#1-#32 MULTIPLE CHOICE: CHOOSE THE ONE BEST ANSWER & ENTER IT ON THE SCORESHEET

1. What is the limit of resolution of a conventional light microscope:
a) 0.25 m
b) 0.25 mm
c) 0.25 µm
d) 0.25 nm
e) 0.25 angstroms

2. Which of the following is NOT an example of a histochemical stain:
a) using eosin to visualize intermediate filaments
b) using hematoxylin to visualize hyaluronic acid
c) using Weigert's stain to visualize elastic fibers
d) using a trichrome stain to visualize collagen
e) using an antibody-based stain to visualize an integrin

3. In a trilaminar image of a plasmamembrane generated using a transmission electron microscope, where are the hydrophobic tails of the phospholipids located:
a) in the outer layer
b) in the middle layer
c) in the inner layer
d) in the outer and the inner layers
e) in all three layers of the plasmamembrane

4. When a glycosylated protein hormone is synthesized in an epithelial cell located within an endocrine gland, which of the following is INCORRECT:
a) the signal peptide is removed from the protein in the cytoplasm
b) the protein is folded in the endoplasmic reticulum
c) the protein is glycosylated in the Golgi
d) secretory vesicles containing the glycosylated protein aggregate in the basal portion of the cell
e) SNAREs cause secretory vesicles containing the glycosylated protein to fuse with plasmamembrane during exocytosis

5. During trafficking to the lysosome and/or receptor-mediated endocytosis, where is the mannose-6-phosphate (M6P) receptor released from the phosphorylated enzyme:
a) in the cis-Golgi
b) in the trans-Golgi
c) in a clathrin-coated vesicle
d) in an early endosome
e) in a late endosome

6. Which of the following holds/binds the outer membrane of a mitochondrion and the ER membrane in close proximity (i.e. in an 'ER junction') so that phospholipids can be efficiently trafficked from one membrane to the other in a non-vesicular fashion.
a) bridging complex
b) translocon of the outer membrane (TOM) complex
c) donor membrane phospholipid receptor
d) acceptor membrane phospholipid receptor
e) lipid transfer protein

7. Which of the following has its own DNA that encodes genes:

a) peroxisome
b) lysosome
c) mitochondrion
d) smooth endoplasmic reticulum
e) rough endoplasmic reticulum

8. Regarding microtubules, which of the following is INCORRECT:

a) elongate at their plus ends
b) involved in chromosome segregation
c) required for anterograde transport in axons
d) found in the core of microvilli
e) thickest of the cytoskeletal elements in cross-section

9. Which of the following responds to DNA damage and initiates a process that halts the cell cycle at the G1 to S checkpoint:

a) cytochrome C
b) cyclin D
c) p53
d) caspase 3
e) caspase 8

10. Which of the following causes cadherin straightening and homodimerization in 'trans':

a) calcium binding to the intracellular domain
b) calcium binding to the extracellular domain
c) calcium release from the intracellular domain
d) calcium release from the extracellular domain
e) linkage to actin via the catenin complex

11. Heparin is a:

a) glycosaminoglycan (GAG)
b) proteoglycan (PG)
c) glycoprotein (GP)
d) extracellular matrix fiber
e) monosaccharide

12. Which of the following is NOT found in the basement membrane ECM:

a) laminin
b) actin
c) fibrillin
d) perlecan
e) collagen

13. What percentage of cells in a pseudostratified columnar epithelium are attached to the basement membrane ECM:

a) 0%
b) 25%
c) 50%
d) 75%
e) 100%

14. Highly glycosylated collagen type III fibers are most prominent in:
a) loose connective tissue
b) dense irregular connective tissue
c) dense regular connective tissue
d) adipose connective tissue
e) reticular connective tissue

15. Which of the following best defines loose connective tissue:
a) many cells, many fibers, abundant ground substance
b) many cells, few fibers, abundant ground substance
c) many cells, few fibers, little ground substance
d) few cells, few fibers, little ground substance
e) few cells, many fibers, little ground substance

16. Which of the following distinguishes bone from cartilage:
a) only bone has progenitor cells
b) only bone has blast cells
c) only bone has differentiated cells in lacunae
d) only bone has collagen
e) only bone has hydroxyapatite crystals

17. Which of the following is NOT a characteristic of hyaline cartilage in the trachea:
a) proteoglycans contribute to the ground substance of the ECM
b) water contributes to the ground substance of the ECM
c) collagen type II contribute to the fibers of the ECM
d) collagen type I contributes to the fibers of the ECM
e) the presence of a perichondrium

18. During bone deposition, which cells lay down significant amounts of osteoid prior to mineralization
a) osteoprogenitor cells
b) osteoblasts
c) osteoclasts
d) osteocytes
e) mesenchymal stem cells

19. Bisphosphonates, which are often used to treat osteoporotic bone loss that occurs in post-menopausal women, acts to decrease the activity of which cells:
a) osteoprogenitor cells
b) osteoblasts
c) osteoclasts
d) osteocytes
e) mesenchymal stem cells

20. Which of the following is avascular:
a) stratified squamous keratinized epithelium of the skin
b) dense regular connective tissue of the biceps tendon
c) loose connective tissue in the mucosa of the small intestine
d) dense bone in the femur of the adult
e) the periosteal bud that gives rise to the primary ossification center in the developing femur of the fetus

21. Regarding muscle types, which of the following is CORRECT:
a) skeletal muscles do, while cardiac and smooth muscles do not, contain sarcomeres
b) cardiac muscles do, while skeletal and smooth muscles do not, contain sarcomeres
c) smooth muscles do, while skeletal and cardiac muscles do not, contain sarcomeres
d) smooth and skeletal muscles do, while cardiac muscles do not, contain sarcomeres
e) skeletal and cardiac muscles do, while smooth muscles do not, contain sarcomeres

22. In skeletal muscle, which of the following represents a single muscle cell:
a) myofibril
b) myofiber
c) endomysium
d) perimysium
e) epimysium

23. Which of the following shifts its position to unmask the myosin binding site on actin filaments during calcium-mediated skeletal muscle contraction:
a) tropomyosin
b) troponin
c) calsequestrin
d) ryanodine receptor
e) dihydropyridine receptor

24. Which of the following are located in the transverse portions of the intercalated disks found in cardiac muscle:
a) gap junctions
b) adherens junctions
c) tight junctions
d) hemidesmosomes
e) focal adhesions

25. Which of the following best describes what happens in skeletal muscle when dystrophin is mutated in such a way that it eventually results in muscular dystrophy:
a) terminal cisternae are no longer linked to t-tubules efficiently
b) actin is no longer linked to the z-disks efficiently
c) basal lamina is no longer linked to actin efficiently
d) tendons are no longer linked to the muscle efficiently
e) the dystroglycan complex does not form efficiently

26. Which of the following is NOT derived from neuroectoderm:
a) a fibrous astrocyte in a nucleus deep within the brain
b) a fibroblast in the dura mater covering the brain
c) an ependymal cell lining a brain ventricle
d) a motor neuron in the pre-central gyrus of the cerebral cortex of the brain
e) a sensory neuron in the post-central gyrus of the cerebral cortex of the brain

27. Which of the following synapse with skeletal muscle cells:
a) pre-ganglionic sympathetic neurons
b) post-ganglionic sympathetic neurons
c) pre-ganglionic parasympathetic neurons
d) somatic motor neurons
e) somatic sensory neurons

28. Which of the following occurs first during synaptic transmission between two neurons:
a) binding of neurotransmitter to receptors on the plasmamembrane at the post-synaptic terminal
b) vesicle fusion with the plasmamembrane at the pre-synaptic terminal
c) depolarization of the plasmamembrane at the post-synaptic terminal
d) depolarization of the plasmamembrane at the pre-synaptic terminal
e) exocytosis of neurotransmitter from the pre-synaptic terminal

29. Which of the following are only found in the peripheral nervous system (PNS):
a) Schwann cells
b) oligodendrocytes
c) protoplasmic astrocytes
d) microglial cells
e) myelin

30. Which of the following most contribute to the formation of the blood-brain-barrier:
a) tight junctions between ependymal cells
b) tight junctions between capillary endothelial cells
c) tight junctions between fibrous astrocytes and capillary endothelial cells
d) tight junctions between protoplasmic astrocytes and capillary endothelial cells
e) microglial cell phagocytosis

31. Regarding 'potency' which of the following is correct (during normal development):
a) more differentiated cells are more potent
b) less differentiated cells are more potent
c) less differentiated cells are less potent
d) cells of the epiblast are unipotent
e) osteoprogenitor cells are totipotent

32. In the placenta, which of the following is contributed by the mother:
a) chorionic villi
b) decidua basalis
c) cytotrophoblasts
d) syncitiotrophoblasts
e) extraembryonic mesoderm

End of Multiple Choice Questions; Proceed to Short Answer Questions

#33-#40 SHORT ANSWERS: WRITE THE CORRECT ANSWER DIRECTLY ON THE EXAM

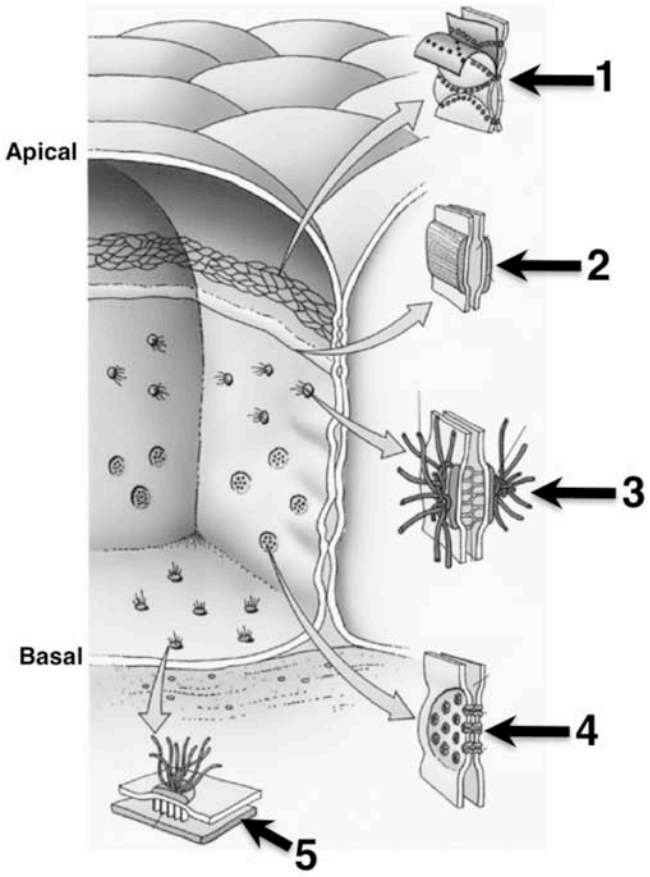


Fig 01: Cell Junctions In A Simple Columnar Epithelium

33. In Fig 1, which numbered junction contains integrins:

(write the number) ***5***

34. In Fig 1, which numbered junction forms a permeability barrier that regulates paracellular transport between cells of the epithelium:

(write the number) ***1***

35. In Fig 1, which two numbered junctions form 'zonula' or belts that encircle the cells of the epithelium :

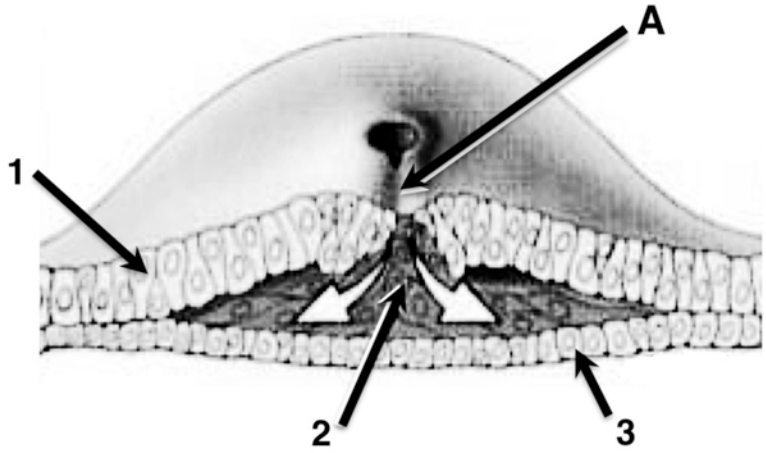
(write both numbers) ***1 and 2 (order doesn't matter)***

36. In Fig 1, what is the name of channels that form within junction #4:

(write name of the channels) ***connexons, connexins, hemi-channels, electrochemical channels***
(not 'Gap Junctions)

End of questions from Fig 1; Proceed to Fig 2

Fig 02: Gastrulation (16 Days Post-Fertilization)



37. In Fig 2, which numbered structure is the endoderm:

(write the number) ***3***

38. In Fig 2, which numbered structure contains cells that express the transcription factor 'slug':

(write the number) ***2*** ***Please note: For students who wrote the exam at Access & Diversity there was a significant error in this question. Thus, all A&D students received a mark for this question regardless their answer.***

39. In Fig 2, which numbered structure will later give rise to the neural tube:

(write the number) ***1***

40. In Fig 2, what is the name of the structure labelled 'A':

(write the name of the structure) ***primitive streak, groove or pit (not primitive 'node')***

End of Midterm Examination