Fibrous Proteins – 30 Difficult MCQs

Multiple Choice Questions (Circle the ONE best answer)

1) Which of the following BEST explains why collagen can provide tensile strength to tissues?

A. It contains many branched-chain amino acids

B. It forms a triple-helical structure with specific amino acid organization

C. It is rich in sulfur-containing amino acids

D. It has extensive β-pleated sheet regions

2) Glycine is especially important in collagen because it:

A. Stabilizes disulfide bonds between α-chains

B. Is present at every second residue

C. Occupies every third position and permits tight packing

D. Directly forms desmosine cross-links

3) Hydroxyproline and hydroxylysine in collagen are formed mainly by:

A. Deamination of lysine and proline

B. Posttranslational hydroxylation of lysine and proline

C. Direct incorporation during translation

D. Extracellular cleavage of procollagen

4) Hydroxylation of collagen residues requires all of the following EXCEPT:

A. Vitamin C

B. Molecular oxygen

C. Prolyl and lysyl hydroxylases

D. Vitamin K

5) A defect in vitamin C would MOST directly impair which step in collagen biosynthesis?

A. Formation of pro-α-chain

B. Hydroxylation of proline and lysine

C. Extracellular cleavage of procollagen

D. Cross-link breakdown

6) Which statement regarding collagen glycosylation is CORRECT?

A. It mainly occurs on glycine residues

B. It occurs on hydroxylysine residues

C. It requires elastase

D. It occurs only after fibril formation

7) Which of the following collagen types is correctly matched with its structural organization?

A. Type I — network - forming

B. Type IV — fibril - forming

C. Type IX — fibril - associated

D. Type III — basement membrane mesh

8) Which collagen types are classically fibril - forming?

A. I, II, III

B. II, IV, VII

C. IV, VII, IX

D. I, IX, XII

9) A major component of basement membrane is formed mainly by:

A. Type I collagen

B. Type III collagen

C. Type IV collagen

D. Type XII collagen

10) Which of the following BEST describes collagen in bone?

A. It exists only as a dispersed gel

B. It is arranged randomly and has no directional resistance

C. It is arranged as fibers at angles to resist shear from multiple directions

D. It lacks mechanical function

11) Collagen precursors are synthesized primarily in:

A. Chondrocytes only

B. Fibroblasts

C. Hepatocytes

D. Neutrophils

12) Which event occurs AFTER secretion of procollagen into the extracellular matrix?

A. Formation of pro - α - chain

B. Hydroxylation of lysine

C. Cleavage of procollagen

D. Ribosomal translation

13) Cross - link formation in collagen fibrils contributes MOST directly to:

A. Increased solubility

B. Increased mechanical strength

C. Reduced secretion

D. Prevention of glycosylation

14) Breakdown of normal collagen during growth or injury is mainly due to:

A. Trypsin

B. Elastase

C. Collagenase

D. Lysyl hydroxylase

15) Cleavage of type I collagen characteristically generates fragments of:

A. Equal half - and - half size

B. Three - quarter and one - quarter length

C. Random sizes only

D. One - third and two - thirds length

16) A patient with stretchy skin and loose joints is suspected to have Ehlers - Danlos syndrome. Which defect is MOST consistent?

A. Deficiency of lysyl hydroxylase

B. Deficiency of α 1 - antitrypsin

C. Mutation of fibrillin only

D. Deficiency of collagenase

17) In one form of Ehlers - Danlos syndrome, mutation of collagen III is particularly dangerous because collagen III is important in:

A. Hair follicles

B. Arteries

C. Enamel

D. Red blood cells

18) Failure of secretion of mutated collagen III may lead to:

A. Only mild cosmetic findings

B. Lethal vascular complications

C. Severe emphysema only

D. Basement membrane thickening only

19) Osteogenesis imperfecta is BEST described as:

A. An acquired inflammatory bone disease

B. An inherited disorder causing easily fractured bones

C. A disorder caused by excess collagenase

D. A disease limited to old age

20) Which statement about osteogenesis imperfecta in the provided material is CORRECT?

A. It is unrelated to bone fragility

B. Humped back may be a common feature

C. It always presents after age 40

D. It is caused by α 1 - antitrypsin deficiency

21) According to the material, the more severe form of osteogenesis imperfecta is:

A. Osteogenesis imperfecta tarda

B. Osteogenesis imperfecta congenita

C. Ehlers - Danlos vascular type

D. Marfan syndrome

22) Elastin is BEST characterized as a protein that:

A. Forms rigid triple helices

B. Provides rubber - like elasticity to connective tissue

C. Is rich in hydroxyproline and glycine every third residue

D. Is the major basement membrane mesh

23) Tropoelastin is:

A. The active enzyme that degrades elastin

B. The precursor of elastin

C. A collagen peptidase

D. A subtype of type IV collagen

24) Elastin is particularly rich in:

A. Histidine and arginine

B. Glycine and hydroxylysine

C. Small nonpolar amino acids, especially proline and lysine

D. Tryptophan and cysteine

25) Elastin is secreted and deposited onto:

A. Keratin

B. Fibrillin

C. Fibronectin

D. Laminin only

26) Oxidative deamination of lysine residues in elastin produces:

A. Hydroxylysine

B. Desmosine directly

C. Allysine

D. Glyoxylate

27) The special cross - link associated with elastin is:

A. Pyridoxine

B. Desmosine

C. Hydroxyproline

D. Procollagen

28) α 1 - Antitrypsin normally protects the alveoli mainly by inhibiting:

A. Procollagen peptidase

B. Neutrophil elastase

C. Lysyl oxidase

D. Collagenase in bone

29) A smoker with α 1 - antitrypsin deficiency develops rapid lung destruction because smoking:

A. Increases collagen III secretion

B. Activates lysyl hydroxylase

C. Oxidizes a critical methionine residue in α 1 - antitrypsin

D. Converts elastin into collagen

30) Which individual is MOST at risk for emphysema due to α 1 - antitrypsin deficiency?

A. A heterozygote with one abnormal allele

B. A person with normal alleles who never smoked

C. A person inheriting two abnormal α 1 - antitrypsin alleles

D. A person with isolated collagenase deficiency

Model Answers

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

Tricky Notes (High - Yield)

- Collagen = triple helix
- Glycine is present every third residue

- Hydroxylation requires Vitamin C + O_2
- Hydroxylysine is the residue that gets glycosylated
- Type I, II, III = fibril-forming collagen
- Type IV, VII = network-forming collagen
- Type IX, XII = fibril-associated collagen
- Ehlers-Danlos → stretchy skin + loose joints
- Collagen III mutation → dangerous vascular problems
- Osteogenesis imperfecta → brittle / easily fractured bones
- Elastin precursor = tropoelastin
- Elastin is deposited onto fibrillin
- Lysine oxidase forms allysine
- Elastin cross-link = desmosine
- α1-antitrypsin inhibits neutrophil elastase
- Smoking worsens α1-AT deficiency by oxidizing a key methionine residue