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Mahdi Masarwa

**Corrector:** OMAR ALMATAR



1. In relation to hypertrophy, which of the following statements is CORRECT?

a- it is triggered by hormonal stimulation .

b- it increases the function of an organ exponentially

c- it is usually pathological

d- it occurs after partial hepatectomy

2. All the following are features of apoptosis, with the EXCEPTION of?

a- chromatin condensation

b- formation of cytoplasmic blebs

c- cell swelling

d- phagocytosis of apoptotic bodies

3. Which of the following types of necrosis is grossly opaque and chalky white?

a- coagulation necrosis

b- liquefaction necrosis

c- caseous

d- fat necrosis

4. In which of the following situations is epithelial metaplasia most likely to have

occurred:

a- tanning of the skin following sunlight exposure

b- lactation following pregnancy

c- vitamin A deficiency

d- acute myocardial infarction

5. Caseation necrosis is most characteristic of:

a- acute myocardial infarction

b- tuberculosis

c- acute pancreatitis

d- cerebral infarct

e- pulmonary pneumoconiosis

6. A well-demarcated lesion with increased cytoplasmic eosinophilia karyolysis, and intact tissue architecture is characteristic of:

a- caseous necrosis

b- enzymatic fat necrosis

c- coagulative necrosis .

d- swelling

7. Which tissue is the most susceptible to liquefactive necrosis following ischemic injury?

a- pancreas

b- liver

c- spleen

d- brain .

e- intestine

8. Coagulative necrosis usually results from?

a. abscess formation

b. ischemia

c. trauma

d. tuberculosis

9. While in a home improvement center warehouse buying paint, a 35-year-old male hears, "look out below!" and is then struck on the leg by a falling pallet rack. the yellow-brown color of the bruise to this thigh a couple of weeks after injury is due to accumulation of:

a- lipofuscin

b- bilirubin

c- melanin

d- hemosiderin

e- glycogen

10. The presence of squamous epithelium in the lower trachea of a 42-year-old female with a history of smoking is called:

a- dysplasia

b- anaplasia

c- hyperplasia

d- metaplasia

The accumulation of misfolded proteins results in a disease because of the deficiency of essential protein due to it being degraded in which of the following:

- A. Cystic fibrosis
- B. Parkinson's disease
- C. Alzheimer's disease
- D. Amyloidosis
- E. Huntington's disease

50 year-old tumor patient was given chemotherapeutic drugs to kill malignant cells. These cells are affected through:

- A. Hypertrophy
- B. Apoptosis
- C. Necrosis
- D. They aren't affected

A lung biopsy caseating necrosis that shows calcium deposition can be explained as?

- A. Apoptosis.
- B. Metastatic calcification.
- C. Hypercalcemia.
- D. Dystrophic calcification.
- E. Excessive calcium nutritional intake.

Brown atrophy is a term that refers to the deposition of which of the following substances?

- A. Melanin pigment.
- B. Bilirubin pigment.
- C. Hemosiderin pigment.
- D. Lipofuscin pigment.
- E. Glycogen pigment.

Which of the following patterns of necrosis can be caused by focal bacterial and fungal infections/ Brain ischemia is characterized by?

- A. Caseous necrosis
- B. Liquefactive necrosis
- C. Fibrinoid necrosis
- D. Fat necrosis
- E. Coagulative necrosis

Accumulation of misfolded proteins in the cytoplasm, activates which of the following enzymes:

- A. Caspases
- B. Glutathione peroxidase
- C. Telomerase
- D. Superoxide dismutase
- E. Bax/Bak activation

Which of the following enzymes reduce oxidative stress?

- A. Nitric oxide synthase
- B. Glutathione peroxidase
- C. myeloperoxidase
- D. Proteases

Which of the following is caused by GERD (Gastroesophageal reflux disease)?

- A. Atrophy
- B. Hyperplasia
- C. Hypertrophy
- D. Metaplasia
- E. There is no correct answer

Which of the following pigments is found in sites of bruises?

- A. Carbon
- B. Lipofuscin
- C. Hemosiderin
- D. Melanin

Which of the following is caused by vitamin A deficiency?

- A. Atrophy
- B. Hyperplasia
- C. Hypertrophy
- D. Metaplasia
- E. There is no correct answer

Which of the following is caused by an enlarged prostate?

- A. Atrophy
- B. Hyperplasia
- C. Hypertrophy
- D. Metaplasia
- E. There is no correct answer



You can

Coagulative necrosis is characterized by which of the following?

- A) Central caseation.
- B) Preserved tissue architecture initially.
- C) Caused by bacterial infections.
- D) Cheesy like material.
- E) Liquified Center.

Lipid peroxidation of cellular and organelle membranes in the process of cell injury is mediated by:

- A) Membrane pump failure.
- B) Low PH.
- C) Direct acting toxins.
- D) ATP depletion.
- E) Reactive oxygen species.

The hallmark of CCL4 toxicity in the liver is?

- A) Caseous necrosis.
- B) Protein accumulation.
- C) Influx of inflammatory cells.
- D) Fatty change.
- E) Endoplasmic reticulum stress.

A 49-year-old male patient came with recent non-intentional weight loss, fever, and lymphadenopathy. A lymph node biopsy showed multiple necrotizing granulomas. The top differential diagnosis should be:

- A) Auto immune necrotizing lymphadenitis
- B) Non-specific chronic inflammation
- C) Viral lymphadenitis
- D) Tuberculous lymphadenitis
- E) Sarcoidosis

Exposure to a high dose of radiation injury with resultant DNA damage is associated with which of the following cellular responses?

- A) Bel2 activation.
- B) Cytochrome c inhibition.
- C) Caspase inhibition.
- D) BH3 sensor inhibition.
- E) Bax/Bak activation.

Accumulation of misfolded proteins in the cytoplasm, activates which of the following enzymes:

- A) Glutathione peroxidase.
- B) Telomerase.
- C) Superoxide dismutase.
- D) Caspase.
- E) Catalase.

Elimination of self-reactive lymphocytes by apoptosis is mediated by which of the following molecules?

- A) Bax/Bak
- B) Fas-Fas ligand.
- C) BH3.
- D) Bel2.
- E) P53.

ONE of the following changes is associated with cellular hypertrophy?

- A) Protein degradation,
- B) Increased protein synthesis.
- C) Autophagy.
- D) Decreased protein synthesis.
- E) Decreased function.

b.e.d.d.e.d.b.b

Brown atrophy is a term that refers to the deposition of which of the following substances?

- A) Melanin pigment.
- B) Bilirubin pigment.
- C) Hemosiderin pigment.
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- E) Glycogen pigment.

Which of the following patterns of necrosis can be caused by focal bacterial and fungal infections?

- A) Caseous necrosis.
- B) Liquefactive necrosis.
- C) Fibrinoid necrosis.
- D) Fat necrosis.
- E) Coagulative necrosis.

The changes in the epithelial lining of the lower esophagus in patients with reflux esophagitis, from squamous epithelium to glandular epithelium are termed?

- A) Hypertrophy.
- B) Metaplasia.
- C) Hyperplasia.
- D) Dysplasia.
- E) Atrophy.

One of the followings is an IRREVERSIBLE change in cell injury?

- A) Myelin figures.
- B) Nuclear karyorrhexis.
- C) Mitochondrial densities.
- D) Cell membrane blebs.
- E) Cellular swelling.

In intracellular accumulations, one of the following is an example of accumulation due to inherited enzyme deficiency:

- A) Anthracosis.
- B) Steatosis.
- C) Lysosomal storage diseases.
- D) Alpha 1 antitrypsin deficiency.
- E) Silicosis.

Which of the following is a typical example of adaptive physiological atrophy?

- A) Uterine smooth muscle changes in pregnancy.
- B) Skeletal muscle changes in athletes.
- C) Endometrial changes after menopause.
- D) Breast lobules changes during lactation.
- E) Left ventricular changes in hypertension.

Myeloperoxidase enzyme in macrophages catalyzes the conversion of?

- A) H<sub>2</sub>O<sub>2</sub> to hydroxyl group.
- B) Superoxide to H<sub>2</sub>O<sub>2</sub>.
- C) H<sub>2</sub>O<sub>2</sub> to hypochlorite.
- D) Oxygen to superoxide.
- E) H<sub>2</sub>O<sub>2</sub> to water.

Restoration of blood flow following myocardial infarction may impose more tissue injury sometimes, the main mechanism directly responsible for this paradoxical effect is?

- A) Accumulation of misfolded proteins.
- B) Decreased ATP production.
- C) Hypoxia.
- D) Increased reactive oxygen species formation.
- E) Decreased PH.

After sun exposure, a fair skinned patient noted a brownish discoloration over the skin of her face and dorsum of hands. Which of the following substances most likely accumulated at these sites?

- A) Hemosiderin pigment.
- B) Melanin pigment.
- C) Bilirubin pigment.
- D) Lipofuscin pigment.
- E) Glycogen pigment.

Calcium deposition in damaged aortic valves can be explained as?

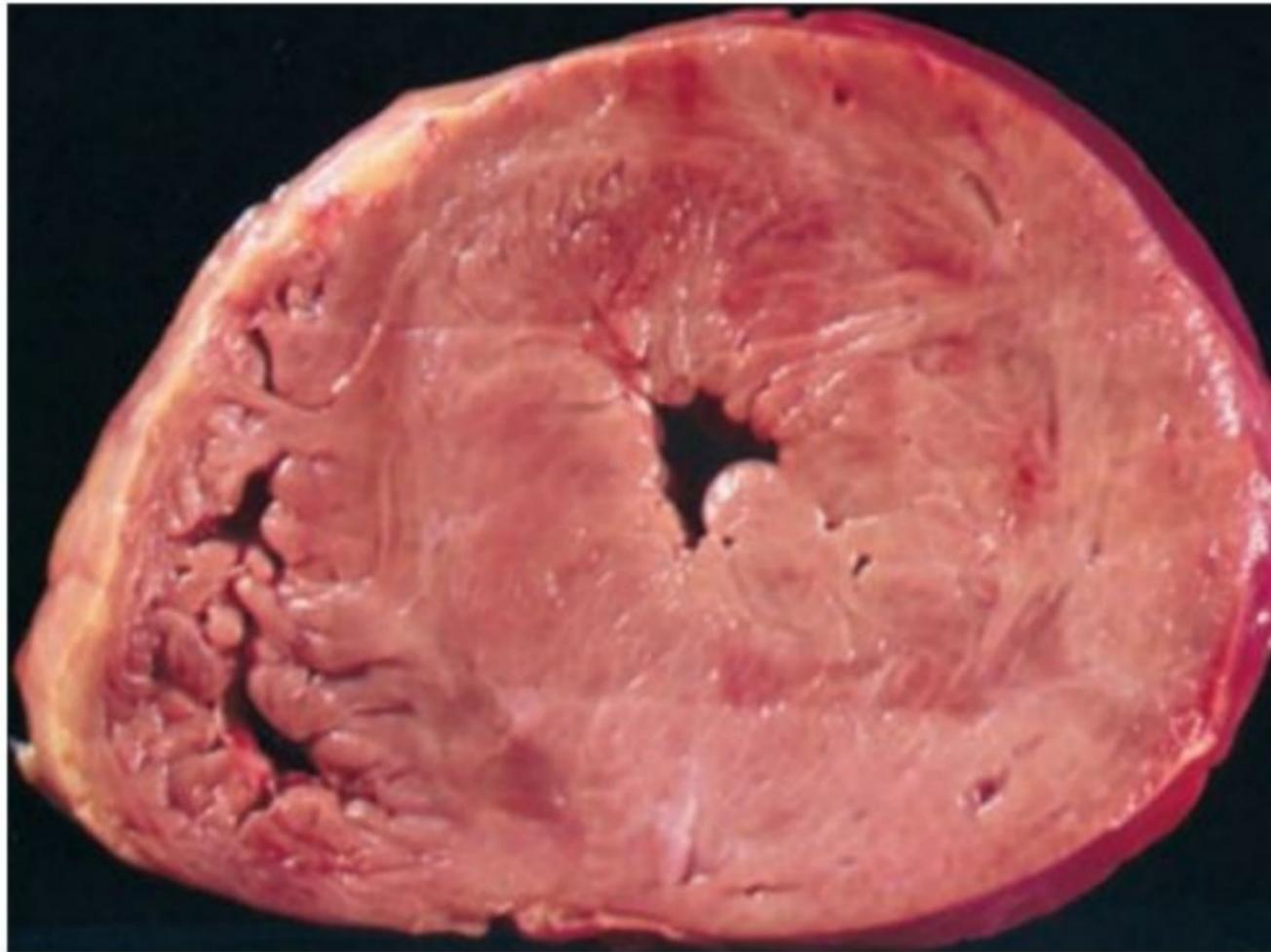
- A) Apoptosis.
- B) Metastatic calcification.
- C) Hypercalcemia.
- D) Dystrophic calcification.
- E) Excessive calcium nutritional intake.

One of the following can cause pathologic apoptosis?

- A) Turnover of gut epithelium.
- B) Embryogenesis.
- C) Elimination of self-reactive lymphocytes.
- D) Involution of endometrium after menopause.
- E) Viral infections.

عن أبي ذر الغفاري رضي الله عنه ، عن النبي صلى الله عليه وسلم فيما يرويه عن ربه عز وجل أنه قال : ( يا عبادي إني حرمت الظلم على نفسي ، وجعلته بينكم محرما فلا تظالموا ، يا عبادي كلّم ضال إلا من هديته ، فاستهدوني أهدكم ، يا عبادي كلّم جائع إلا من أطعمته ، فاستطعموني أطعمكم ، يا عبادي كلّم عار إلا من كسوته ، فاستكسوني أكسكم ، يا عبادي إنكم تخطئون بالليل والنهار ، وأنا أغفر الذنوب جميعا فاستغفروني أغفر لكم ، يا عبادي إنكم لن تبلغوا ضري فتضروني ، ولن تبلغوا نفعي فتنفعوني ، يا عبادي لو أن أولكم وآخركم وإنسكم وجنكم كانوا على أتقى قلب رجل واحد منكم ما زاد ذلك في ملكي شيئا ، يا عبادي لو أن أولكم وآخركم وإنسكم وجنكم كانوا على أفجر قلب واحد منكم ما نقص من ملكي شيئا ، يا عبادي لو أن أولكم وآخركم وإنسكم وجنكم قاموا في صعيد واحد فسألوني ، فأعطيت كل واحد مسألته ما نقص ذلك مما عندي إلا كما ينقص المخيط إذا أدخل البحر ، يا عبادي إنما هي أعمالكم أحصيها لكم ثم أوفيكم إياها ، فمن وجد خيرا فليحمد الله ، ومن وجد غير ذلك فلا يلومن إلا نفسه ) رواه مسلم .

1. The illustration shows a section of the heart from a 45-year-old African-American man with long-standing hypertension who died of a “stroke.” Which of the following adaptive changes is exemplified in the illustration?



(A) Aplasia (B) Atrophy (C) Hyperplasia (D) Hypertrophy (E) Hypoplasia

2. An impending myocardial infarction was successfully averted by thrombolytic (clot-dissolving) therapy in a 55-year-old man. Which of the following biochemical events most likely occurred during the period of hypoxia?

- (A) Decreased hydrogen ion concentration
- (B) Increase in oxidative phosphorylation
- (C) Loss of intracellular  $\text{Na}^+$  and water
- (D) Stimulation of ATP synthesis
- (E) Stimulation of anaerobic glycolysis and glycogenolysis

3. A 45-year-old man with a long history of alcoholism presents with severe epigastric pain, nausea, vomiting, fever, and an increase in serum amylase. During a previous hospitalization for a similar episode, computed tomography scanning demonstrated calcifications in the pancreas. A diagnosis of acute pancreatitis superimposed on chronic pancreatitis was made. In this condition, which of the following types of necrosis is most characteristic?

- (A) Caseous
- (B) Coagulative
- (C) Fat
- (D) Fibrinoid
- (E) Liquefactive

4. A 29-year-old man hospitalized for acquired immunodeficiency syndrome (AIDS) is found to have pulmonary tuberculosis. Which type of necrosis is found in the granulomatous lesions (clusters of modified macrophages) characteristic of this increasingly frequent complication of AIDS?

- (A) Caseous
- (B) Coagulative
- (D) Fibrinoid
- (E) Liquefactive

5. A 45-year-old woman is investigated for hypertension and is found to have enlargement of the left kidney. The right kidney is smaller than normal. Contrast studies reveal stenosis of the right renal artery. The size change in the right kidney is an example of which of the following adaptive changes?

- (A) Aplasia
- (B) Atrophy
- (C) Hyperplasia
- (D) Hypertrophy
- (E) Metaplasia

6. A 56-year-old man recovered from a myocardial infarction after his myocardium was entirely "saved" by immediate thrombolytic therapy. If it had been possible to examine microscopic sections of his heart during his ischemic episode, which of the following would be the most likely cellular change to be found?

- (A) Karyolysis
- (B) Karyorrhexis
- (C) Pyknosis
- (D) Swelling of the endoplasmic reticulum

7. A 64-year-old woman presents with fever, chills, headache, neck stiffness, vomiting, and confusion. The Kernig sign (passive knee extension eliciting neck pain) and Brudzinski sign (passive neck flexion eliciting bilateral hip flexion) are both positive. Examination of the cerebrospinal fluid reveals changes consistent with bacterial meningitis, and brain imaging

demonstrates a localized abscess. Which of the following types of necrosis is most characteristic of abscess formation?

- (A) Caseous
- (B) Coagulative
- (D) Fibrinoid
- (E) Liquefactive

8. A 56-year-old man dies 24 hours after the onset of substernal chest pain radiating down his left arm to the ulnar aspect of his fingertips. Which of the following morphologic myocardial findings is an indicator of irreversible injury?

- (A) Cell blebs
- (B) Depletion of glycogen
- (C) Mitochondrial swelling
- (D) Myelin figures
- (E) Pyknotic nuclei

9. A 75-year-old woman with Alzheimer disease dies of congestive heart failure. The brain at autopsy is shown in the image. This patient's brain exemplifies which of the following responses to chronic injury?



- (A) Anaplasia
- (B) Atrophy
- (C) Dysplasia
- (D) Hyperplasia
- (E) Hypertrophy

## صعب حبتين 10.

A 53-year-old man comes to the emergency department due to a few weeks of severe heartburn and difficulty swallowing. He has had mild to moderate heartburn for several years and has tried weight loss, elevating the head of the bed while sleeping, and several months of proton pump inhibitor therapy. Other medical problems include hypertension and hypothyroidism. Temperature is 36.7 C (98.1 F), blood pressure is 130/80 mm Hg, pulse is 78/min, and respirations are 16/min. BMI is 25 kg/m<sup>2</sup>. Physical examination is unremarkable. An upper gastrointestinal endoscopy is performed, and esophageal biopsy shows columnar epithelium with interspersed goblet cells. A similar adaptive response can be seen in which of the following scenarios?

- A. Bronchial epithelial cells in a chronic cigarette smoker
- B. Epidermal cells in a patient with psoriasis
- C. Melanocytes in a large, irregular mole
- D. Myocardial cells in a patient with aortic stenosis
- E. Skeletal myocytes after prolonged immobility

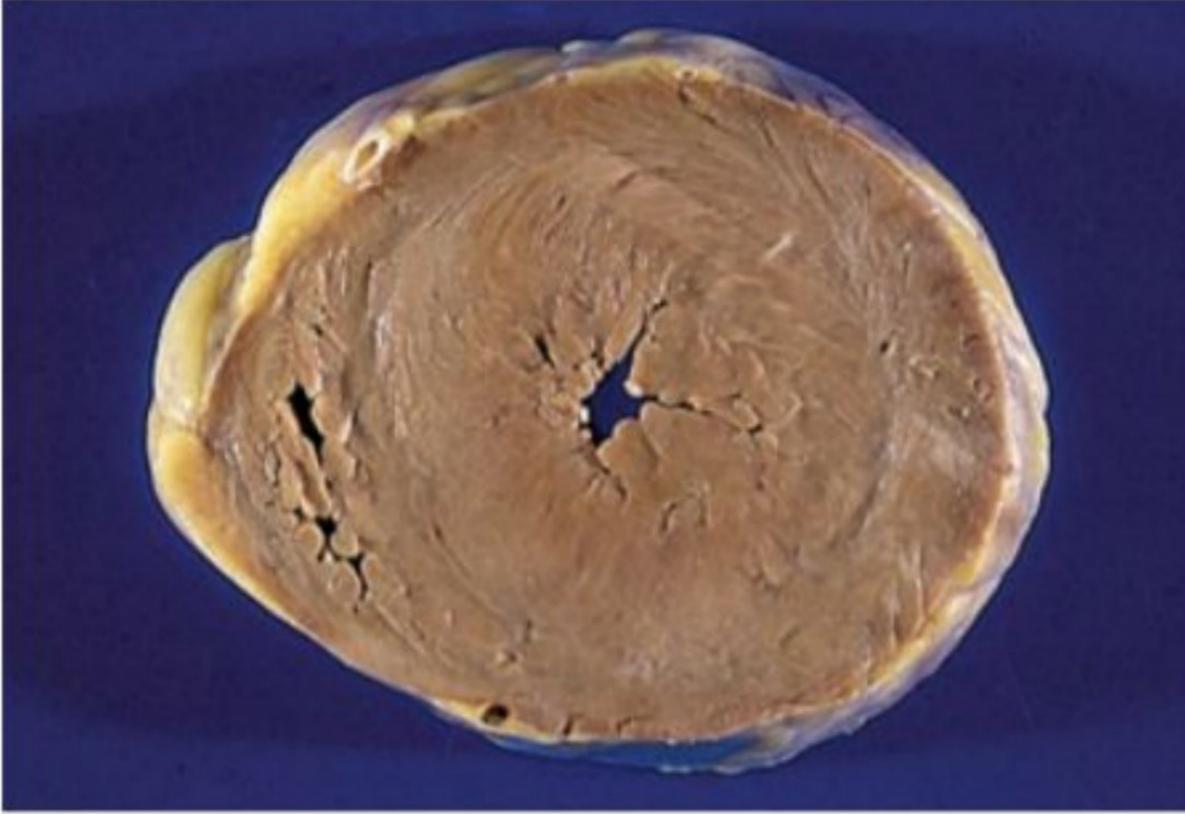
## 11. برضو صعب حبتين وجمع اكثر من مادة (ميكرو و اميونو وبائو و حبتين ميتا)

A 61-year-old man comes to the emergency department due to fever, chills, and a productive cough with thick, blood-tinged sputum for the past several days. His temperature is 38.8 C (102 F), blood pressure is 90/60 mm Hg, and pulse is 110/min. On examination, the patient is lethargic and ill appearing. Bronchial breath sounds and crackles are present in the right lung. Blood and sputum cultures grow *Klebsiella pneumoniae*. It is determined that the bacteria express a lipopolysaccharide on their outer membrane surface that stimulates toll-like receptors in the inflammatory cells. This in turn leads to degradation of the I $\kappa$ B inhibitor protein, which normally binds to a latent transcription factor found in the cytoplasm. Which of the following factors is most likely to be directly activated by the removal of this inhibitor protein?

- A. Granulocyte colony-stimulating factor
- B. Janus kinase 2
- C. Nuclear factor-kappa B
- D. Transforming growth factor- $\beta$
- E. Tumor necrosis factor- $\alpha$

اسهل من الي قبله بس بده شوية تفكير عميق

12. A 64-year-old man with long-standing angina pectoris and arterial hypertension dies of spontaneous intracerebral hemorrhage. At autopsy, the heart appears globoid. The left ventricle measures 2.8 cm on cross section (shown in the image). This adaptation to chronic injury was mediated primarily by changes in the intracellular concentration of which of the following components?



- (A) DNA
- (B) Glycogen
- (C) Lipid
- (D) mRNA
- (E) Water

زي الي قبله

13. A 30-year-old man with AIDS-dementia complex develops acute pneumonia and dies of respiratory insufficiency. At autopsy, many central nervous system neurons display hydropic degeneration. This manifestation of sublethal neuronal injury was most likely mediated by impairment of which of the following cellular processes?

- (A) DNA synthesis
- (B) Lipid peroxidation
- (C) Mitotic spindle assembly
- (D) Plasma membrane sodium transport
- (E) Ribosome biosynthesis

## Robbin's questions

Type of cell death which is energy-dependent, tightly regulated, and associated with normal cellular functions.

2- Type of cell death which results from a pathologic cell injury.

3- Type of cell death associated with inflammation

4-It is the irreversible condensation of chromatin in the nucleus of a cell undergoing necrosis or apoptosis

5-It is the destructive fragmentation of the nucleus of a dying cell

6-It is the complete dissolution of the chromatin of a dying cell

7- This is the first manifestation of almost all forms of injury to cells

8- Surface blebs, increased eosinophilia of the cytoplasm, cellular swelling

9-Cell injury with loss of nuclei, cellular fragmentation and leakage of cellular contents.

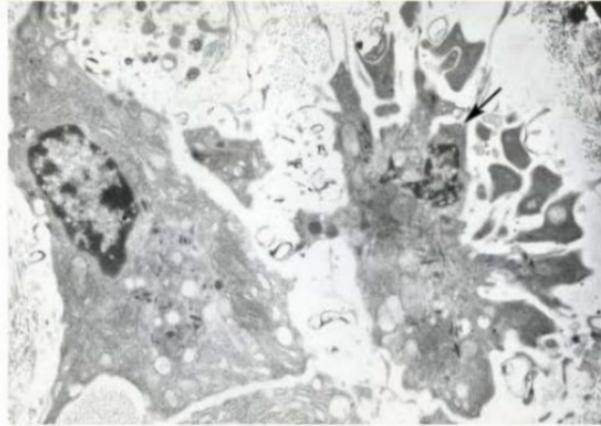
### Answers to MCQ

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

### Answers to Robbin's questions

1. Apoptosis
2. necrosis
3. necrosis
4. Pyknosis
5. Karyorrhexis
6. Karyolysis
7. Cellular swelling
8. Reversible/ Early Ischemic Injury
9. Irreversible/ Necrotic cellular injury

1.



An investigator is studying the mechanism of bone healing in experimentally induced fractures in an animal model. Decalcified sections of bone at various stages of healing are examined. An electron micrograph of the bone is shown. The image shows two different cells located within one particular slice of the bone. Which of the following best describes the cell identified by the arrow in this image?

- A. Apoptotic cell
- B. Bone-lining macrophage
- C. Dividing osteoblast
- D. Necrotic cell
- E. Typical osteoblast

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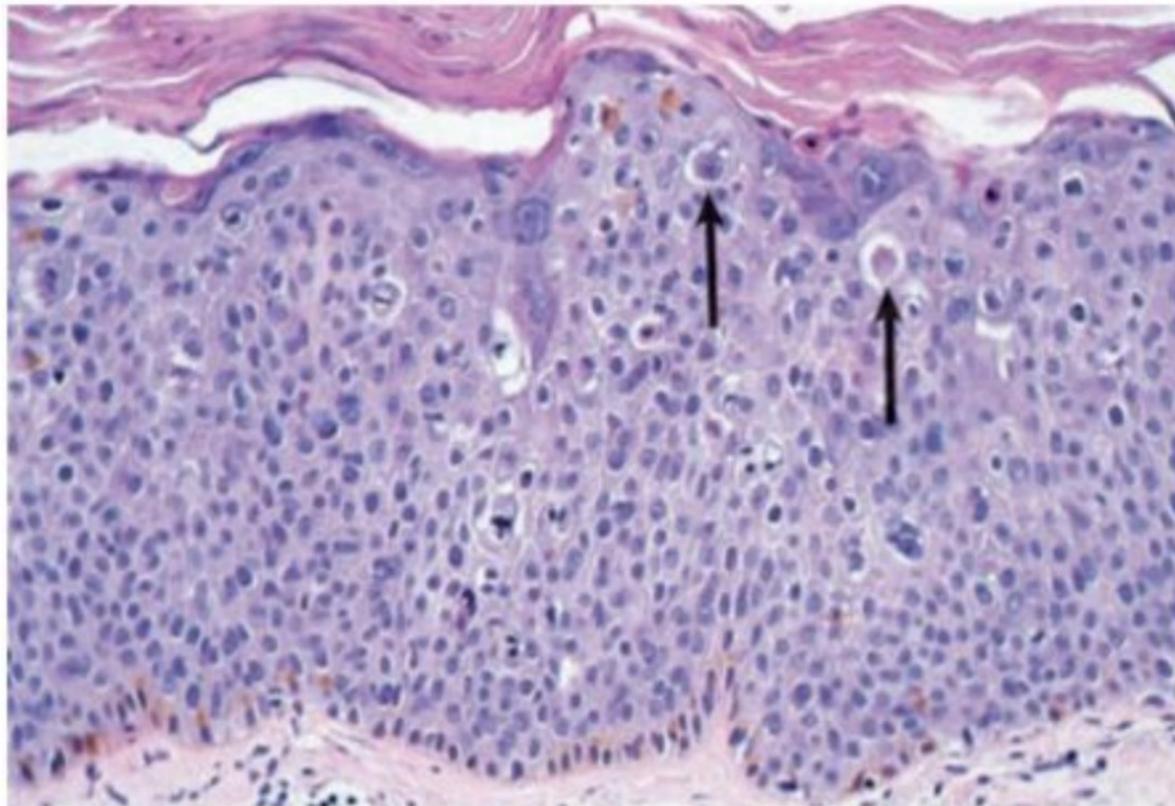
2.

A 37-year-old man comes to the physician for a follow-up visit for management of non-Hodgkin lymphoma, follicular type. The lymphoma cells do not appear to be actively dividing, however the number of malignant cells continues to increase. Overexpression of which of the following best accounts for the inhibited apoptosis of these abnormal cells?

- A. *bcl-2*
- B. Caspases
- C. Fas
- D. Perforin
- E. p53

3

A 43-year-old man presents with a scaly, erythematous lesion on the dorsal surface of his left hand. A skin biopsy reveals atypical keratinocytes filling the entire thickness of the epidermis (shown in the image). The arrows point to apoptotic bodies. Which of the following proteins plays the most important role in mediating programmed cell death in this patient's skin cancer?



- (A) Catalase
- (B) Cytochrome *c*
- (C) Cytokeratins
- (D) Myeloperoxidase
- (E) Superoxide dismutase

4

A 40-year-old man is pulled from the ocean after a boating accident and resuscitated. Six hours later, the patient develops acute renal failure. Kidney biopsy reveals evidence of karyorrhexis and karyolysis in renal tubular epithelial cells. Which of the following biochemical events preceded these pathologic changes?

- (A) Activation of Na<sup>+</sup>/K<sup>+</sup> ATPase
- (B) Decrease in intracellular calcium
- (C) Decrease in intracellular pH
- (D) Increase in ATP production
- (E) Increase in intracellular pH

5. An 11-year-old girl becomes infected with hepatitis A and experiences mild nausea for 1 week. On physical examination, she has minimal right upper quadrant tenderness and scleral icterus. Laboratory findings include a serum AST of 68 U/L, ALT of 75 U/L, and total bilirubin of 5.1 mg/dL. Her laboratory findings most likely result from which of the following changes in her hepatocytes? (basically leakage of AST and ALT)

- A Cell membrane defects
- B Lysosomal autophagy
- C Mitochondrial swelling
- D Nuclear chromatin clumping
- E Ribosomal dispersion

6. A 33-year-old woman has had increasing lethargy and decreased urine output for the past week. Laboratory studies show her serum creatinine is 4.3 mg/dL and urea nitrogen 40 mg/dL. A renal biopsy is performed, and the specimen is examined using electron microscopy. Which of the following morphologic cellular changes most likely suggests a diagnosis of acute tubular necrosis?

- A Chromatin clumping
- B Mitochondrial swelling
- C Nuclear fragmentation

- D Plasma membrane blebs
- E Ribosomal disaggregation

7. An experimental drug administered to a tissue preparation is found to inhibit cellular oxidative phosphorylation when given in high doses, and ATP production drops to 5% of normal. Cell membrane function is diminished. Which of the following substances is most likely to be present at increased concentration in culture fluid bathing the tissue?

- A Calcium
- B Glucose
- C Ketones
- D Potassium
- E Sodium

8. A 47-year-old woman has poorly controlled diabetes mellitus and develops coronary artery disease. She now has decreasing cardiac output with blood pressure of 80/40 mm Hg and ejection fraction of 18%. An increase in which of the following substances in her blood is most indicative of reversible cell injury from decreased systemic arterial perfusion of multiple organs and tissues?

- A Carbon dioxide
- B Creatinine
- C Glucose
- D Lactic acid
- E Troponin

9. A tissue preparation is experimentally subjected to a hypoxic environment. The cells in this tissue begin to swell, and chromatin begins to clump in cell nuclei. ATPases are activated, and ATP production decreases. Which of the following ions accumulating in mitochondria and the cytosol contributes most to these findings and to eventual cell death?

- A  $\text{Ca}^{2+}$
- B  $\text{Cl}^-$
- C  $\text{HCO}_3^-$
- D  $\text{K}^+$
- E  $\text{Na}^+$
- F  $\text{PO}_4^{3-}$

10. In an experiment, a large amount of a drug is administered to experimental organisms and is converted by cytochrome P-450 to a toxic metabolite. Accumulation of this metabolite leads to increased intracellular lipid peroxidation. Depletion of which of the following intracellular substances within the cytosol exacerbates this form of cellular injury by this mechanism?

- A ADP
- B Glutathione
- C NADPH oxidase
- D Nitric oxide synthase
- E mRNA
- F Sodium

11. In an experiment, metabolically active cells are subjected to radiant energy in the form of x-rays. This results in cell injury caused by hydrolysis of water. Which of the following intracellular enzymes helps to protect the cells from this type of injury?

- A Endonuclease
- B Glutathione peroxidase
- C Lactate dehydrogenase
- D Phospholipase
- E Protease

12. A 5-year-old child ingests 50 iron tablets, each with 27 mg of iron. Within 6 hours the child develops abdominal pain and lethargy. On physical examination he is hypotensive. Laboratory studies show metabolic acidosis. Through formation of which of the following compounds is the cell injury in this child most likely mediated?

- A Ascorbic acid
- B Hemosiderin
- C Hydroxyl radical
- D Nitric oxide
- E Superoxide dismutase

13. A 54-year-old man experienced severe substernal chest pain for 3 hours. An ECG showed changes consistent with an acute myocardial infarction. After thrombolytic therapy with tissue plasminogen activator (t-PA), his serum creatine kinase (CK) level increased. Which of the following tissue events most likely occurred in the myocardium after t-PA therapy?

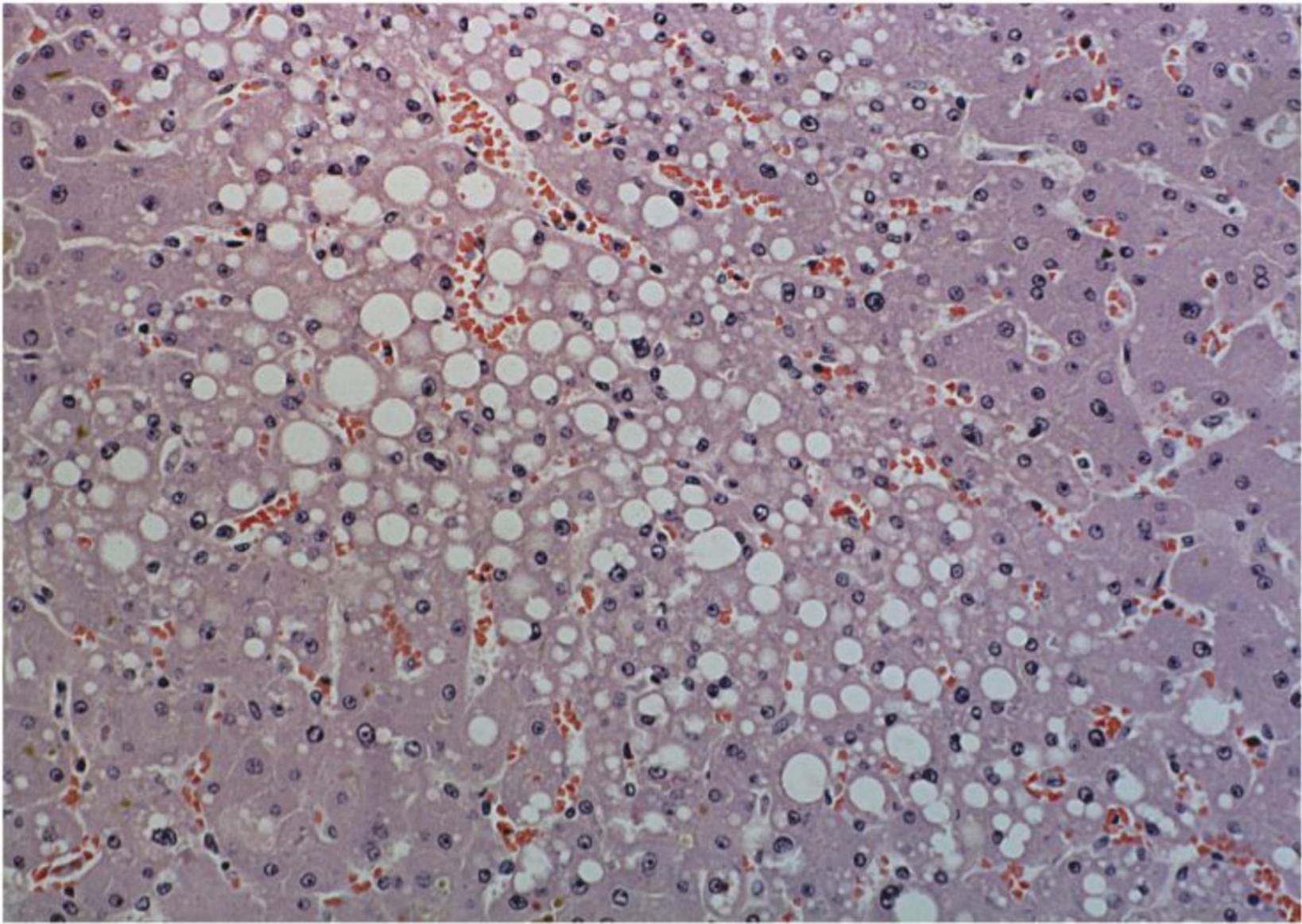
- A Cellular regeneration
- B Drug toxicity
- C Increased synthesis of CK
- D Myofiber atrophy
- E Reperfusion injury

14. An experiment introduces a knockout gene mutation into a cell line. The frequency of shrunken cells with chromatin clumping, karyorrhexis, and cytoplasmic blebbing is increased compared with a cell line without the mutation. Overall survival of the mutant cell line is reduced. Which of the following genes is most likely to be affected by this mutation?

A BAX  
B BCL2  
C C-MYC  
D FAS  
E p53

1. A
2. A
3. B
4. C
5. A
6. C
7. D
8. D
9. A
10. B
11. B
12. C
13. E
14. B

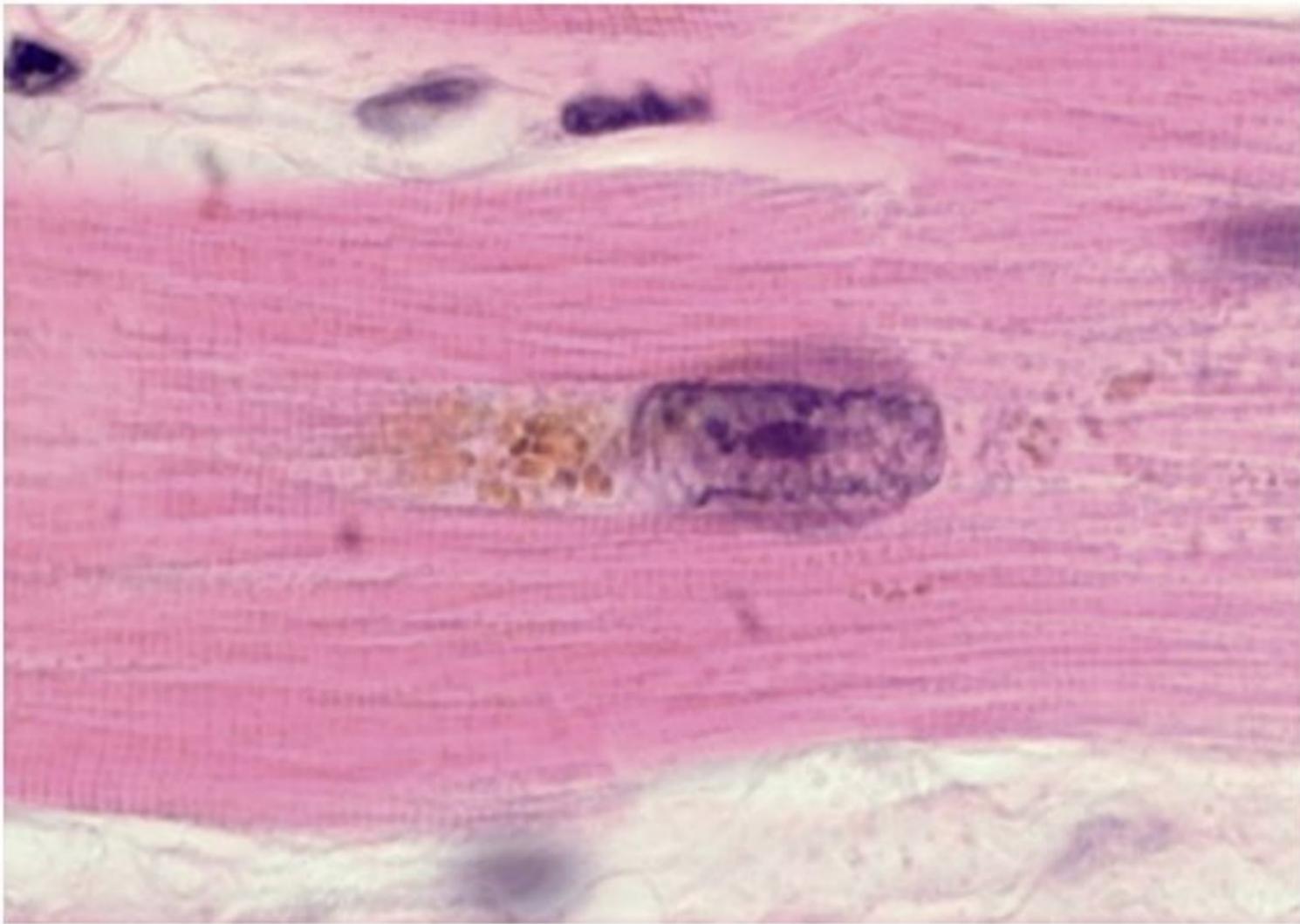
1.



A 46-year-old man has noted increasing abdominal size for the past 6 years. On physical examination his liver span is increased to 18 cm. An abdominal CT scan shows an enlarged liver with diffusely decreased attenuation. Laboratory findings include increased total serum cholesterol and triglyceride levels, increased prothrombin time, and a decreased serum albumin concentration. The representative microscopic appearance of his liver is shown in the figure. Which of the following activities most likely led to these findings?

- A Drinking beer
- B Ingesting aspirin
- C Injecting heroin
- D Playing basketball
- E Smoking cigarettes

2.



At autopsy, the heart of a 63-year-old man weighs only 250 g (normal 330 g) and has small right and left ventricles. The myocardium is firm, with a dark chocolate-brown color throughout. The coronary arteries show minimal atherosclerotic changes. An excessive amount of which of the following substances, shown in the figure, would most likely be found in the myocardial fibers of this heart?

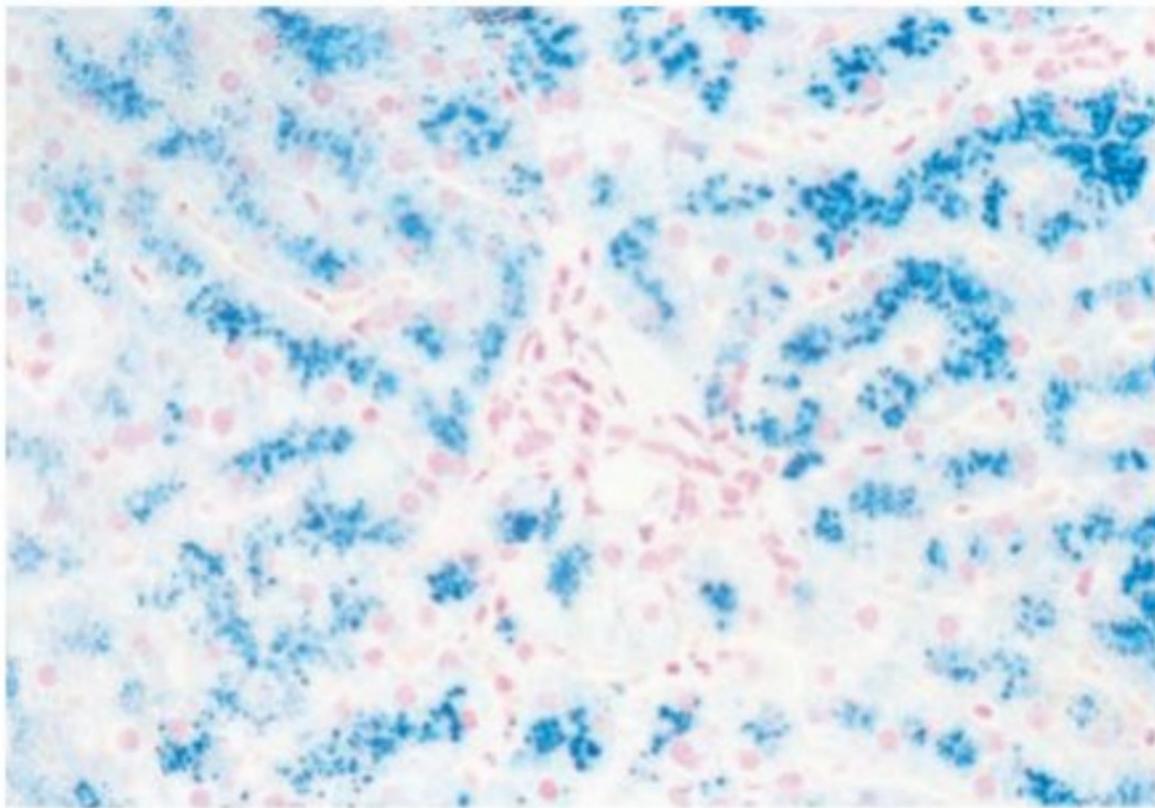
- A Bilirubin
- B Glycogen
- C Hemosiderin
- D Lipofuscin
- E Melanin

3. An experiment analyzes cells for enzyme activity associated with sustained cellular proliferation. Which of the following cells is most likely to have the highest telomerase activity?

- A Endothelial cells
- B Erythrocytes
- C Germ cells
- D Neurons
- E Neutrophils

4.

A 45-year-old man presents with increasing abdominal girth and yellow discoloration of his skin and sclera. Physical examination reveals hepatomegaly and jaundice. A Prussian blue stain of a liver biopsy is shown in the image. What is the major intracellular iron storage protein in this patient's hepatocytes?



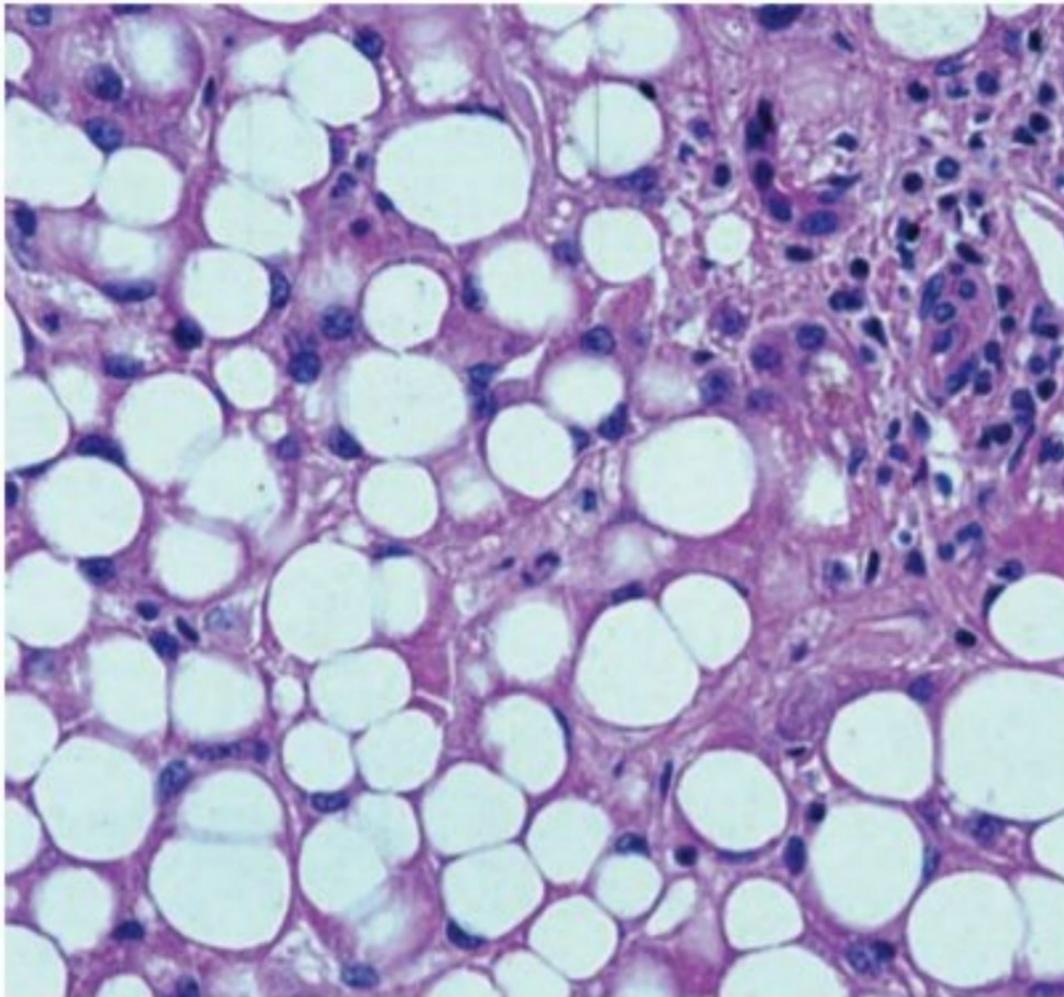
- (A) Bilirubin
- (B) Haptoglobin
- (C) Hemoglobin
- (D) Hemosiderin
- (E) Transferrin

سؤال مريض شوي تحملوني

5. A 45-year-old woman has had worsening dyspnea for the past 5 years. A chest CT scan shows panlobular emphysema. Laboratory studies show a deficiency of  $\alpha$ 1-antitrypsin (AAT). Her AAT genotype is PiZZ. A liver biopsy specimen examined microscopically shows abundant PAS-positive globules within periportal hepatocytes. Which of the following molecular mechanisms is most likely responsible for this finding in her hepatocytes?  
A Decreased catabolism of AAT in lysosomes

- B Excessive hepatic synthesis of AAT
- C Impaired dissociation of AAT from chaperones
- D Inability to metabolize AAT in Kupffer cells
- E Retained misfolded AAT in endoplasmic reticulum

6. The illustration is from a liver biopsy of a 34-year-old woman with a long history of alcoholism. Which of the following is the best explanation for the changes shown here?



- (A) Accumulation of triglycerides within hepatocytes
- (B) Apoptosis with replacement of damaged cells by lipid-laden macrophages
- (C) Bilirubin accumulation with mobilization of fat by bile salts
- (D) Enzymatic fat necrosis with digestion of liver parenchyma by released enzymes
- (E) Irreversible damage to mitochondria

7. A 45-year-old man is referred because of a recent diagnosis of hereditary hemochromatosis. Which of the following is a correct statement about this disorder?

- (A) Damage to organs results from abnormal deposition of lead
- (B) It can cause skin pigmentation
- (C) Most cases are due to spontaneous mutations
- (D) Skin hyperpigmentation is due to bilirubin accumulation
- (E) The TIBC is characteristically increased

8. A 60-year-old woman with breast cancer and widespread bony metastases is found to have calcification of multiple organs. The calcifications are best described as

- (A) dystrophic with decreased serum calcium.
- (B) dystrophic with increased serum calcium.
- (C) metastatic with decreased serum calcium.
- (D) metastatic with increased serum Calcium.

9. A 69-year-old woman has had a chronic cough for the past year. A chest radiograph shows a 6-cm mass in the left lung. A needle biopsy specimen of the mass shows carcinoma. A pneumonectomy is performed, and examination of the hilar lymph nodes reveals a uniform, dark black cut surface. Which of the following factors most likely accounts for the appearance of these lymph nodes?

- A Aging effects
- B Bleeding disorder
- C Cigarette smoking
- D Liver failure
- E Multiple metastases

10. A 22-year-old woman from Albania has a congenital anemia requiring multiple transfusions of RBCs for many years. On physical examination, her skin has a bronze color. Liver function tests show reduced serum albumin. Which of the following findings would most likely appear in a liver biopsy specimen?

- A Amyloid in portal triads
- B Bilirubin in canaliculi
- C Glycogen in hepatocytes
- D Hemosiderin in hepatocytes
- E Steatosis in hepatocytes

11.



A 72-year-old man died suddenly from congestive heart failure. At autopsy, his heart weighed 580 g (normal 330 g) and showed marked left ventricular hypertrophy and minimal coronary arterial atherosclerosis. A serum chemistry panel ordered before death showed no abnormalities. Which of the following pathologic processes best accounts for the appearance of the aortic valve seen in the figure?

- A Amyloidosis
- B Dystrophic calcification
- C Hemosiderosis
- D Hyaline change
- E Lipofuscin deposition

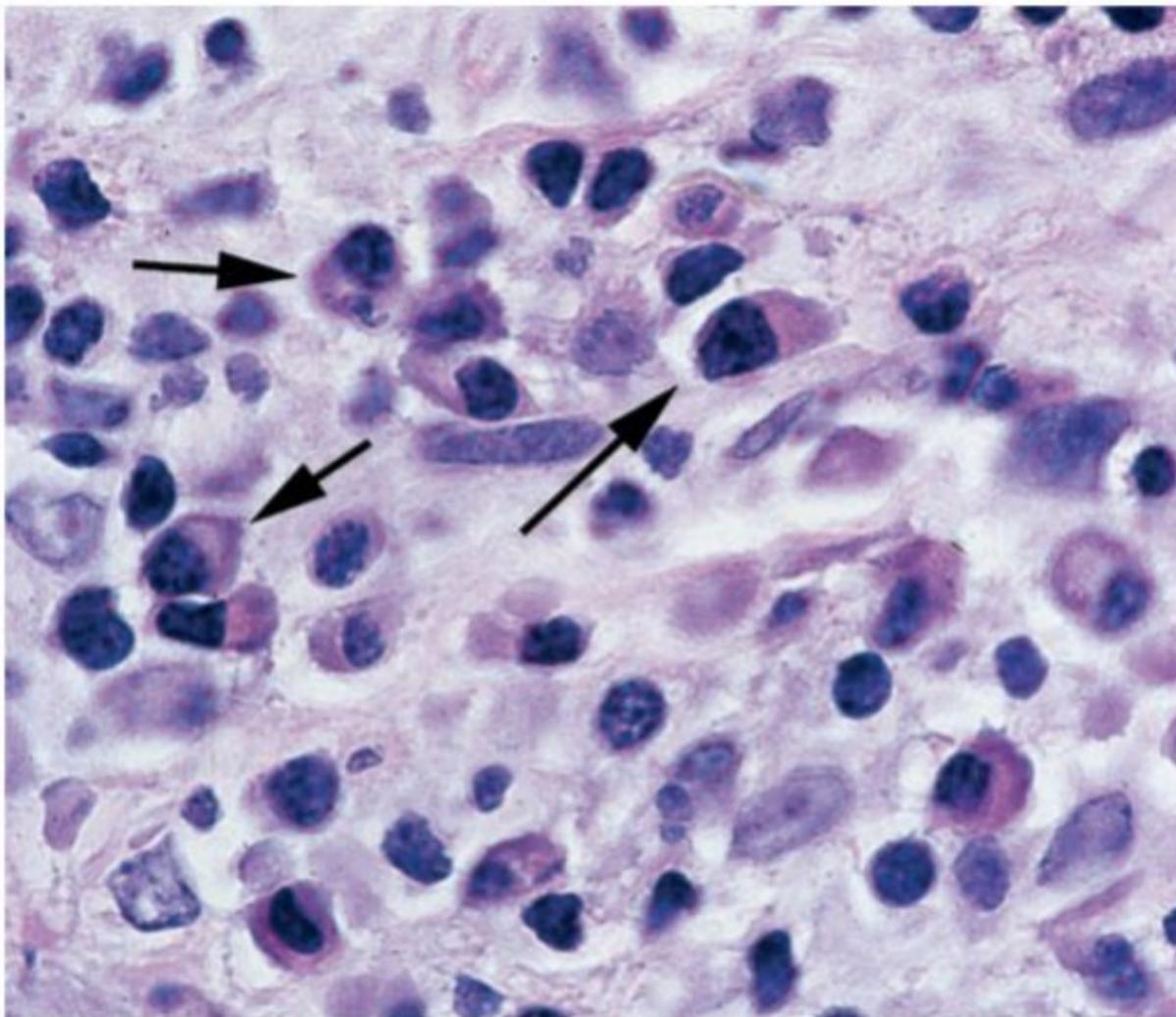
12. A 70-year-old man with hypercalcemia died suddenly. At autopsy, microscopic examination showed noncrystalline amorphous deposits of calcium salts in gastric mucosa, renal interstitium, and alveolar walls of lungs. Which of the following underlying conditions would most likely explain these findings?

- A Chronic active hepatitis
- B Diffuse parathyroid hyperplasia
- C Disseminated tuberculosis

- D Generalized atherosclerosis
- E Normal aging process
- F Pulmonary emphysema

13.

**14** A 41-year-old woman complains of excessive menstrual bleeding and pelvic pain of 4 months. She uses an intrauterine device for contraception. Endometrial biopsy (shown in the image) reveals an excess of plasma cells (arrows) and macrophages within the stroma. The presence of these cells and scattered lymphoid follicles within the endometrial stroma is evidence of which of the following conditions?



- (A) Acute inflammation
- (B) Chronic inflammation
- (C) Granulation tissue
- (D) Granulomatous inflammation
- (E) Menstruation

**14. A 68-year-old coal miner with a history of smoking and emphysema develops severe airflow obstruction and expires. Autopsy reveals a “black lung,” with coal-dust nodules scattered throughout the parenchyma and a central area of dense fibrosis. The coal dust entrapped within this miner’s lung was sequestered primarily by which of the following cells?**

- (A) Endothelial cells**
- (B) Fibroblasts**
- (C) Lymphocytes**
- (D) Macrophages**
- (E) Plasma cells**

1. a

2. d

3. c

4. d

5. e

6. a

7. b

8. d

9. c Remember cigarettes have carbon -> exogenous substance

10. d Remember the liver is involved in iron metabolism

11. b

12. b

13. b

14. d