Plasma Proteins

1. **Which of the following represents a TRUE statement:**

   A) Albumin is glycosylated
   B) The main copper-binding plasma protein is albumin
   C) Transferrin oxidizes Fe2+ to Fe3+
   D) Elastase activity is elevated in smokers
   E) Alpha 1 antitrypsin is the main contributor to blood oncotic pressure

2. **Which of the following proteins would you least expect to be initially tagged with an N-terminal signal peptide:**

   A) Fibrinogen
   B) Hemoglobin
   C) Albumin
   D) Alpha globulins
   E) Gamma globulins

3. **Which of the following statements regarding blood composition is FALSE:**

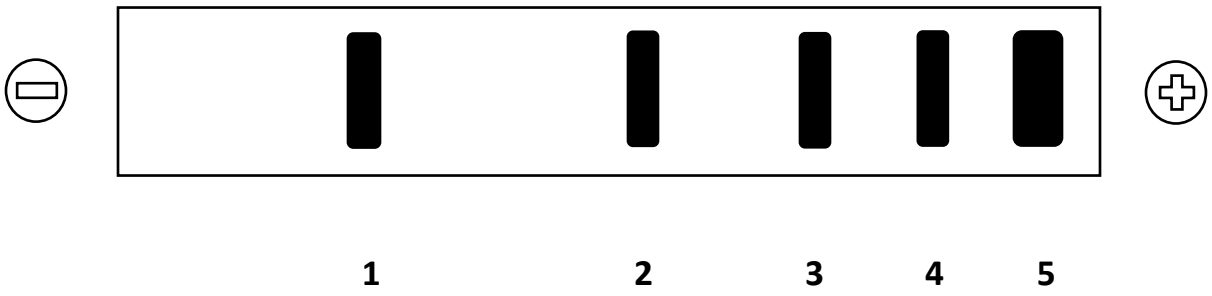
   A) Blood of a patient with anemia is expected to contain more than 55% plasma.
   B) Fibrinogen is present in plasma while absent in serum
   C) The blood component with highest density is: Red Blood Cells
   D) The most abundant plasma protein is synthesized in the liver
   E) None of the above is false

4. **A 50 g sample of plasma was obtained. How many grams of plasma proteins (approximately) would there be in this sample:**

   A) 10 grams
   B) 3.5 grams

C) 45 grams
D) 35 grams
E) 1 gram

5. Gel electrophoresis was applied to a serum sample, and the resulting 5 bands (representing albumin, γ, β, α1, α2 globulins) are shown in the adjacent figure. Which of the bands represents albumin:



A) Band 1
B) Band 2
C) Band 3
D) Band 4
E) Band 5

6. True about Prealbumin:

A) Migrates at a lower speed than albumin in gel electrophoresis
B) Converted to albumin after cleavage of hexapeptide
C) Is a sensitive marker of protein malnutrition due to its long half-life
D) A+B
E) None of the above

7. A deficiency in which of the following proteins causes Wilson disease:

A) Ceruloplasmin
B) Haptoglobin
C) Albumin
D) Alpha 1 antitrypsin
E) C reactive protein

8. Choose the mismatched pair among the following:

A) Hemolytic anemia – Elevated Haptoglobin levels
B) Acute inflammation – Elevated C-reactive protein levels
C) PiZZ genotype – Decreased release of Alpha 1 antitrypsin into plasma
D) Down syndrome – Low alpha 1 fetoprotein levels
E) None of the above

9. Albumin is involved in the transport of all of the following except:

A) Free fatty acids
B) Aspirin
C) Steroids
D) Some cations
E) Hemoglobin

10. Choose the correctly matched pair of words:

A) Liver disease – Increased albumin concentration
B) Bacterial infection – Decreased C reactive protein concentration
C) Increased alpha 2 macroglobulin concentration – decreased trypsin activity
D) Smoking – oxidation of methionine in elastase
E) C+D

Answers

1. D	**2.** B	**3.** E	**4.** B	**5.** E
6. E	7. A	**8.** A	**9.** E	**10.** C

1. **D**

   Explanation:

   - Option A: A false statement because albumin is not glycosylated.
   - Option B: A false statement because albumin only carries 10% of plasma copper.
   - Option C: A false statement because ceruloplasmin oxidizes Fe2+, not transferrin.
   - Option D: A true statement because smoking causes inactivation of alpha 1 antitrypsin which normally inhibits elastase. Decreased alpha 1 antitrypsin activity causes elevated elastase activity.

2. **B**

   Explanation: Plasma proteins (like albumin, fibrinogen..etc) must be initially tagged by a signal peptide to target them for secretion outside the cell and into the plasma. All of the options represent plasma proteins except for hemoglobin, which is a cytosolic protein that remains within RBCs, meaning it is not secreted, and therefore not tagged with a signal sequence for secretion.

3. **E**

   Explanation:

   - Option A is not a false statement (blood is 45% RBCs, 55% plasma. Anemic patients have less amounts of RBCs, and so their RBC percentage is < 45%, thus their plasma percentage is >55%)
   - Option B is not false. Fibrinogen is generally present in blood. When blood coagulates, fibrinogen is converted to fibrin. Plasma is obtained

from unclotted blood, so fibrinogen is still present and has not been converted to fibrin, whereas serum is obtained from clotted blood, in which fibrinogen has been converted to fibrin, thus fibrinogen is absent in serum.

- Option C is not false. RBCs are the most dense component, which is why they settle at the bottom of a test tube after centrifugation.
- Option D is not false. The most abundant plasma protein is albumin and is synthesized in the liver.
- Since all options represent true statements, the answer is "none of the above.

4. B

Explanation: Plasma proteins comprise 6-8% of plasma, or 7% on average. So: 7% * 50 g = 3.5 grams of plasma protein.

5. E

Explanation: In gel electrophoresis, the proteins travel towards the anode (positive charge) according to their molecular weight (the lower the molecular weight, the faster the speed of travel, the closer the band is to the anode(+)). We already know that among the plasma proteins mentioned, the one with the least molecular weight is albumin, thus the band closest to the anode (+) represents albumin. So, band 5 is the answer.

6. E.

Explanation:

- Prealbumin has higher migratory speed than albumin in gel electrophoresis. Option A is incorrect.
- Prealbumin is NOT a precursor for albumin. Do not confuse it with proalbumin. Option B is false.
- Prealbumin is indeed a sensitive marker for protein malnutrition by virtue of its SHORT (not long) half-life. Option C is false
- None of the options are true, therefore the answer is E.

7. A

Explanation: Refer to slides. (Wilson disease involves low levels of ceruloplasmin)

8. A

Explanation:

- Option A: In hemolytic anemia, destruction of RBCs causes increased hemoglobin concentrations in blood (due to their release from the cells destroyed). More haptoglobin binds to hemoglobin, and the complexes formed have shorter half-lives than unbound haptoglobin, resulting in decreased (not increased) haptoglobin levels. So this is the mismatched pair.
- Option B: C reactive protein is an acute phase protein whose concentration increases in inflammatory conditions. Correct pair
- Option C: The PiZZ genotype gives rise to abnormal alpha 1 antitrypsin molecules that polymerize and aggregate preventing their release. Correct pair
- Option D: Down syndrome involves low levels of alpha 1 fetoprotein. Correct pair

9. E

Explanation: Refer to slides.

10. C

Explanation:

- Option A: Liver disease causes decreased production of albumin. Mismatched pair.
- Option B: Infection would increase C reactive protein level (acute phase protein). Mismatched pair.
- Option C: Alpha2 macroglobulin inhibits trypsin → decreased trypsin activity. Correct pair.
- Option D: Smoking oxidizes methionine residue of alpha 1 antitrypsin not elastase.

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