For the following questions, indicate the letter that corresponds to the SINGLE MOST APPROPRIATE ANSWER.

1. A 31-year-old rugby player is kicked in the chest during a match and suffers a fracture at the sternal angle. Which of the following structures are involved in this injury?
   A. Manubrium and clavicle
   B. Manubrium and body of sternum
   C. Manubrium and costal cartilage of rib 3
   D. Body of sternum and xiphoid process
   E. Body of sternum and clavicle

2. A 37-year-old man suffers a traumatic injury to the axilla (armpit) that damages the lateral and medial pectoral nerves. What movement of the arm could be most affected in this individual?
   A. Extension
   B. Abduction
   C. Retraction
   D. Adduction
   E. Lateral rotation

3. During the evaluation of a sensory deficit in a 63-year-old male, the neurologist recalled that spinal nerves emerge via the intervertebral foramina so that the
   A. C1 spinal nerve emerges between vertebrae C1 and C2.
   B. C7 spinal nerve emerges between vertebra C7 and T1.
   C. L2 spinal nerve emerges between vertebra L1 and L2.
   D. T9 spinal nerve emerges between vertebrae T9 and T10.
   E. S1 spinal nerve emerges between vertebrae L5 and S1.

4. A protruding intervertebral disc can cause significant pain and discomfort. Ligaments that prevent an intervertebral disc from protruding past the vertebral body include the
   A. ligamentum flavum.
   B. anterior longitudinal ligament.
   C. interspinous ligament.
   D. supraspinous ligament.
5. A 45-year-old woman has a malignant tumor in the upper lateral quadrant of her left mammary gland. To which set of lymph nodes would cells from this tumor usually metastasize?

A. Pectoral group of axillary lymph nodes  
B. Lymph nodes of abdominal wall  
C. Parasternal (internal thoracic) lymph nodes  
D. Posterior (subscapular) group of axillary lymph nodes  
E. Supraclavicular lymph nodes

6. During a surgical procedure to remove a tumor found at the level of the spinous process of the axis, a nerve was cut as it emerged between the occipital bone and vertebra C1. The patient would experience

A. loss of sensation to the posterior part of the scalp.  
B. loss of sensation from the skin overlying the ligamentum nuchae.  
C. paralysis of the rectus capitis posterior major muscle.  
D. paralysis of the splenius capitis muscle.  
E. paralysis of the trapezius muscle.

7. In a biking accident, the patient fractured a number of his ribs and severed the lateral cutaneous branch of a thoracic spinal nerve. The types of nerve fibers that were severed include all of the following EXCEPT

A. sensory fibers with their cell bodies in a dorsal root ganglion.  
B. motor fibers to skeletal muscle.  
C. general visceral afferent fibers.  
D. preganglionic sympathetic fibers.  
E. fibers carrying pain sensation from the skin.

8. The Emergency Department physician, while examining a 45-year-old man who was in a motor vehicular accident, suspected that there might be bleeding from brain tissue into the CSF. While preparing to perform a lumbar puncture to withdraw some CSF, he recalled that

A. the CSF is found in the epidural space.  
B. the dura mater and arachnoid mater terminate at the L2 vertebral level.  
C. denticulate ligaments are specializations of the arachnoid.  
D. he could insert the needle between spinous processes of vertebrae L3 – L4.  
E. the cauda equina consists only of ventral nerve roots only.
9. While hiking in the Rockies out west, you suddenly spot signs that you might be traveling along the same path as a bear (possibly a grizzly). The part of your nervous system that is activated

A. has nerve cell bodies located in the lateral horn of the spinal cord.
B. has nerve cell bodies located in the sacral spinal cord.
C. decreases heart rate.
D. constricts the pupils.
E. increases salivary gland secretion.

10. A 26-year-old man was hit in the back of the neck with pellets from a shotgun. After the injury, he noticed that he couldn’t feel the posterior part of his scalp when he brushed his hair. This could have resulted from injury to the

A. dorsal roots of the C-1 spinal nerve.
B. ventral roots of the C-1 spinal nerve.
C. suboccipital nerve.
D. greater occipital nerve.
E. spinal accessory nerve.

11. In order to drain a cyst attached to the posterior part of the third rib, a surgeon introduced a needle medial to the scapula, at the level of its spine. The needle passed through numerous layers of muscle, including all of the following EXCEPT the

A. trapezius.
B. latissimus dorsi.
C. rhomboid layer.
D. erector spinae layer.
E. serratus posterior superior.

12. During surgery to remove a small tumor of the dura mater, a single lamina of the L-5 vertebra was removed. A ligament attached to this lamina that was also removed is the

A. anterior longitudinal ligament.
B. posterior longitudinal ligament.
C. ligamentum flavum.
D. supraspinous ligament.
E. interspinous ligament.
13. A 30-year-old man is brought to the emergency department with multiple injuries, including lesions of dorsal primary rami. These lesions could result in paralysis of which of the following muscles?

A. Latissimus dorsi  
B. Serratus posterior inferior  
C. Levator scapulae  
D. Iliocostalis  
E. Rhomboid major

14. During a physical examination, your patient demonstrates weakness when she extends, medially rotates and adducts her right arm. Which of the following muscles is probably affected?

A. Trapezius  
B. Levator scapulae  
C. Latissimus dorsi  
D. Rhomboid major  
E. Serratus posterior superior

15. A 25-year-old man is brought to the hospital after being stabbed near the superior angle of his left scapula, injuring both the dorsal scapular nerve and the spinal accessory nerve. This would result in paralysis or weakness of which of the following muscles?

A. Trapezius and serratus posterior superior  
B. Rhomboid major and trapezius  
C. Latissimus dorsi and rhomboid minor  
D. Levator scapulae and longissimus  
E. Rhomboid major and splenius capitis

16. All of the following statements are correct concerning primordial germ cells EXCEPT that they

A. are first identified within the endoderm of the yolk sac.  
B. will eventually give rise to sperm or egg cells.  
C. are incapable of mitosis once they leave the yolk sac.  
D. migrate from the yolk sac to the genital ridges.  
E. stain for alkaline phosphatase activity.

17. The genital ridges are initially composed of which of the following?

A. Endoderm and mesoderm  
B. Endoderm and ectoderm  
C. Endoderm and mesothelium  
D. Mesoderm and mesothelium  
E. Mesoderm and ectoderm
18. Which of the following is involved in the prevention of polyspermy?

A. Acrosome  
B. Polar bodies  
C. Follicle cells  
D. Cortical granules  
E. Oviduct (Fallopian tube)

19. All of the following statements concerning the first two weeks of development are correct EXCEPT that

A. the zygote divides into a multicellular morula without an increase in the overall size.  
B. implantation begins before cleavage is completed.  
C. the morula differentiates into a trophoblast and an inner cell mass (embryoblast).  
D. the trophoblast gives rise to structures of the placenta.  
E. the blastocyst cavity is filled with fluids absorbed by the embryo.

20. Couples wishing to have assisted reproduction have their sperm and eggs harvested. To perform an in vitro fertilization, the physician implants what structure(s) into the female’s reproductive tract?

A. Sperm and egg  
B. Single celled zygote  
C. Embryo at the four cell stage  
D. Embryo in the 32 cell stage  
E. Embryo as a blastocyst

21. All of the following are correct concerning transgenic technology EXCEPT that a

A. knockout mouse has an entire mouse genome plus an additional (exogenous) gene.  
B. knockout mouse is produced by manipulating embryonic stem cells.  
C. knockout mouse often is unable to express a specific protein.  
D. transgenic mouse is created by injecting fertilized eggs.  
E. transgenic mouse often contains a protein that is dominant negative.

22. The chorionic cavity (extraembryonic coelom)

A. gives rise to the primary yolk sac.  
B. gives rise to the secondary yolk sac.  
C. contains amniotic fluid.  
D. surrounds cytotrophoblast cells.  
E. arises as a result of the disappearance of extraembryonic reticulum.
23. Which of the following pairs contribute to the lining of the primary yolk sac?

A. Epiblast and Heuser’s membrane
B. Cytotrophoblast and epiblast
C. Cytotrophoblast and hypoblast
D. Hypoblast and Heuser’s membrane
E. Heuser’s membrane and cytotrophoblast

24. You inject cells in an early embryo with a blue dye. The adult from this embryo contains chondrocytes that are stained blue. The cells that you originally injected were

A. cytotrophoblasts.
B. cells of the epiblast.
C. cells of the hypoblast.
D. cells of Heuser’s membrane.
E. amnioblasts.

25. A secondary villus in the developing placenta consists of

A. syncytiotrophoblast only.
B. syncytiotrophoblast and cytotrophoblast.
C. syncytiotrophoblast, cytotrophoblast, and extraembryonic mesoderm.
D. syncytiotrophoblast, cytotrophoblast, extraembryonic mesoderm, and blood vessels.

26. All of the following statements are correct concerning the complete hydatidiform mole EXCEPT that

A. it can arise from polyspermy of an egg that retains its female pronucleus.
B. it can arise from a zygote with a male or female genotype (i.e. XX or XY).
C. it lacks a genetic contribution from the mother.
D. if it persists, it usually can be detected because it secretes human chorionic gonadotrophin.

27. The primitive streak is visible from within the

A. amniotic cavity.
B. yolk sac.
C. chorionic cavity (extraembryonic coelom).
D. notochordal canal.
E. intraembryonic coelom.
28. Mesodermal structures that arise from cells migrating through the primitive streak include all of the following EXCEPT the
A. prechordal plate.
B. intermediate mesoderm.
C. extraembryonic mesoderm.
D. notochordal process.
E. caudal eminence.

29. Which of the following mesodermal structures provide most of the contribution to the dermis?
A. Somites
B. Intermediate mesoderm
C. Splanchnopleuric mesoderm
D. Somatopleuric mesoderm
E. Caudal eminence

30. Abnormal gastrulation gives rise to a syndrome of abnormalities called caudal regression. An example of this syndrome is
A. sirenomelia.
B. spinal bifida.
C. meningomyelocele.
D. craniorachischisis.
E. inionschisis.

31. All of the following structures arise from ectoderm EXCEPT the
A. epidermis.
B. neural crest.
C. neural tube.
D. notochord.

32. During neurulation, before closure of the caudal neuropore, fluid in the neural canal is continuous with fluid in the
A. amniotic cavity.
B. definitive yolk sac.
C. notochordal process.
D. extraembryonic coelom (chorion).
E. intraembryonic coelom.
33. Cells from somitomere #14 will give rise to
   A. somite #14.
   B. somite #18.
   C. sclerotome C3.
   D. sclerotome T4.
   E. vertebral body T7.

34. The annulus fibrosus of the intervertebral disk between vertebrae C7 and T1 is derived from
   A. sclerotome C7.
   B. sclerotome C8.
   C. sclerotome T1.
   D. somitomere #17.
   E. somitomere #22.

35. Multifidus muscles arise from
   A. epimeres.
   B. hypomeres.
   C. dermatomes.
   D. sclerotomes.
   E. costal processes of vertebrae.

36. All of the following are correct concerning embryonic folding EXCEPT that the
   A. ectoderm moves from a “dorsal” position to one in which it almost completely lines the
      outside of the embryo proper.
   B. endoderm transforms from a flat sheet into a tube.
   C. definitive yolk sac almost completely surrounds the embryo proper.
   D. connecting stalk becomes lined on the outside by amnioblasts.
   E. future brain moves to a position cranial to the heart and diaphragm.

37. Protrusion of nervous tissue, dura and arachnoid mater through an opening caused by incomplete
    fusion of the lumbar vertebral arches is called
   A. caudal regression.
   B. spinal bifida.
   C. meningomyelocele.
   D. craniorachischisis.
   E. inionschisis.
38. Failure of closure of the entire neural tube is called
   A. spinal bifida.
   B. craniorachischisis totalis.
   C. craniorachischisis (exencephaly, anencephaly).
   D. rachischisis (myeloschisis).
   E. inionschisis.

39. During its transformation into a notochord, the notochordal process fuses with
   A. the ectoderm.
   B. paraxial mesoderm.
   C. intermediate mesoderm.
   D. lateral plate mesoderm.
   E. the endoderm.

40. A successful transplantation of the notochord to a position lateral to the dermatome will cause
    the dermatome to develop into
   A. ventral musculature.
   B. dorsal musculature.
   C. a transverse process.
   D. a spinous process.
   E. a vertebral body.

Answers: 1b2d3d4b5a6c7d8d9a10d11b12c13d14c15b16c17d18d19b20c21a22e23d24b25c26a27a28e29d30a31d32a33c34b35a36c37c38b39e40e