



WEEK NO. 6 +7+8

الطب



# METABOLISM

DOCTOR 2019 | MEDICINE | JU

**DONE BY :**

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## **-Past Papers:**

1) Requires vitamin B12:

**A-Oxidation of odd numbered FA**

**B-Oxidation of unsaturated fatty acid**

**C-Acetyl CoA Carboxylase**

**D-Convert acetyl coA to Malonyl CoA**

2) Which of the following products is not an intermediate of the pentose phosphate pathway ?

a. **NADP**

b. **CO<sub>2</sub>**

c. **Ribose5-phosphate**

d. **NADH and ATP**

e. **Fructose 6-phosphate**

3) Which of the following enzymes is the first enzyme unique to PPP ?

a. **Glucose 6 phosphate dehydrogenase**

b. **6-phosphogluconolactone dehydrogenase**

c. **Transaldolase**

4) At the condensation step ( malonyl CoA & acetyl CoA ) in the fatty acid synthesis the following result is:

**A- release of CO<sub>2</sub>**

**B-require CO<sub>2</sub>**

**C-Forming NADPH**

**D-produce hexoacyl-ACP**

**5)The step required to activate\start TAG synthesis?**

**A- activation of fatty acids by addition of CoA.**

**B-forming DHAP**

**6) True about characteristics of G6PD deficiency:**

**A-has low amount of NADPH.**

**B-RBCs most affected**

**C-Provide resistance to malaria**

**D- All of the above**

**7) True about TAG synthesis:**

**A-DHAP is reduced to glycerol phosphate in adipose tissue**

**B-Glycerol kinase play important role**

**C-It's not a hormone sensitive process**

**D-Phosphatidate is not on the pathway of TAG synthesis**

**8) Right about the conversion from hydroxy acyl coA to ketoacyl coA:**

**A- Requires NAD<sup>+</sup>.**

**B-The enzyme that involved is enoyl-coA hydratase**

**C- It's an hydration process**

**9)What inhibits carnitine shuttle?**

**a. Malonyl coA**

**b. Acyl CoA**

**c. Acetyl CoA**

**d. Acetoacetate**

**10)Its oxidation gives H<sub>2</sub>O<sub>2</sub>:**

**11)all of the following produces ROS except :-**

**a-CoQ in normal respiratory chain**

**b- oxidases**

**c- ionizing radiation**

**d- respiratory burst**

**e- lactic acid formation**

**12)something wrong about pentose phosphate pathway (PPP)**

**a- necessary for synthesis of steroid hormones in testis and ovaries**

**b- produce intermediates of glycolysis**

**c-NADPH inhibits it**

**d- produces NADPH in the reversal pathway**

**13)Glycerol phosphosphate + X -----> Y + Z,, x+y+z represents respectively**

**a- FAD+DHAP+FADH<sub>2</sub>**

**c- NADP+DHAP+NADPH**

**b-NAD<sup>+</sup> +glyceraldehyde3phosphate+NADH<sub>2</sub>**

**d-NAD<sup>+</sup> +DHAP+NADH**

**14)butyric acid is formed by synthase by which of the following :-**

**a- oxidation of long fatty acid**

**b- condensation of malonyl and acetyl**

**15)in the final step of ketone body synthesis the products are acetoacetate and ?**

**a- DHAP**

**b- acetone**

**c- 3-hydroxybutyrate**

**d- acetyl CoA**

**16)ture about acetyl coA carboxylation**

**a- don't require ATP**

**b- exergonic**

**c- require ATP**

**d- B+C**

**17)TAG is produced in adipose tissue, which is true ?**

**a- needs NADPH**

**b- needs glycerol kinase**

**c- needs active glycolysis**

**d- b+c**

**18)3 moles of glucose enter the PPP. What is the net product?**

**a-3 moles of pentoses. 6 moles of NADPH. 3 moles of CO<sub>2</sub>**

**b-3 moles of pentoses. 6 moles of NADPH. 6 moles of CO<sub>2</sub>**

**c-6 moles of pentoses. 12 moles of NADPH. 6 moles of CO<sub>2</sub>**

**d-5 moles of pentoses. 6 moles of NADPH. 3 moles of CO<sub>2</sub>**

**19)3 carbons are transferred from sedoheptulose to another molecule. Which sentence describes this correctly?**

**a-A three-carbon molecule is formed**

**b-The produced molecules are a fructose derivative and a tetrose**

**c-The enzyme used is a transketolase**

**d-The remaining molecule is Xylulose 5-p**

**20)The goal of Pentose Phosphate Pathway is:**

**a-Generation of NADPH + pentose**

**b-Generation of ATP**

**c-Generation of NADH**

**d-Generation of new glucose**

**21) methymalnoyl CoA to succinyl CoA requires**

**a- racemase**

**b- biotin**

**c-vit B12**

**d- TPP**

**22)The fatty acid that has NO double bonds :**

**a) Butyric acid.**

**b) Palmitic acid.**

**c) Capric acid.**

**d) All the above.**

**23)produces diacyl glycerol and inositol 3 phosphate from PIP2**

**a- phospholipase b**

**b- phospholipase d**

**c- phospholipase a**

**d- phospholipase c**

24) Regarding the product in the following figure, which of the following will be used in the next reaction?



- a. CoA
- b. H<sub>2</sub>O
- c. FAD
- d. NAD<sup>+</sup>

25) Which of the following is used in the oxidation of very long fatty acid and not in long or short chain fatty acids?

- a. NAD<sup>+</sup>
- b. FAD
- c. H<sub>2</sub>O
- d. O<sub>2</sub>

26) A coenzyme derived from Vitamin B12 is needed for?

- a. Synthesis of D-Methylmalonyl CoA
- b. Formation of Guanidinoacetate
- c. Decarboxylation of Uroporphyrinogen III
- d. Propionyl CoA metabolism

**27) One of the following increases ketone bodies synthesis:**

- a. High free fatty acids concentration in the blood**
- b. Low blood levels of Glucagon**
- c. Inhibition of beta oxidation**
- d. Inhibitions of hormone sensitive lipases**

**28) True about using acetoacetate as a source of energy:**

- a. Utilizes succinly CoA**
- b. Occurs in the cytosol**
- c. Occurs when oxaloacetate is depleted**
- d. Occurs in the liver and in red blood cells**

**29) To synthesize a 6 carbon fatty acid:**

- a. 1 malonyl CoA ,4 NADPH ,2 acetyl CoA**
- b. 1 malonyl CoA ,2 NADPH ,2 acetyl CoA**
- c. 2 malonyl CoA ,3 NADPH ,1 acetyl CoA**
- d. 2 malonyl CoA ,4 NADPH ,1 acetyl CoA**

**30) Which of the following enzymes catalyzes the production of NADPH used in the synthesis of fatty acids?**

- a. Aconitase**
- b. Cytosolic malate dehydrogenase**
- c. Citrate synthase**

#### **d. Pyruvate dehydrogenase**

**31) Which of the following is used in the step that introduces double bond in the fatty acid during B-oxidation?**

**a. NAD<sup>+</sup>**

**b. NADP**

**c. H<sub>2</sub>O**

**d. FAD**

**32) Second substrate for thiolase :**

**a. ATP**

**b. H<sub>2</sub>O**

**c. O<sub>2</sub>**

**d. Coenzyme A**

**33) Glycerol after TAG hydrolysis**

**a. is used in the liver and muscle for glycolysis**

**b. used to resynthesize fat in the liver**

**c. is used in the liver for gluconeogenesis**

**d. is metabolized in the kidney and excreted in the urine**

# **ANSWERS:**

**1-A**

**2-D**

**3-A**

**4-A**

**5-A**

**6-D**

**7-A**

**8-A**

**9-A**

**10-Very long FA**

**11-E**

**12-D**

**13-D**

**14-B**

**15-D**

**16-C**

**17-C**

**18-A**

**19-B**

**20-A**

21-C

22-D

23-D

24-B

25-D

26-D

27-A

28-A

29-D

30-B

31-D

32-D

33-C

## **-LIPPINCOTT'S Q.:**

1-When oleic acid, 18:1(9), is desaturated at carbon 6 and then elongated, what is the product?

- A. 19:2(7,9)
- B. 20:2 (n-6)
- C. 20:2(6,9)
- D. 20:2(8,11)

2-A 4-month-old child is being evaluated for fasting hypoglycemia. Laboratory tests at admission reveal low levels of ketone bodies, free carnitine, and acylcarnitines in the blood. Free fatty acid levels in the blood were elevated. Deficiency of which of the following would best explain these findings?

- A. Adipose triglyceride lipase

- B. Carnitine transporter**
- C. Carnitine palmitoyltransferase I**
- D. Long-chain fatty acid dehydrogenase**

**3-A teenager, concerned about his weight, attempts to maintain a fat-free diet for a period of several weeks. If his ability to synthesize various lipids were examined, he would be found to be most deficient in his ability to synthesize:**

- A. cholesterol.**
- B. glycolipids.**
- C. phospholipids.**
- D. prostaglandins.**
- E. triacylglycerol.**

**4-In preparation for a trip to an area of India where chloroquine-resistant malaria is endemic, a young man is given primaquine prophylactically. Soon thereafter, he develops a hemolytic condition due to a deficiency in glucose 6-phosphate dehydrogenase. A less-than-normal level of which of the following is a consequence of the enzyme deficiency and the underlying cause of the hemolysis?**

- A. Glucose 6-phosphate**
- B. Oxidized form of nicotinamide adenine dinucleotide**
- C. Reduced form of glutathione**
- D. Ribose 5-phosphate**

**5-Septic shock, a state of acute circulatory failure characterized by persistent arterial hypotension (low blood pressure) and inadequate organ perfusion refractory to fluid resuscitation, results from a severe inflammatory response to bacterial infection. It has a high mortality rate and is associated with changes in the level of nitric oxide.**

**Which statement concerning septic shock is most likely correct?**

- A. Activation of endothelial nitric oxide synthase causes an increase in nitric oxide.**
- B. High mortality is the result of the long half-life of nitric oxide.**

- C. Lysine, the nitrogen source for nitric oxide synthesis, is deaminated by bacteria.**
- D. Overproduction of nitric oxide by a calcium-independent enzyme is the cause of the hypotension.**

**6-An individual who has recently been prescribed a drug (atorvastatin) to lower cholesterol levels is advised to limit consumption of grapefruit juice, because high intake of the juice reportedly results in an increased level of the drug in the blood, increasing the risk of side effects. Atorvastatin is a substrate for the cytochrome P450 enzyme CYP3A4, and grapefruit juice inhibits the enzyme. Which statement concerning P450 enzymes is most likely correct?**

- A. They accept electrons from reduced nicotinamide adenine dinucleotide (NADH).**
- B. They catalyze the hydroxylation of hydrophobic molecules.**
- C. They differ from nitric oxide synthase in that they contain heme.**
- D. They function in association with an oxidase.**

**7-In male patients who are hemizygous for X-linked glucose 6-phosphate dehydrogenase deficiency, pathophysiologic consequences are more apparent in red blood cells (RBC) than in other cells such as in the liver. Which one of the following provides the most reasonable explanation for this different response?**

- A. Excess glucose 6-phosphate in the liver, but not in RBC, can be channeled to glycogen, thereby averting cellular damage.**
- B. Liver cells, in contrast to RBC, have alternative mechanisms for supplying the reduced nicotinamide adenine dinucleotide phosphate required for maintaining cell integrity.**
- C. Because RBC do not have mitochondria, production of ATP required to maintain cell integrity depends exclusively on the shunting of glucose 6-phosphate to the pentose phosphate pathway.**
- D. In RBC, in contrast to liver cells, glucose 6-phosphatase activity decreases the level of glucose 6-phosphate, resulting in cell damage**

## **Answers:**

### **1-D.**

Fatty acids are elongated in the endoplasmic reticulum by adding two carbons at a time to the carboxylate end (carbon 1) of the molecule. This pushes the double bonds at carbon 6 and carbon 9 further away from carbon 1. 20:2(8,11) is an n-9 ( $\omega$ -9) fatty acid.

### **2-B.**

A defect in the carnitine transporter (primary carnitine deficiency) would result in low levels of carnitine in the blood (as a result of increased urinary loss) and low levels in the tissues. In the liver, this decreases fatty acid oxidation and ketogenesis. Consequently, blood levels of free fatty acids rise. Deficiencies of adipose triglyceride lipase would decrease fatty acid availability. Deficiency of carnitine palmitoyltransferase I would result in elevated blood carnitine. Defects in any of the enzymes of  $\beta$ -oxidation would result in secondary carnitine deficiency, with a rise in acylcarnitines.

### **3-D.**

Prostaglandins are synthesized from arachidonic acid. Arachidonic acid is synthesized from linoleic acid, an essential fatty acid obtained by humans from dietary lipids. The teenager would be able to synthesize all other compounds but, presumably, in somewhat decreased amounts.

### **4-C.**

Glutathione (GSH) is essential for red cell integrity and is maintained in its reduced (functional) form by nicotinamide adenine dinucleotide phosphate (NADPH)-dependent glutathione reductase. The NADPH is generated by the oxidative portion of the pentose phosphate pathway. Individuals with a deficiency of the initiating and regulated enzyme of this pathway, glucose 6-phosphate

dehydrogenase (G6PD), have a decreased ability to generate NADPH and, therefore, a decreased ability to keep GSH functional. When treated with an oxidant drug such as primaquine, some patients with G6PD deficiency develop a hemolytic anemia. Primaquine does not affect glucose 6-phosphate levels. Nicotinamide adenine dinucleotide is neither produced by the pentose phosphate pathway nor used as a coenzyme by GSH reductase.

#### **5-D.**

Overproduction of short-lived (not long-lived) nitric oxide (NO) by calcium-independent, inducible nitric oxide synthase (iNOS) results in excessive vasodilation leading to hypotension. NOS uses arginine, not lysine, as the source of the nitrogen. The endothelial enzyme (eNOS) is constitutive and produces low levels of NO at a consistent rate.

#### **6-B.**

The P450 enzymes hydroxylate hydrophobic compounds, making them more water soluble. Reduced nicotinamide adenine dinucleotide phosphate (NADPH) from the pentose phosphate pathway is the electron donor. The electrons are first transferred to the coenzymes of cytochrome P450 reductase and then to the P450 enzyme. Both the P450 enzymes and the nitric oxide synthase enzymes contain heme.

#### **7-B.**

Cellular damage is directly related to decreased ability of the cell to regenerate reduced glutathione, for which large amounts of reduced nicotinamide adenine dinucleotide phosphate (NADPH) are needed, and red blood cells (RBCs) have no means other than the pentose phosphate pathway of generating NADPH. It is decreased product (NADPH), not increased substrate (glucose 6-phosphate), that is the problem. RBCs do not have glucose 6-phosphatase. The pentose phosphate pathway does not generate ATP.

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الطُّريقُ"  