrate Synthase (and NOT with Malate DH!). Draw all reactants and products, name all enzymes, and indicate all cofactors. About 1/2 point per fact. If you wish, you can simply draw out the whole cycle.

(8)

b. Show the "handoff" which occurs in the Pyruvate DH Complex when Dihydrolipoyl Transacetylase picks up the Acetyl group. Draw the structures of the "important parts" of the cofactors involved, and show them and the 2 carbon fragment before and after the transfer. Use back of page if necessary.

(2)

2. a. Write out the linear form of the "main line" of the Mitochondrial Respiratory Chain, starting with NADH and ending with Oxygen. Divide the chain into three complexes and label the complexes.

(5)

b. Calculate the standard potential difference and the standard free energy change when two electrons are transferred from NADPH to NO_3, using the half reaction potentials shown below. F=23.06 kcal/V mol, R = 1.987 cal/mol K and T = 300 K. Show work, state equation(s) and circle answers. What would this process be called? It's common among anaerobic microorganisms.

(5)

Reduction Half Reaction	n	E_o'
$NADP^+$ -> NADPH	2	- 0.330 volts
NO_3 -> NO_2	2	+0.421 volts

3. a. Show the oxidative branch of the Pentose Phosphate Pathway, starting with Glucose-6-P and ending with Ribose-5-P.

(5)

(2) b. Diagram the Cori Cycle -- label organs and pathways involved. No structures required for this problem.

c. Pyruvate Carboxylase is a critical step in Gluconeogenesis. Show the reaction it catalyzes, AND tell what compartment it's in. Draw reactants and products, indicate cofactors and required activators.

(3)

4. a. Diagram the Glycogen Breakdown Cascade, starting with Epinephrine and ending with Glucose-1-P. Remember to add required cofactors.

(6)

b. Glycogen Phosphorylase can respond either to hormonal control or to conditions within the cell – that is, it can be activated in very different ways. Show how the activation/inactivation occurs, with chemical and conformational changes. A diagram would be very helpful.

(4)

5. a. Show the beta-oxidation of fatty acids -- fill in the details on the structures provided below. Don't forget to show cofactors!

(6)

CH_3 CH_2 CH_2 CH_2 CH_2 CO SCoA

C C C C C C SCoA

C C C C C C SCoA

C C C C C C SCoA

you draw next step:

b. Ketone Bodies are formed via HMG CoA. Draw HMG CoA and show the reaction that converts it into a Ketone Body. Draw reactants and products and name enzyme.

(2)

c. An excess of Ketone Bodies is known as Ketosis. What conditions are likely to produce Ketosis in humans? How does the Atkins Diet induce Ketosis?

(2)