

CHAPTER 47

ANIMAL DEVELOPMENT

Learning objectives

The Stages of Embryonic Development in Animals

1. Compare the concepts of preformation and epigenesis.
2. List two key functions of fertilization.
3. Describe the acrosomal reaction and explain how it ensures that gametes are conspecific.
4. Describe the cortical reaction.
5. Explain how the fast and slow blocks to polyspermy function sequentially to prevent multiple sperm from fertilizing the egg.
6. Describe the changes that occur in an activated egg and explain the importance of cytoplasmic materials to egg activation.
7. Compare fertilization in a sea urchin and a mammal.
8. Describe the general process of cleavage.
9. Explain the importance of embryo polarity during cleavage. Compare the characteristics of the animal hemisphere, vegetal hemisphere, and gray crescent in amphibian embryos.
10. Describe the formation of a blastula in sea urchin, amphibian, and bird embryos. Distinguish among meroblastic cleavage, holoblastic cleavage, and the formation of the blastoderm.
11. Describe the product of cleavage in an insect embryo.
12. Describe the process of gastrulation and explain its importance. Explain how this process rearranges the embryo. List adult structures derived from each of the primary germ layers.
13. Compare gastrulation in a sea urchin, a frog, and a chick.
14. Describe the formation of the notochord, neural tube, and somites in a frog.
15. Describe the significance and fate of neural crest cells. Explain why neural crest cells have been called a “fourth germ layer”.
16. List and explain the functions of the extraembryonic membranes in reptile eggs.
17. Describe the events of cleavage in a mammalian embryo. Explain the significance of the inner cell mass.
18. Explain the role of the trophoblast in implantation of a human embryo.
19. Explain the functions of the extraembryonic membranes in mammalian development.

The Cellular and Molecular Basis of Morphogenesis and Differentiation in Animals

20. Describe the significance of changes in cell shape and cell position during embryonic development. Describe the role of the cytoskeleton in these cellular processes.
21. Describe the process of convergent extension.
22. Describe the locations and functions of cell adhesion molecules.
23. Describe the role of the extracellular matrix in embryonic development.
24. Describe the two general principles that integrate our knowledge of the genetic and cellular mechanisms underlying differentiation.
25. Describe the process of fate mapping and the significance of fate maps.

26. Describe the two important conclusions that have resulted from the experimental manipulation of parts of embryos and the use of fate maps.
27. Explain how the three body axes are established in early amphibian and chick development.
28. Explain the significance of Spemann's organizer in amphibian development.
29. Explain what is known about the molecular basis of induction.
30. Explain pattern formation in a developing chick limb, including the roles of the apical ectodermal ridge and the zone of polarizing activity.
31. Explain how a limb bud is directed to develop into either a forelimb or hind limb.