I. FOR THE FOLLOWING QUESTIONS, INDICATE THE LETTER THAT CORRESPONDS TO THE SINGLE MOST APPROPRIATE ANSWER.

1. The muscularis externa of the alimentary canal
   A. is innervated mainly by the submucosal plexi.
   B. has smooth muscle protrusions into the villi.
   C. has projections into each plica circularis.
   D. has parasympathetic ganglion cells between its layers.
   E. lacks sympathetic innervation.

2. The histology of a sagittal section of the tongue would reveal
   A. taste buds within the epithelium of fungiform papillae.
   B. mucous glands, but not serous glands within the connective tissue.
   C. more fungiform papillae than filiform papillae.
   D. that diffuse lymphoid tissue was virtually absent from the lamina propria.
   E. skeletal muscle organized into a superficial longitudinal layer and a deep circular layer.

3. A pregnant mouse was given a single injection (pulse label) of radioactive calcium at the time when initial mineralization was occurring in her fetuses' first molars. After the pup's birth, the erupted first molars were removed and sectioned in preparation for autoradiographic analysis. The highest concentration of label was located
   A. on the outer surface of the crown.
   B. at the dentino-enamel junction.
   C. in the dentin adjacent to the pulp cavity.
   D. at the junction between the dentin and the cementum.
   E. on the external surface of the root.

4. Osteoclastic resorption of the root of the deciduous tooth is stimulated by the pressure exerted by the underlying developing permanent tooth. This osteoclast activity breaks down
   A. dentin and enamel.
   B. enamel and cementum.
   C. dentin and cementum.
D. dentin only.
E. enamel only.

5. Statements that describe the esophagus include which of the following?

A. Skeletal muscle in the muscularis externa is most abundant near the esophageal-cardiac junction.
B. Serous glands are located throughout the lamina propria.
C. The muscularis mucosae consists of an inner circular and an outer longitudinal layer of smooth muscle.
D. The outermost layer is an adventitia except at the distal end.
E. The mucous glands within the submucosa are found only at the esophageal cardiac junction.

6. The main function of the enterokinase (enteropeptidase) located on the microvillar surface of the enterocytes is to

A. convert pepsinogen to pepsin.
B. increase pH in the lumen of the intestine.
C. regulate the quantity of water that is absorbed.
D. convert trypsinogen to trypsin.
E. reduce secretion of pancreatic bicarbonate.

7. In the colon,

A. villi appear as short projections into the lumen.
B. enteroendocrine cells are found in the epithelium of the crypts.
C. the epithelium that faces the luminal surface consists entirely of goblet cells.
D. Paneth cells are more numerous than stem cells at the base of the crypts.
E. Brunner’s glands are found in the submucosa.

8. Which of the following describes the hepatic portal lobule? It

A. has a hexagonal organization.
B. has a bile duct as its center.
C. has a central vein as its center.
D. emphasizes endocrine functions.
E. emphasizes the location of Kupffer cells.

9. Plicae circulares (valves of Kerckring)
A. are found in the stomach.
B. are found in the small and large intestine.
C. have villi on their surface.
D. occur in the esophagus.
E. have a function similar to that of the pyloric sphincter.

10. Following fat absorption by enterocytes in the small intestine, chylomicra

A. are found in the Golgi apparatus.
B. pass through junctional complexes to reach the intercellular space.
C. lack a surrounding unit membrane.
D. first appear in the rough endoplasmic reticulum found in the basal region of enterocytes.
E. are synthesized by enzymes in the glycocalyx.

11. Endocrine cells, widely distributed in the epithelium of the digestive tract and also found in the islets of Langerhans, can inhibit activity in adjacent cells by a paracrine mode of action. The hormone formed by these cells is

A. gastrin.
B. secretin.
C. cholecystokinin.
D. somatostatin.
E. glucagon.

12. In order to best distinguish the types of enteroendocrine cells that secrete specific hormones, tissue must be prepared and evaluated using

A. H and E staining.
B. silver stains.
C. transmission electron microscopy.
D. immunocytochemistry.
E. periodic acid Schiff.

13. Hypothalamic neurons that secrete GnRH are most likely to

A. have short axons (less than 10 micrometers in length).
B. synapse on cells of the anterior pituitary.
C. synapse on pituicytes in the pars nervosa.
D. terminate in the median eminence or infundibular stalk.
E. be directly supplied by blood from the inferior hypophyseal artery.
14. The neurohypophysis contains
   A. pinealocytes.
   B. cell bodies of neurons that synthesize oxytocin.
   C. secretory granules containing vasopressin.
   D. secretory granules containing aldosterone.
   E. remnants of Rathke's pouch.

15. When the patient's ejaculate was determined to have a normal sperm count but a low concentration of fructose, the physician suspected a defect in his
   A. bulbourethral glands.
   B. glands of Littre.
   C. glans penis.
   D. prostate gland.
   E. seminal vesicles.

16. Benign prostatic hypertrophy afflicts most males over 40 years of age, and results from an increase in size of the epithelial cells lining the
   A. mucosal glands (only).
   B. submucosal glands (only).
   C. main prostatic glands (only).
   D. mucosal and submucosal glands.
   E. mucosal, submucosal and main prostatic glands.

17. In the male reproductive system, peritubular cells (myoid cells) are immediately adjacent to the basement membrane of the
   A. seminiferous tubules.
   B. penile urethra.
   C. rete testis.
   D. colliculus seminalis.
   E. vas deferens.

18. During spermatogenesis, the axoneme of a mature spermatozoon is derived from the
   A. Golgi apparatus.
   B. distal centriole.
   C. manchette.
D. acrosome.
E. annulus.

19. Concerning steroid biosynthesis by the interstitial cells of Leydig, which of the following choices correctly shows the changes in steroid synthesis as a function of age?

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Steroid biosynthesis as a function of age

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20. The endometrium of the body of the uterus

A. becomes edematous superficially in the luteal phase.
B. contains compound tubuloalveolar glands.
C. contains lamina propria that is predominantly composed of thick collagen fibers.
D. is sloughed at menses to below the level of the bases of the glands.
E. primarily synthesizes mucus in early secretory phase.

21. Which of the following statements about the placenta is true?

A. The trophoblast develops from the cumulus oophorus.
B. The placenta contains maternal blood in lacunae lined with maternal endothelium.
C. The placenta has villi containing cores of myometrial smooth muscle.
D. Fibrinoid may be found in villi or the basal plate.
E. The cytotrophoblasts form a continuous layer in term villi.

22. The corpus luteum

A. secretes estrogen and progesterone during the follicular phase.
B. develops from the theca interna and granulosa cells in response to oxytocin.
C. supports the stratum functionalis through the proliferative phase.
D. involutes in response to human chorionic gonadotropin.
E. involutes to form a corpus albicans.

23. John was unable to donate blood during the student blood drive due to a low hematocrit.
Although he had felt tired recently, he assumed it was due to his rigorous schedule because he consumed a nutritious diet that included daily vitamin tablets. A subsequent thorough clinical evaluation revealed, however, that he had pernicious anemia, resulting from the malfunction of his

A. enterocytes in the duodenum.
B. gastric parietal cells.
C. gastric chief cells.
D. enteroendocrine G cells.
E. alpha cells of pancreatic islets.

24. Of the following structures, which contains the highest level of secretory IgA?

A. Bile canaliculus
B. Liver sinusoid
C. Central vein
D. Hepatic artery
E. Space of Disse

25. Regarding the lower rectum and anal canal,

A. the internal anal sphincter consists of skeletal muscle.
B. the external anal sphincter consists of smooth muscle.
C. stratified squamous epithelium covers the rectal columns (of Morgagni).
D. the internal anal sphincter is formed from the inner layer of the muscularis externa.
E. simple columnar epithelium of the colon covers the anal valves and anal orifice.

26. Colloid in the thyroid gland

A. is a lipoprotein.
B. contains iodinated amino acids.
C. lacks carbohydrate residues.
D. is the stored form of thyroid stimulating hormone.
E. is found near the basal surface of principal cells.

27. Primary follicles

A. contain a PAS-negative zona pellucida.
B. have an antrum.
C. contain a tri-layered theca folliculus.
D. develop from primordial follicles by gonadotropin-independent mechanisms.
E. form secondary oocytes concurrent with secondary follicle formation.

28. Which of the following "precursor>>placental structure" relationships is correct?
   A. Endometrial glandular epithelial cell>>decidual cell.
   B. Extraembryonic mesoderm>>basal plate.
   C. Syncytiotrophoblast>>fetal blood vessel wall.
   D. Stratum functionalis>>decidua basalis.
   E. Cytotrophoblast>>umbilical cord.

29. Which of the following is lined with simple cuboidal epithelium?
   A. Efferent ducts
   B. Epididymis
   C. Seminal vesicles
   D. Straight tubules
   E. Vas deferens

II. IN THE FOLLOWING SECTION, NOTE THAT THE CORRECT ANSWER IS THE STATEMENT THAT IS LEAST LIKELY.

30. Concentration of bile by the gallbladder requires all of the following EXCEPT
   A. specializations at the apical surface of epithelial cells.
   B. specializations at the basolateral surfaces of the epithelial cells.
   C. an ATP-dependent sodium pump.
   D. an intracellular osmotic gradient.
   E. specializations of the basal lamina.

31. Which of the following is LEAST likely to enter the liver by the hepatic portal vein?
   A. Products from digested proteins and carbohydrates
   B. IgA
   C. Venous blood from large and small intestines
   D. Chylomicra
   E. Bilirubin

32. Characteristics of M cells include the following EXCEPT they
   A. synthesize abundant IgA.
B. form part of the intestinal epithelium.
C. have irregular folds on their apical surface.
D. transport antigens from the intestinal lumen to lymphoid tissue.
E. are mainly associated with lymph nodules.

33. Characteristics of Paneth cells include the following EXCEPT

A. originate from stem cells in the base of the intestinal glands (crypts).
B. eosinophilic secretory granules.
C. cells confined to base of the crypts.
D. turnover in five to seven days.
E. secretion of a bactericidal protein.

34. In the mucosa of the small intestine, the pairs of cells LEAST likely to lie adjacent to one another are

A. differentiating goblet cells and differentiating enterocytes.
B. mature Paneth cells and stem cells.
C. mature enterocytes and stem cells.
D. differentiating goblet cells and differentiating enteroendocrine cells.
E. M cells and lymphocytes.

35. All of the following are properties of Sertoli cells EXCEPT they

A. express cell surface receptors for follicle stimulating hormone.
B. phagocytize residual bodies.
C. synthesize and secrete acid phosphatase.
D. synthesize and secrete androgen binding protein.
E. synthesize and secrete anti-Mullerian hormone.

36. All of the following are true of the helicine arteries of the penis EXCEPT they

A. are highly coiled arteries.
B. are located in the cavernous tissue.
C. contain intimal cushions.
D. have valves.
E. provide the major nutritional blood supply for the cavernous tissue.

37. In the seminiferous tubules, which of the following is LEAST likely to be found in an immunologically privileged area?

A. Ad spermatogonia
B. Ap spermatogonia
C. B spermatogonia
D. primary spermatocytes
E. secondary spermatocytes

38. Spermatozoa show some level of motility in all of the following EXCEPT the
A. efferent ducts.
B. epididymis.
C. prostatic urethra.
D. seminal vesicles.
E. vas deferens.

39. Which of the following would be ABSENT in a section of the appendix?
A. Crypts of Lieberkuhn
B. Taeniae coli
C. Lymph nodules
D. Goblet cells
E. Muscularis mucosae

III. MATCH THE NUMBERED QUESTIONS BELOW WITH THE LETTERED OPTIONS A-E. EACH ANSWER MAY BE USED ONCE, MORE THAN ONCE OR NOT AT ALL.

A. C-cells (parafollicular cells)
B. Oxyphil cell
C. Chromophobes
D. Central veins with thick muscular adventitia
E. Mitochondria with tubular cristae

40. Adrenal medulla

41. Ovarian interstitial cells

A. Parietal cells
B. Chief cells
C. Enteroendocrine D cells
D. Enteroendocrine G cells
E. Surface mucous cells
42. These cells secrete an inactive enzyme that requires a low pH for activation.

43. Eosinophilia in these cells is due to numerous mitochondria and a unique intracellular arrangement and large quantity of smooth membranes/vesicles.

VI. GREATER OR LESSER

Answer the following questions according to the scheme below:

A. A is greater than B
B. B is greater than A
C. A and B are approximately the same

44. A. The size of granulosa lutein cells.
   B. The size of the theca lutein cells.

45. A. The secretory activity of endometrial glands on day 8 of a normal menstrual cycle in a 23-year-old female.
   B. The secretory activity of endometrial glands on day 24 of a normal menstrual cycle in a 23-year-old female.

46. A. The viscosity of the cervical mucus during the late follicular phase of the menstrual cycle.
   B. The viscosity of the cervical mucus during the late luteal phase of the menstrual cycle.

47. A. The thickness of smooth muscle in the wall of the cervix.
   B. The thickness of smooth muscle in the wall of the fundus of the uterus.

48. A. The number of alveoli in the mammary gland of a non-pregnant, post-pubertal female.
   B. The number of alveoli in the mammary gland of a pregnant female.
A. The number of epithelial layers of the vaginal wall in the late follicular phase.
B. The number of epithelial layers of the vaginal wall in the late luteal phase.

IV. DIAGRAM

Use this diagram of a hepatocyte with labels A-E to identify the following regions:

50. The site of VLDL's prior to secretion.

51. The site of carbohydrate storage.

Use the diagram below of stomach to answer the following questions.

52. Stem cells that give rise to the cells of the gastric glands are most likely to be found in which region?

53. Cells similar to which cell type also may be present in the small intestine?

54. Which cells are most similar to pancreatic acinar cells?

Use the diagram below to answer the following questions.

55. Which diagram is most characteristic of the pancreas?

56. Which diagram is most characteristic of the sublingual gland?

From this diagram of the blood supply of the pituitary gland, (solid vessels are arteries, open vessels are veins), identify the structures indicated in the following two questions.

57. Vessel(s) in which thyroid stimulating hormone first appears
58. Vessel(s) containing the highest concentration of growth hormone releasing hormone prior to reaching a target cell.

Use the diagram below of adrenal gland to identify the regions indicated in the next three questions.

59. Electron microscopic evaluation of cells in which region(s) would reveal (extensive) smooth endoplasmic reticulum.

A. 1 (only)
B. 1 and 2 (only)
C. 1, 2 and 3 (only)
D. 1, 2, 3 and 4
E. 4 (only)

60. Which region(s) receive(s) oxygenated blood directly from capsular arteries?

A. 1 (only)
B. 2 (only)
C. 3 (only)
D. 4 (only)
E. 1 and 4 (only)

61. Electron microscopic evaluation of this region would reveal two types of secretory granules.

A. 1 (only)
B. 2 (only)
C. 3 (only)
D. 4 (only)
E. Not present

62. On the above diagram of a primary follicle, "X" indicates the

A. theca interna.
B. basal lamina.
C. granulosa cells.
D. zona pellucida.
E. oocyte cytoplasm.

A. fine, free nerve endings.
B. lactiferous sinuses.
C. sebaceous glands.
D. mammary alveoli.
E. smooth muscle bundles.