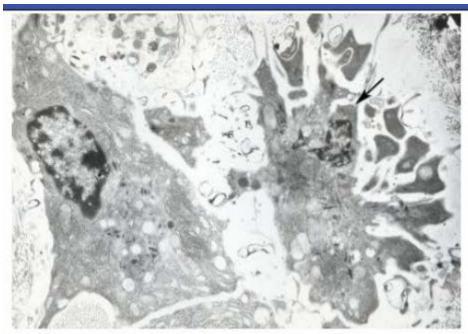
1.



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

Activate Windows

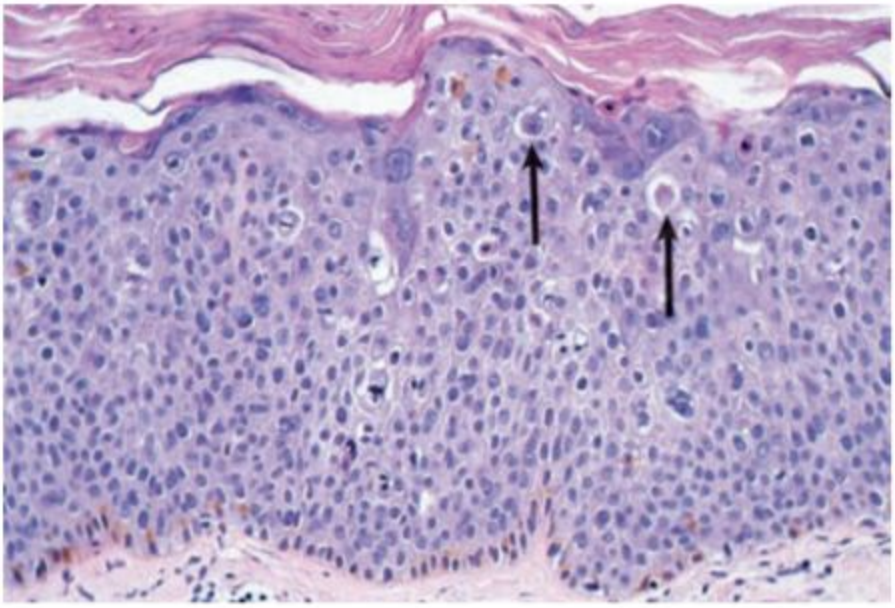
2.

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^+/K^+ 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 Ca^{2+}
B Cl^{-}
C HCO_3^{-}
D K^{+}
E Na^{+}
F 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