Chapter 4: Prenatal Development and Birth

Learning Objectives (chap 4)

- Identify the three stages of prenatal development and describe what happens during each stage.
- Describe the functions of the amnion, chorion, and placenta.
- Describe how sex differentiation takes place.
- Describe the process of neuronal development: proliferation, migration, differentiation, and synaptogenesis.
- Be able to define these terms: age of viability; teratogen; myelin.
- Be able to describe the effects of the following teratogens and when they are likely to have an effect on prenatal development.
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- Be familiar with the effects that maternal age, stress, and nutritional status have on prenatal development.
- What causes anoxia and what effect does it have on the baby?
- List the pros and cons of Cesarean delivery.
- Describe the effects on the baby of using pain medications during labor and delivery.
- Define postnatal depression and list factors that either cause or contribute to it. How does it differ from baby blues?
- Describe how the Apgar test is used to assess newborn infants.
- State the findings of research on the effects of low birth weight.
- Describe resilience and list factors that contribute to a child’s resilience.
- Summarize the results of Werner and Smith’s study of the children of Kauai. Know what research design was used for this study.

**Prenatal Development**

**Prenatal Stages**

1. What are the three stages of prenatal development?

**The Germinal Period**

2. The germinal period lasts about how long?

**The Embryonic Period**

3. The embryonic period lasts from _______________ to _______________ after conception.

4. During the embryonic period, all of the major _______________ are developing.

5. Label the two outer layers of the blastocyst and tell what each does.

6. What does the placental barrier do?
7. During the 7th-8th week of pregnancy __________________ differentiation occurs.

8. The sex of the child is determined by their genotype (XX or XY) and also by what else?

9. If an embryo's genotype is XY but the embryo is not exposed to testosterone, what will happen?

The Fetal Period

10. The fetal period lasts from __________________ until __________________.

11. Neurons are produced at a staggering rate during the prenatal period (particularly during the fetal period), and this process is called proliferation. The two periods of concentrated proliferation are _____________________________ and ____________________________.

12. The period of proliferation after birth involves the development of glial cells rather than neurons. What is the function of glial cells?

13. During migration, neurons move along glial cells from their place of origin to _____________________________ where they will become _____________________________. The process of becoming specialized parts of the brain is called ___________________.

14. Early in development, every neuron starts with the potential to become any specific type of neuron, and what it eventually becomes (how it differentiates) depends on _____________________________.

15. What are stem cells and why are they important?

**NOTE:** As they become specialized in function, neurons form connections (SYNAPSES) with other neurons. This process is called synaptogenesis, and it also occurs at a staggering rate. The period from the last three months of prenatal life and the first two years after birth are known as a brain growth spurt because of the concentrated proliferation, migration, differentiation, and synaptogenesis.
16. When neurons form new connections with other neurons, this process is called ________________.

17. When is the brain growth spurt?

**HINT:** It may help you to remember some of these new concepts by thinking about what the root words mean. For example, **differentiation** comes from the word different. It means that cells start out all alike, and then they start to become different or specialized (serve different functions). Another example is **proliferation**, which comes from the word proliferate. What does nuclear proliferation mean? Proliferate basically means more and more (neurons rapidly divide and form more and more new cells). For **migration**, think about what it means for birds to migrate south for the winter and how they develop specific behaviors that are suited to the habitat they are in (neurons move to different parts of the brain and nervous system, taking on specialized functions depending on where they end up). For **synaptogenesis**, think about what a synapse is (a silly clue to help remember this is to think about how synapse sounds like snaps – this is where one neuron snaps together or connects with another neuron).

18. Identify each of the developmental processes described below (differentiation, migration, proliferation, synaptogenesis).

a. Specialized functions of neurons. The actual functions they adopt is determined after they move to a particular position in the brain (neural functioning is thus is influenced by location).

b. Creation of new neurons during the prenatal period.

c. Formation of connections among neurons.

d. Movement of neurons to different parts of the brain. This is influenced by both genetic instructions and the biochemical environment of the brain.

19. List some of the behaviors that develop during the fetal period.

20. At about 23 weeks after conception, the fetus reaches _________________. What does this mean?

21. Early in pregnancy, the basic architecture of the nervous system is laid down. What happens during the second half of pregnancy?
22. What is myelin and what is its function?

23. Why is it so important for parents to know how rapidly development takes place during the embryonic stage?

**NOTE:** You’ll need to know the critical times for brain development and what is happening during those times. You will also need to know that the embryonic period is considered a critical period for other aspects of development. This will be discussed in more detail in the next section on the prenatal environment. For now, you need to know that a critical period is a window of time when the developing fetus/infant/child is susceptible to environmental influences. This includes both harmful effects (e.g., when teratogens interfere with development) and beneficial effects (e.g., when certain kinds of stimulation enhance or accelerate development. The general rule about critical and sensitive periods is that they are times when new systems or abilities are first developing, when they are rapidly growing, and when they can be influenced by certain environmental stimuli or experiences.

24. Define what a critical/sensitive period is. Why are these times considered to be critical?

25. Disregarding brain development, which period of prenatal development is a critical period? Why is this period considered to be critical?

**The Prenatal Environment**

**Teratogens**

26. A teratogen is defined as:
27. Although there are an alarming number of teratogens that can harm the developing fetus, only ________% of newborns have minor problems and only ________% have more significant problems.

28. Describe the 4 general rules for the effects of teratogens listed below:

(1) critical period –

(2) dosage and duration –

(3) genetic makeup –

(4) environment –

29. A teratogenic agent has its greatest effect when an organ system is developing. This period of rapid growth of an organ system is called a __________________ period.

30. Define critical period:

31. For most (but not all) teratogenic agents, the prenatal stage when they are most likely to damage the unborn child is during the ________________ period.

Drugs

32. List four drugs that are teratogenic agents and describe the effect of each.
Diseases

33. List three diseases that are teratogens and describe the effect that each has on the unborn child.

Environmental Hazards

34. List two environmental hazards that are teratogens and describe their effect on the unborn child.

For the above questions, it would be a good idea to make yourself a chart listing the various teratogens and their effects.

Applications: Getting Life off to a Good Start

35. If you had a friend or relative who was expecting a child, how would you summarize for them the important things they should do while pregnant?

The Mother's State

Age

36. What effect can the mother’s age have on the unborn child?
**Emotional Condition**

37. By what mechanism does maternal stress affect fetal development and what are the effects of maternal stress on the baby?

38. A temporarily stressful experience generally will not damage mother or fetus. Damage is more likely when a mother experiences __________________________ during pregnancy.

39. What can we tell potential parents about the effects of stress on the developing fetus?

**NOTE** that how the mother reacts to stress also plays an important role. Thus, the presence of stress may not be as important as the mother’s responsiveness to stress in determining outcomes.

40. Depression during pregnancy is related to __________________________ in newborn infants.

**Nutritional Conditions**

41. If a mother suffers from malnutrition during pregnancy, what effect can that have on the child?

**The Perinatal Environment**

**Possible Hazards**

**Anoxia**

42. What is anoxia, what causes it, and what is its effect on the baby?

43. What are the outcomes for milder cases of anoxia?
Complicated Delivery

44. For what reasons might a physician deliver a baby by Cesarean section?

45. What effect does Cesarean delivery have on the mother? What effect does it have on the baby?

Medications

46. What are the possible effects of labor medication on the baby?

The Mother's Experience

47. What factors influence the mother’s experience of childbirth?

48. What are the effects of having the father or another companion with the mother during delivery?

Postnatal Depression

49. Differentiate between baby blues and postnatal (postpartum) depression. How common is each?

50. What are some of the major causes of postnatal depression and what is its effect on mothers' interaction with their infants?
The Neonatal Environment

Identifying At-Risk Newborns

51. What is the Apgar test and what does it measure?

52. If newborns score above ________, then they are considered to be in good shape. If they score below ________, then they are considered to be at risk and typically require medical intervention.

53. Approximately ________% of infants born in the US have low birth weight, which means weighing less than __________________.

NOTE: Low birth weight does NOT simply mean that a baby is undernourished and just needs to eat more. Several different factors can cause low birth weight, and thus different interventions are needed, depending on the nature and severity of the problem.

54. What are the main causes of low birth weight?

55. Low birth weight infants are at greater risk for what kinds of problems?

56. Low birth weight infants are less likely to have long term problems if what is true?

Risk and Resilience

57. What is resilience?

58. What did the study of the children of Kauai done by Emmy Werner and Ruth Smith tell us?
59. Think back to chapter 1 -- what research design did they use in this study (cross-sectional, longitudinal, or sequential)?

60. What are two types of protective factors that increase a child’s resilience?

61. **Critical Thinking Question**: This chapter may not seem to have much to do with Psychology. Why do you think it is included in a Developmental Psychology book? What is the "take home" message from this chapter? The answer depends on you.

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**Chapter 5: Health and Physical Development**

**Learning Objectives (chap 5)**

- Label each part of a neuron (axon, dendrite, synapse, myelin) and identify the function of each.
- Describe the importance of early experience on brain development.
- Define and understand the concept of brain plasticity.
- Define the critical/sensitive period for brain development.
- Describe the development of brain lateralization and how it relates to plasticity.
- Relate development of the brain to cognitive development.
- Describe brain development during the aging process.
- Define proximodistal and cephalocaudal growth, and recognize examples of each.
- Identify and describe the following newborn reflexes: grasping, sucking, rooting, Moro, Babinski, stepping, and swimming. How are these reflexes useful to a baby or to a pediatrician?
- Identify the sequence of motor development milestones.
- Know the findings of research relating to dynamic systems theory.
- Describe physical development during adolescence.
- Explain cohort changes in the onset of puberty.
- Describe the effects of early versus late maturation on girls versus boys.
- Be able to list three things that contribute to physical and cognitive deterioration in the elderly and how they can prevent these problems.
- Describe the findings of Snowdon’s Nun Study.
The Nervous System

62. The part of a neuron that looks like multiple branches of a tree and whose function is to receive signals from other neurons is called the ________________.

63. The part of a neuron that stretches from the cell body in a single long branch and whose function is to transmit signals to other neurons or to muscles is called the ________________.

64. Neurons communicate by passing chemicals called neurotransmitters from the ________________ of one cell to the ________________ of the next cell. The tiny gap at the connection between two neurons is called the ________________.

65. An important developmental change in the nervous system is the formation of a waxy, fatty covering around axons called ________________. What function does this waxy coating serve?

Brain Development

66. Development of the brain early in life reflects a combination of ____________________________________.

67. Define plasticity.

**HINT**: Remember to consider what these words mean. Plasticity suggests the word plastic. Something that is plastic can change shape or form. Plasticity in the brain means that it can recover from injury by having other parts of the brain take over a function that is lost.

68. What are the negative consequences of plasticity?

69. What are the positive benefits of plasticity?

70. How does the brain recover from early damage?
71. When is the critical or sensitive period for brain development? How does this relate to plasticity?

72. Briefly define brain lateralization.

73. Relate lateralization to the previous concepts of differentiation and plasticity. What would be likely to happen to an infant or young child who suffered brain damage in the left hemisphere? Why?

74. What is the earliest evidence of lateralization?

75. How are growth spurts in the brain related to Piaget's theory of cognitive development?

The Aging Brain

76. Which of the following is part of the normal aging process?
   a. Alzheimer’s and other forms of dementia
   b. gradual and relatively mild degeneration

77. Briefly describe the normal process of brain degeneration that occurs with aging.

78. Briefly describe the concept of plasticity with regard to the aging brain.
79. The aging brain is characterized by both ________________ and ________________.

80. When plasticity prevails, aging brains form new and adaptive neural connections faster than they are lost so that performance on some tasks __________________________. However, when degeneration wins, the result is __________________________.

81. What two major steps can be taken to promote greater brain plasticity and maintenance of intellectual functioning in old age?

**Principles of Growth**

82. Identify the principle of growth that fits with each of the descriptions below (proximodistal, cephalocaudal, orthogenetic).

a. Development is a process of increasing differentiation. A good example is the fertilized egg which starts out as a single, undifferentiated cell and then develops into highly organized systems of specialized cells.

b. Growth moves in a head-to-tail direction. This is why babies have such large heads relative to the rest of their bodies.

c. Growth moves from the center outward to the extremities. This is why development of the arms and legs happens later than development of the internal organs and trunk of the body.

d. This principle is evident in early motor development when infants progress from lifting their heads to sitting up without support to crawling and walking.

**HINT:** Here's a helpful way to distinguish cephalocaudal and proximodistal growth taught to us by students. Look for the word halo in cepHALOcaudal and think of a halo over an angel's head (growth is from the head downward). For proximodistal, think of the word proximity as meaning nearby and distance as meaning farther away (growth is from near the body outward toward the limbs then fingers and toes).

**The Infant**

**Newborn capabilities**

**Reflexes**

83. A reflex is:
84. Full-term newborn infants exhibit a variety of reflexes that serve different functions. Identify each of the reflexes described below (use Table 5.2).

a. When held upright with their feet lightly touching a flat surface (stimulus), infants make pronounced marching movements as if walking (response).

b. Infants turn their faces (response) in the direction of a light touch to the cheek (stimulus).

c. A loud noise or sudden change in position of infants’ heads (stimulus) will cause them to throw out their arms, arch their backs, and then quickly bring their arms together as if trying to hold onto something (response).

d. Infants will curl their fingers tightly around a small object (response) when that object lightly touches the palms of their hands (stimulus).

e. Stroking the bottom of infants’ feet (stimulus) causes them to fan or spread out and then curl up their toes (response).

f. Infants suck (response) on objects placed in the mouth (stimulus).

g. When immersed in water (stimulus), infants will actively move their arms and legs while holding their breath. [NOTE: Beware of "infant water intoxicification". Although babies may hold their breath when they first go underwater, they tend to open their mouths and swallow water if they are repeatedly submerged. Taking in too much water can lower the concentration of salt in the infant’s blood which leads to swelling of the brain, lethargy, irritability, vomiting, and even seizures.]

85. How are these reflexes used to diagnose infants’ neurological status?

86. Organize the following motor milestones in order of their developmental sequence (number them with 1 being first, 2 is second, etc.). Use Table 5.4.

a. begins to walk
b. can sit up without using hands to balance
c. begins to grasp small objects
d. can raise head up while lying on stomach
e. begins to crawl
f. walks while holding onto furniture
87. How does locomotor development follow the cephalocaudal and proximodistal principles of growth?

88. Cephalocaudal OR Proximodistal OR Orthogenetic? Infants develop gross motor skills before they master fine motor skills.

89. Cephalocaudal OR Proximodistal OR Orthogenetic? At first, infants use their entire bodies when trying to reach an object. Later they use only one arm to reach.

90. With the onset of independent mobility (i.e., crawling and walking), infants gain a whole new set of experiences. For the first time, they have control over where they go. They can trek across a room to retrieve a desired toy or to explore a new object, and they can approach adults in order to initiate social interactions. Experience crawling is related to changes in a variety of developmental domains. What three areas of development are affected by the onset of crawling?

**NOTE:** Traditional explanations for the appearance and disappearance of newborn reflexes focus exclusively on development of the brain and nervous system. Research by Esther Thelen on the stepping reflex has shown us that the story is much more complex. Remember that the stepping reflex appears as marching or walking movements when newborn infants are held upright with the soles of their feet lightly touching a flat surface, and this behavior typically drops out at around age two months. Dr. Thelen, however, noticed that when young infants are lying on their backs, they make kicking motions with their legs that look very much like the “missing stepping reflex”. Dr. Thelen also studied physical changes during the first year of life, and found that infants’ legs become heavier while the development of muscle strength tends to lag behind. Thus, another reason that the stepping reflex “disappears” is that infants’ legs become too heavy to lift while standing upright until much later when muscle strength increases and they begin to shed some of their baby fat.

91. **Critical Thinking Questions:** Dr. Thelen tested this idea with a clever experiment which involved standing babies in a fishtank so that they were submerged in warm water up to their chest. This was much like taking a bath or playing in a pool, except that an experimenter gently held the babies upright in a standing position with the soles of their feet lightly touching the flat bottom of the tank. Dr. Thelen found that babies who did not show the stepping reflex under normal conditions started stepping when they were standing in water.

a. Why do you think the babies were able to make stepping movements when held upright in the fishtank but not when held upright outside of the fishtank?
b. Esther Thelen concluded that infants’ stepping movements did not disappear after all, but were simply masked. Briefly explain what this means.

Recommended Reading (if you are interested in learning more about this topic): For a more detailed description of Professor Thelen’s work and her career as a developmental psychologist, see chapter 2 in Merrens & Brannigan’s text, *The Developmental Psychologists: Research Adventures Across the Life Span* (1996, McGraw-Hill). Ask Dr. Eppler or Dr. Ironsmith for a copy.

92. Use the description of early walking to explain why newly walking infants are called "toddlers".

93. What are some of the disadvantages of using infant walkers (seat with tray on wheels)?

**Grasping and Reaching**

94. Briefly describe how the development of infants’ use of their hands follows the proximodistal principle of growth.

95. Organize the following motor milestones in order of their developmental sequence (number them with 1 being first, 2 is second, etc.).
   a. can scribble with crayon
   b. can build tower of five or more blocks
   c. uses pincer grasp
   d. grasp objects by pressing palm and outer fingers together

**Motor Skills as Dynamic Action Systems**

96. Describe Esther Thelan's dynamic systems approach to understanding motor development.
97. In the study by Adolph and Avolio, what was the purpose of placing saddlebags on infants’ shoulders?

98. How did the babies react to the saddlebags?

99. Explain how Adolph and Avolio's findings relate to the dynamic systems approach.

**The Adolescent**

100. The process of biological changes that result in sexual maturity is called ________________.

**The Growth Spurt**

101. Does physical growth during adolescence follow the slow and steady pattern of growth, or is it characterized by growth spurts?

102. Why do boys, in general, appear smaller than girls during the middle school years?

**Sexual Maturation**

103. Menarche refers to:

104. Timing of the onset of puberty is controlled by an interaction between genes and environment. Historical changes in the average age of onset (i.e., trend toward earlier maturation) for industrialized nations provide evidence for the role of environmental factors. This kind of historical change is called a ________________.

105. The historical trend toward earlier onset of puberty in industrialized nations is most likely caused by what two factors?
106. **Critical Thinking Question:** What effect might the earlier onset of puberty have on a technological society? **Hint:** Think about the difference between becoming an adult physically and becoming an adult financially.

107. How does the secular trend for puberty relate to the concept of cohort effects in developmental research? (chapter 1)

**Early versus Late Development**

108. Large individual differences in the timing of puberty produce a wide range of body types during the junior high school years. Interestingly, the advantages and disadvantages of experiencing the physical changes of puberty well ahead of peers are different for boys and girls. Identify whether each statement below best describes early-maturing or late-maturing girls or boys.

a. Tend to score highest on school achievement tests.

b. Tend to score lowest on school achievement tests.

c. Tend to get into trouble because they hang with older teens who are engaged in dating, smoking, drinking, sex, and minor troublemaking.

d. Tend to have the disadvantage of earlier involvement in substance use and other problem behavior such as bullying.

e. Tend to feel more anxious, unsure, and experience more behavior and adjustment problems.

f. Tend to have the advantage of being perceived as more socially competent, attractive, self-assured, and athletic.

g. Tend to be unpopular with their same-sex peers and are likely to be teased and to report feeling depressed.

h. Tend to have the most trouble adjusting to puberty.

109. How persistent are the effects of late and early maturation? In other words, how long do the differences for the four groups last?
The Adult

The Reproductive System

110. True OR False -- Much like menarche, the average age of menopause has been declining as part of a secular trend.

111. True OR False -- Only a very small proportion of women experience significant negative psychological symptoms of menopause.

Slowing Down

112. What major change in physical/cognitive behavior is typical across the adult years? What are some of the causes for this?

113. Not all older adults slow down in all situations. What factors seem to help older adults maintain faster reactions?

Disease, Disuse, or Abuse?

114. List and briefly discuss the three reasons for significant deterioration of physical behavior in elderly adults. What advice would you give to your parents about how to avoid these?

Successful Aging

115. What were the major findings of Snowdon’s (2002) Nun Study? What is the primary message to take away from this kind of research?