Name _____KEY_____

Biology 411 - Developmental Biology
Winter Quarter 2009

Midterm 3 KEY

100 Total Points
Open Book

All of the 25 multi-choice questions are single-answer. Choose the best answer. (4 pts each) Place your answer on the ScanTron sheet. Make sure you put on name and student number on the ScanTron sheet.

1. (p. 380) Lack of folic acid will increase the incidence of spina bifida because
a. folic acid is need to specify the neural crest
b. folic acid is needed for the expression of N-cadherin
c. folic acid is needed to promote the secretion of cerebrospinal fluid in the spinal cord
d. all of the above
e. none of the above

2. (p. 384) If the BMP gradient were eliminated in the forming neural tube, what would happen to the specification of neural fates?
a. no major change would occur because the Shh gradient is still intact
b. the entire neural tube would adopt a floorplate identity because the Shh gradient would be unopposed by the BMP gradient
c. random right-left asymmetries in cell fate specification would occur
d. an expansion of ventral cell identities would occur
e. the floorplate would disappear

3. (p. 383) If a morpholino to *snakehead* was injected into a fertilized zebrafish egg, the resulting phenotype would look like
a. a chick embryo
b. a snake embryo
c. an embryo with a snake-like head
d. an embryo with fang rudiments
e. none of the above

4. (p. 468) The human cloaca is:
a. the remnant of the primitive streak
b. the precursor of the posterior endoderm
c. a stem cell zone
d. a transient allantois
e. a dilation of the embryonic gut

5. (p. 409) Mutation of a *Hox* gene results in the mis-specification of neural crest cells in the region of the embryo spanning somites 1-7. Which of the following developmental defects would be expected to arise?
a. an absence of the septum between the pulmonary arteries and the aorta
b. loss of enteric ganglia
c. loss of thoracic ribs
d. a and b
e. a, b, and c

6. (p. 413) A mutation in Pax3 prevents the binding of beta-catenin/Lef1. Identify the phenotype that would result.
a. bald person
b. bald person with black beard
c. grey-haired person
d. black-haired person
e. red-headed person

7. (p. 412) A knockdown of Ephrin in somites would result in:
a. the inability of neural crest to migrate through the sclerotome
b. change in fate of motor neurons
c. ability of neural crest to migrate through posterior sclerotome
d. loss of intercellular adhesion in the somite
e. all of the above

8. (p. 419) In Harry Potter 1, the young wizards, Harry, Ron, and Hermione, confront a three-headed dog named "Fluffy", a pet owned by Hagrid the Giant. Fluffy was created by the wizard Dumbledore, using embryological knowledge similar to what you have learned in Biology 411. Dumbledore overexpressed *noggin* in two ectopic sites of the anterior blastoderm of a dog embryo to obtain the three-headed dog phenotype (*i.e*. Fluffy). On a practical exam, Dumbledore asks the young wizards to create a "cat-dog". (Dumbledore came up with this idea after watching a cartoon character on the Muggles' TV Cartoon Network.) How would you advise Harry, Ron, and Hermione to create an animal with both a cat's head and a dog's head? (Hint: it is OK for the cat's head to end up with the brain of a dog)

a. overexpress cat *noggin* in an ectopic site in a dog blastoderm
b. overexpress dog *noggin* in an ectopic site in a dog blastoderm, then replace dog pharyngeal endoderm with cat pharyngeal endoderm
c. overexpress cat *noggin* in an ectopic site in a dog blastoderm, then remove the cat cranial crest
d. overexpress dog *noggin* in an ectopic site in a dog blastoderm, then replace dog cranial crest with cat cranial crest.
e. ask "He-Who-Shall-Not-Be-Named" (i.e. Voldemort) for help

9. (paper from Discussion section) What effect would retinoic acid inhibitors have on the expression waves of *her1* and *her7* in zebrafish?

a. loss of expression in the tailbud
b. cardiac expression of the genes
c. phase shift between the left and right sides of embryo
d. cross-midline migration of the waves
e. no effect at all

10. (p. 459) What would happen if the expression of *Sox5* is upregulated in the diagram shown in Figure 14.19?

a. more tendons would form
b. more cartilage would be produced
c. the sclerotome would not form
d. all of the above
e. none of the above

11. (p. 473) The endocardium arises from

a. blood precursors
b. endoderm
c. intermediate mesoderm
d. lateral plate mesoderm
e. Purkinjie fibers

12. (pp. 437-439) Retinal ganglion cells follow
a. pathways to the ipsilateral tectum
b. pathways to the contralateral tectum **(legend for Fig. 13.33 indicates this is correct)**
c. pathways to both tecta (this answer accepted as well as d.)
d. all of the above
e. none of the above

13. The blastopore in humans becomes
a. the anus
b. the cloaca
c. the allantois
d. the urethral opening
e. none of the above

14. (pp. 474-475) Cardia bifida could arise if
a. endoderm is not specified in the embryo
b. the splanchnopleure fails to fuse in the lumbar region
c. head mesenchyme cells fails to aggregate around the neural tube
d. the liver primordium forms in an ectopic location
e. all of the above

15. (p. 460) What would happen in intermediate mesoderm if it were cut in several places along the anterior-posterior axis of the trunk prior to the induction of the kidney rudiment?
a. no kidney rudiment would be formed
b. the notochord would stop secreting Shh
c. there would be no effect on the induction of the kidney rudiment
d. somites in these areas would not form
e. the intermediate mesoderm would undergo a homeotic transformation into lateral plate mesoderm

16. (pp. 446-447) If a defective Notch receptor, with a null phenotype, were electroporated in the paraxial mesoderm of a chick embryo, what effect on segmentation would this have?
a. no effect would be expected
b. somites would double their length in the anterior-posterior dimension
c. waves of *c-hairy* would cease to occur
d. waves of *c-hairy* would reverse in direction
e. cells with the defective Notch receptor would not form segment boundaries

17. (p. 425) Upregulation of Isl2 in the Column of Terni would
a. convert sympathetic neurons into motor neurons
b. have no effect on cell fate specification
c. cause sympathetic neurons to target intercostal muscle

d. cause sympathetic neurons to target axial muscle
e. none of the above

18. (p. 430) In an embryo that lacks Shh (Sonic Hedghog), the floor plate will not be specified. What effect will this have on the migration of commissural neurons? (From the figure it seems Shh guides ventrally, then Netrin-1 guides medially.)
a. no effect
b. apoptosis
c. lack of chemotaxis toward the ventral midline
d. increased chemotaxis toward the ventral midline
e. none of the above

19. (p. 433) In a Robo-1 *Drosophila* mutant
a. CNS neurons fail to respond to Netrin
b. CNS neurons fail to respond to Slit
c. CNS neurons upregulate Robo-3
d. CNS neurons downregulate Robo-3
e. CNS neurons fail to cross the midline

20. (p. 491) If N-cadherin was downregulated in endosteal osteoblasts, what would happen to HSC cells?
a. HSC cells would upregulate N-cadherin
b. HSC cells would downregulate N-cadherin
c. HSC cells would leave the liver
d. HSC cells would leave bone marrow
e. HSC cells would die

21. (p. 579) An amphibian blastema treated with retinoic acid
a. is unable to undergo patterning
b. undergoes dorsalization
c. is unable to form distal blastema fates
d. induces proximal tissues to transdifferentiate
e. none of the above

22. (pp. 580-583) If a hydra loses both its head and its basal disc
a. it is unable to regenerate a body axis
b. it regenerates two heads
c. it regenerates two basal discs
d. the remaining piece of tissue becomes tentacles
e. none of the above

23. (pp. 588-589) Aging in *C. elegans* is linked to
a. decreased response to reactive oxygen species
b. activation of the dauer phenotype
c. activation of an insulin receptor
d. damage induced by reactive oxygen species
e. lack of food

24. (p. 500) A respiratory diverticulum would be induced to branch by
a. tracheal mesenchyme
b. lung mesenchyme
c. liver mesenchyme
d. all of the above
e. none of the above

25. (p. 456-457) Endochondral bone undergoes ossification by
a. deposition of bone by the periosteum
b. deposition of bone by the endosteum
c. a conversion of chondrocytes to osteoblasts
d. all of the above
e. none of the above