

Chapter 29: Development, Growth, Aging, and Genetics

I. Prenatal Development

A. General

1. The prenatal period is the time from _____ until _____
2. Define each of the three prenatal periods:
 - a. Germinal Period _____

 - b. Embryonic Period _____

 - c. Fetal Period _____

3. How does the medical community calculate clinical age? _____

 - a. Embryologists describe the timing of developmental events in terms of _____
 - b. What is the time difference between these two approaches? _____

B. Fertilization

1. What is fertilization? _____

2. The corona radiata is a _____ to the _____
 - a. Action of the flagella propel _____
3. The zona pellucida is an _____ composed mostly of _____
 - a. It is located between the _____ & the _____
 - b. What is ZP3? _____
 - c. What happens when a sperm cell binds to ZP3? _____

 1. This process is called _____
4. The first sperm cell through the zona pellucida attaches to _____
on the outer surface of the _____

- a. The attachment causes _____
within _____
 - b. Prevents additional sperm from _____
 - c. The depolarization is called _____
5. Depolarization causes a series of events including:
- a. Intracellular _____
 - b. Causes the exocytosis of _____ and _____ molecules
 - 1. What are cortical granules? _____
 - c. Causes the oocyte to _____
 - d. Zona pellucida denatures and _____
 - 1. ZP3 is inactivated and no _____
 - e. This reaction is called _____
6. What is the perivitelline space? _____
7. Entrance of a sperm cell into the oocyte stimulates _____
_____ and the _____ formed
- a. What is the female pronucleus? _____
8. When the male pronucleus and female pronucleus fuse together:
- a. Completes the process of _____
 - b. Restores the _____
 - c. What is a zygote? _____
- C. Early Cell Division
- 1. The cells of the dividing embryonic mass are referred to as _____
 - a. What does that mean? _____

- D. Morula and Blastocyst
- 1. When does the dividing embryonic mass become a morula? _____

 - 2. Three or four days after ovulation, the morula consists of _____
 - a. Near this time, _____ cavity called _____
begins to appear _____

3. The blastocyst is a _____
 - a. The blastocyst is surrounded by a single layer of cells the _____
 - b. At one end of the blastocyst the cells are _____
 1. The thickened area is called the _____ and is the tissue _____
 - c. What does the trophoblast form? _____

E. Implantation of the Blastocyst and Development of the Placenta

1. All of the events of the early germinal phase occur as the embryonic mass moves through the _____
2. About 7 days after fertilization the _____ to the uterine wall, usually in the area of _____ and begins _____
 - a. What is implantation? _____
3. Two populations of _____ develop and form the embryonic portion of the _____
 - a. Cytotrophoblast is a _____ trophoblast cells
 - b. Syncytiotrophoblast is a _____ or _____ cell
4. The cytotrophoblast remains _____ and the syncytiotrophoblast invades the _____
5. The syncytiotrophoblast is _____ which means _____
6. As the syncytiotrophoblast encounters maternal blood vessels:
 - a. Surrounds them and _____
 - b. Forming _____ called _____
 - c. Maternal blood circulates _____
7. Cords of cytotrophoblast surround the syncytiotrophoblast and lacunae:
 - a. Fingers called _____ branch from _____ and protrude into the lacunae
 - b. What is the chorion? _____
 - c. Embryonic blood vessels follow _____
8. In the mature placenta the _____ disappears.

a. Embryonic blood supply is separated from maternal blood supply by only:

1. Embryonic _____
2. _____
3. Thin layer of _____

F. Formation of the Germ Layers

1. After implantation a new cavity forms called the _____
 - a. The cavity forms inside the _____
 - b. The cavity is surrounded by a layer of cells called _____ or _____
2. Formation of the amniotic cavity causes a part of the _____ nearest the _____ to separate as a _____ called the _____
3. The embryonic disk is composed of two layers of cells:
 - a. Ectoderm _____
 - b. Endoderm _____
4. The yolk sac forms _____ from the _____
5. Eventually the amniotic sac enlarges _____ providing it with _____
6. About 13 or 14 days after fertilization, the embryonic disk becomes _____
 - a. Proliferating cells of the _____ migrate toward the _____ and the _____ of the disk, forming a _____ called _____
 - b. Some ectoderm cells:
 1. Leave _____
 2. Migrate through _____
 3. Emerge _____ as a new germ layer _____
7. The three germ layers _____, _____, and _____ are _____
 - a. All tissues _____
8. What is the notochord? _____

G. Neural Tube and Neural Crest Formation

1. About 18 days after fertilization the ectoderm near the _____ of the primitive streak forms a thickened _____
 - a. The lateral edges of the neural plate begin to _____
 1. The edges are called _____
 2. The low area between the edges is called _____
 - b. The underlying notochord stimulates _____
 - c. The crests of the neural fold _____ and fuse into a _____ which is completely closed by _____
 1. The neural tube becomes the _____
 2. Cells of the neural tube are called _____
2. As the neural folds come together and fuse _____ all along _____
 - a. These cells are called _____
3. Neural crest cells migrate _____ to become:
 - a. Part of the _____ and the _____
 - b. Migrate laterally to just below the _____ where they become _____
4. Neural crest cells can become other structures in the head, including:
 - a. Contribute to _____
 - b. Dentin of _____
 - c. Few small _____
 - d. General _____
5. The term mesenchyme refers to _____

H. Somite Formation

1. As the neural tube develops, the _____ immediately adjacent to the tube forms _____ called _____
2. Somitomeres are indistinct _____ that develop in _____

3. The somites and somitomeres eventually give rise to:
 - a. _____
 - b. _____
 - c. _____
4. Most of the head muscles are derived from _____

I. Formation of the Gut and Body Cavities

1. At the same time the neural tube is forming, the embryo is becoming a tube along the _____
2. The _____ & _____ develop as the _____ & _____ ends of the yolk sac separate from _____
 - a. This is the beginning of the _____
 - b. The developing _____ pinches off as a tube but remains attached in the center to the yolk sac by _____
3. The foregut and hindgut are in close relationship to overlying _____
 - a. Foregut forms _____ that opens to form _____
 - b. Hindgut forms _____ that opens to form _____ and _____
4. Numerous evaginations occur along the early digestive tract that become:

a. _____	d. _____
b. _____	e. _____
c. _____	f. _____
5. Solid bars of tissue called _____ form along the _____ _____ and the sides of the foregut expand as _____ between _____
 - a. The central expanded foregut is called _____
 - b. The pockets along both sides are called _____
6. Adult derivatives of the pharyngeal pouches include:

a. _____	c. _____
b. _____	d. _____
7. At the same time, a series of isolated _____ starts to form within the _____ beginning development of _____ or _____

- a. The most cranial group of cavities _____ & _____ to form the _____
- b. The celomic cavity extends _____ as the
 - 1. _____
 - 2. _____
- c. Initially all three cavities are _____

J. Limb Bud Development

- 1. Arms and legs first appear as _____ at about _____
- 2. What is the apical ectodermal ridge? _____
 - a. It develops on _____ of each limb bud and _____
- 3. As the buds elongate, limb tissues are laid down in a _____ sequence

K. Development of the Face

- 1. Fusion of five embryonic structures occurs in development of the face:
 - a. Frontonasal process forms _____
 - b. Two maxillary processes form _____
 - c. Two mandibular processes form _____
- 2. Nasal placodes develop at the _____ of the _____
 - a. Become the _____
- 3. As the brain enlarges and the face matures:
 - a. Nasal placodes approach _____
 - b. Medial edges _____
 - c. This is between the _____ that fuses with them to form the _____ known as the _____
- 4. The lateral edges of the _____ fuse with the _____ to close off _____
 - a. The inferior margins of the _____ fuse with the superior margins of the _____ to decrease the _____
- 5. By about day 50 all processes result in a _____
- 6. The roof of the mouth, known as the _____

- a. Begins to form as _____
- b. Swing _____ and begin to _____
_____ at about _____
- c. Fusion is not complete until about _____
- d. If the secondary palate does not fuse, a _____ in the
_____ results, called a _____

L. Development of the Organ Systems What is the period of organogenesis?

1. Skin

- a. What is the epidermis derived from? _____
- b. What is the dermis derived from? _____ or _____
- c. What structures develop from the epidermis?
 - 1. _____
 - 2. _____
 - 3. _____
- d. Melanocytes and sensory receptors are derived from _____

2. Skeleton

- a. The bones of the face develop from _____
- b. Somite-derived or somitomere-derived mesoderm forms:
 - 1. Rest of _____
 - 2. _____
 - 3. _____
- c. The appendicular skeleton develops from _____

3. Muscle

- a. What are myoblasts? _____
- b. Myoblasts migrate from somites or somitomeres to _____
- c. What are myotubes? _____

- 1. Myotubes enlarge to become _____
- d. Shortly after myotubes form _____
- e. The total number of muscle fibers is _____
and remains _____
- f. What causes muscle enlargement after birth? _____

4. Nervous System

- a. The nervous system is derived from _____ & _____
- b. Neural tube closure begins in the _____ and proceeds into the _____ and _____
- c. Soon after the neural tube has closed, the part that becomes the brain begins to _____
- d. The central cavity of the neural tube becomes:
 1. _____ in the brain
 2. _____ in the spinal cord
- e. Neuron cell bodies within the neural tube become:
 1. Somatic _____
 2. Preganglionic _____
- f. Neural crest cells become:
 1. _____ neurons
 2. Postganglionic _____

5. Special Senses

- a. The olfactory bulb and nerve develop as _____ from _____
- b. The eyes develop as _____ from _____
 1. Each evagination elongates to form an _____
 2. The optic vesicle develops at the _____
 3. At the side of the head the optic vesicle stimulates the _____
- c. The sensory part of the ear appears as an _____ or _____ that invaginates and _____

6. Endocrine System

- a. The posterior pituitary forms _____
- b. The anterior pituitary develops from _____ in the roof of _____ and grows _____
- c. The thyroid gland originates as _____

- d. The parathyroid glands are derived from the _____ & _____
_____ migrate _____
- e. The adrenal medulla arises from _____
1. Consists of specialized _____
- f. The adrenal cortex is derived from _____
- g. The pancreas originates as _____ from the
_____ which come together to _____

7. Circulatory System

- a. The heart develops from _____ which fuse into a

- b. Blood vessels form from _____ on the surface of the
_____ and _____
1. What are blood islands? _____ that become
a. _____ on the outside
b. _____ on the inside
2. The islands fuse to form the _____
- c. A series of dilations appear along the length of the primitive heart tube:
 - 1. Sinus venosus _____
 - 2. Single _____
 - 3. Single _____
 - 4. Bulbus cordis _____
- d. The elongating heart, confined within the _____, becomes
bent into a loop, the apex is the _____
1. The atrium and ventricle _____
2. The right part of the sinus venosus becomes _____
3. Bulbus cordis is absorbed into _____
4. Sinus venosus initiates _____
a. Later part of the sinus venosus becomes the _____
- e. The single ventricle is divided into _____ when an
_____ develops

1. _____

2. _____

g. What is the foramen ovale? _____

1. What does it allow? _____

8. Respiratory System

a. The lungs begin to develop as a _____
from the _____ in the region of the _____

1. The evagination branches to form _____

b. The lung buds elongate and branch:

1. First forming _____

2. Then forming _____

3. Branching continues until, by the end of _____
about _____ occurred

4. Branching continues after birth until about _____

9. Urinary System

a. The kidneys develop from _____ located between the
_____ and the _____

b. About 21 days after fertilization, mesoderm in the _____
region differentiates into _____

c. The pronephros consists of a _____ and _____
connecting the duct to the _____

1. Probably not functional and soon _____

d. The mesonephros is a _____ in the embryo

1. It consists of:

a. Duct which is a _____

b. Number of _____

1. One end of each tubule opens into the _____

2. The other end forms a _____

e. As the mesonephros is developing the caudal end of the _____

begins to _____ to form the _____

1. This is the common junction of the _____
_____ & _____ systems

f. The cloaca is divided into two parts by the

1. Digestive part called _____

2. Urogenital part called _____

g. The cloaca has two tubes associated with it:

1. _____

2. _____

a. A blind tube extending into the _____

b. The part of the allantois nearest the cloaca _____
to form _____

c. The remainder _____

h. The mesonephric duct extends _____ as it
develops and eventually joins the _____

1. At the point of junction, another tube begins to form called _____

a. The distal end _____ & _____ to form the
_____ of the adult kidney called _____

2. The metanephros takes over the function of the _____

10. Reproductive System

a. The male and female gonads appear as _____ the

b. The primordial germ cells, destined to become _____ or _____

1. Form on the _____

2. Migrate _____

3. Enter _____

c. The female ovaries originate high in the abdomen and _____
to a position _____

d. As the male testes descend and reach the _____ wall

1. A pair of tunnels called _____ form through the

-
2. The testes pass through the _____
 - a. Leaving the _____
 - b. Coming to lie within the _____
 3. Descent begins about _____
 4. Testes enter the _____ about _____
 - e. Paramesonephric ducts begin to develop _____ and grow _____ where they
 - f. Testosterone secreted by the fetal _____ causes the _____ duct system to _____ & _____ into
 - a. _____
 - b. _____
 - c. _____
 - g. Testes also secrete _____ hormone which causes the _____ to degenerate
 - h. If neither testosterone or mullerian-inhibiting hormone is secreted:
 1. The mesonephric duct system _____
 2. Paramesonephric system develops into _____, and part of the _____
 - i. An enlargement called the _____ develops in the groin.
 1. Urogenital folds develop on _____
 2. Labioscrotal swellings develop _____
 3. Urethral groove develops along the _____
 - j. In the male, under the influence of dihydrotestosterone:
 1. The _____ & _____ close over the _____ & the _____ to form _____
 - a. If the closure does not _____ results in a defect called _____
 2. The testes move into the _____ which become the _____

- k. In the female, in the absence of testosterone:
1. Genital tubercle becomes the _____
 2. Urethral groove _____
 3. Urogenital folds _____
 4. The urethra opens _____ to the _____ but _____ to the _____
 5. Urogenital folds become _____
 6. Labioscrotal folds become _____

M. Growth of the Fetus

1. When does the embryo become a fetus? _____
 - a. In the embryo most of the organ systems are _____
 - b. In the fetus the organs _____
 - c. Most morphological changes occur _____
 - d. The fetal period is primarily a _____
2. What is lanugo? _____
3. What is vernix caseosa? _____
 - a. Functionally the vernix caseosa protects the fetus from _____
 _____ formed by _____
 from _____
4. Subcutaneous fat accumulates in the _____ & _____
 - a. Provides a _____
 - b. Helps _____
 - c. Aids the baby in _____ by _____ &
 _____ the cheeks so _____
 can be developed in _____
5. Peak body growth occurs _____
 - a. As placental _____ and _____ limits are approached
 the growth rate _____
 - b. Growth of the placenta essentially stops at _____
 restricting _____
6. At about 38 weeks of development _____

II. Parturition

What is parturition? _____

A. Late Gestation

1. Near the end of pregnancy the uterus becomes _____

- a. Usually exhibits _____ that become
_____ and _____ until parturition is initiated
- b. Amniotic sac _____
- c. Amniotic fluid flows _____

B. Labor

1. First Stage
 - a. Begins with the onset of _____ and extends until the

 - b. Normally the head of the fetus is in _____
 1. The head acts as a wedge, forcing the _____

2. Second Stage
 - a. Lasts from the time of _____ until the

 - b. Contractions of _____ assist the _____
 - c. Contractions generate enough pressure to _____
 1. Blood flow to the fetus _____
 2. During periods of relaxation _____
3. Third Stage
 - a. Involves the _____
 - b. Contractions of the uterus cause _____
 - c. Some bleeding occurs because of _____
 - d. Bleeding normally is restricted _____

4. Once the placenta has been removed, blood levels of _____
& _____ fall _____
5. Following parturition:
 - a. Uterus becomes much _____
 - b. Cell of the uterus _____ & many _____
 - c. Vaginal discharge persists for 1 week or more composed of:
 1. Small _____
 2. Degenerating _____
6. The precise signal that triggers parturition is unknown but factors include:
 - a. Progesterone levels _____
 1. Progesterone has _____
 - b. Near the end of pregnancy _____ rapidly increase
 1. Excitatory influence of _____
overcome the _____
 - c. The adrenal glands of the fetus are greatly _____
 1. The anterior pituitary of the fetus increases the secretion rate of _____
_____ due to stress of:
 - a. Confined _____
 - b. Limited _____ resulting from a
more _____
than size of _____
 2. ACTH causes the fetal adrenal cortex to produce _____
which travel to the _____ where they:
 - a. Decrease _____
 - b. Increase _____
 - c. Initiate synthesis of _____ which strongly

 - d. Stretch of the uterine cervix initiates _____ that cause
_____ to be released from _____
 1. Oxytocin stimulates _____
 2. Which move the fetus _____

3. Causing _____ and release of more oxytocin
 - a. This establishes a _____ in which stretch _____ & oxytocin _____
 - b. When does the positive-feedback system stop? _____
- e. Progesterone inhibits _____ so the decreased _____ can support increased _____
- f. Estrogen makes the uterus _____ by increasing the synthesis of _____
- g. Oxytocin may also stimulate _____
- h. All of these events support _____ which results in parturition

III. The Newborn

A. Respiratory and Circulatory Changes

1. Expansion of the lungs at birth:
 - a. Reduces the resistance to _____
 - b. Resulting in increased _____
 - c. More blood flows from right _____ and into _____
 1. Less blood flows from _____ to _____ through _____
 - d. An increased volume of blood _____
 - e. Which increases the _____
 - f. Increased _____ & decreased _____ forces blood against _____ causing _____
 1. This functionally completes the separation _____
 2. What does the foramen ovale become? _____
2. Ductus Arteriosus
 - a. What two vessels does the ductus arteriosus connect in the fetus?
 1. _____
 2. _____

- b. How long after birth does the ductus arteriosus close? _____
- c. The closure occurs because of _____

- d. The ductus arteriosus is replaced with connective tissue and is known as the _____

3. Placental Blood Vessels

- a. During fetal life:
 - 1. Fetal blood passes to the placenta through _____
from the _____
 - 2. Fetal blood returns from the placenta through _____
 - a. Blood passes through the liver via the _____
 - b. Which joins the _____
- b. When the umbilical cord is tied and cut:
 - 1. No more blood flows through the _____
and they _____
 - 2. The remnant of the umbilical vein becomes the _____
_____ or _____ of the liver
 - 3. The ductus venosus becomes the _____

B. Digestive Changes

- 1. What is meconium? _____
- 2. Meconium consists of:
 - a. Amniotic _____
 - b. Cells _____
 - c. Mucus _____
 - d. _____ from the liver
- 3. What is stomach pH at birth? _____ Why? _____
- 4. Maximum stomach acidity is reached at _____
 - a. Over the next 10-30 days the pH _____
- 5. The neonatal liver is _____
 - a. Lacks adequate amounts of the enzyme _____

1. This enzyme system usually develops within _____
- b. The lack of this enzyme system can cause _____
6. What is the newborn capable of digesting at birth? _____
 - a. Which organ is sufficiently mature for a milk diet? _____
7. The digestive system gradually develops the ability to digest more solid foods over the _____
8. Amylase secretion remains low until _____
9. Lactase activity in the small intestine is _____ but _____
 - a. Lactase activity is lost in _____

C. Apgar Scores

1. Apgar scores are an assessment of the newborn's _____
2. The acronym "Apgar" stands for:
 - a. a _____
 - b. p _____
 - c. g _____
 - d. a _____
 - e. r _____
3. Each characteristic is rated on a scale of _____
 - a. 2 denotes _____
 - b. 1 denotes _____
 - c. 0 denotes _____
4. What is considered a normal Apgar score? _____

IV. Lactation

A. During Pregnancy

1. High concentration and continuous presence of _____ and _____ cause _____
 - a. Ducts grow and _____
 - b. Additional _____
2. Which hormone is primarily responsible for breast growth during pregnancy?

- _____
3. Progesterone causes development of _____
 - a. Which enlarge but _____
 4. The other hormones involved in breast development include:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 5. The placenta secretes _____ and _____ that help support breast development
 6. Prolactin
 - a. Where is prolactin produced? _____
 - b. Prolactin is the hormone responsible for _____
 - c. Before parturition, high levels of estrogen stimulate _____
 - d. Milk production is inhibited during pregnancy because _____
 - e. After parturition, _____, _____, & _____ levels _____
 1. With lower _____ & _____ levels, _____ stimulates _____
 - f. Despite a decrease in response produces _____ a reflex
 1. During suckling, _____ of the breasts
 - a. Initiates _____
 - b. That reach _____
 1. Causing the secretion of _____
 2. Inhibiting the release of _____
 2. Therefore, prolactin levels _____ and _____
 7. What is colostrum?
 - a. When is colostrum secreted? _____

8. In addition to nutrients, colostrum and milk contain _____
 - a. Help protect the nursing baby _____
9. If nursing stops, within a few days the ability to produce _____

_____ and _____
10. Because it takes time to produce milk:
 - a. Nursing causes an increase in _____
 - b. Results in production of milk to be used in _____
11. Stored milk is released during nursing as a result of a reflex response:
 - a. Mechanical _____
 - b. Cause the release of _____ from the _____
 - c. Which stimulates _____
 - d. Milk is then _____ from the breasts in a process _____
12. Higher brain centers can stimulate _____
 - a. Hearing an infant cry _____

V. First Year After Birth

A. Central Nervous System

1. The brain is still developing and _____

2. It is estimated that the total _____ is

present in the CNS at birth
 - a. Subsequent _____ and _____ of the

brain involve:
 1. Addition of new _____
 - a. Some of which form _____
 2. Addition of new _____
 - a. Which may continue _____

VI. Life Stages

A. List the life stages from fertilization to death:

1. _____
2. _____

3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

VII. Aging

A. Cell Proliferation

1. During early development cells proliferate _____
then the process _____
2. Many cells of the body continue to _____
replacing _____ or _____
3. Many other cells cease to _____
and dead cells are _____
 - a. After the number of neurons reaches a peak at _____
 1. Numbers begin to _____
 - a. Loss is most rapid _____
 - b. Later _____

B. Mitochondrial DNA

1. Mitochondrial DNA function _____ with age
2. If the decline in function reaches a threshold _____
_____ & the tissue or organ may _____
3. Can result in premature _____

C. Physical Plasticity

1. What is physical plasticity? _____
2. The physical plasticity of young embryonic tissues results from the presence:
 - a. Large amounts of _____
 - b. Relatively small amounts of _____
 - c. Collagen and other related proteins are not _____
 1. Thus tissues are _____

3. As the individual ages _____ cross-links form between _____ rendering the tissues
 - a. More _____
 - b. Less _____
4. One of the first structures to exhibit pathologic changes as a result of increased rigidity is _____
5. Structures with reduced functional ability, due to loss of elasticity, include:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____

D. Muscle Tissue

1. Mature muscle cells don't normally _____
 - a. Total number of skeletal and cardiac muscle fibers _____
2. The strength of skeletal muscle reaches a peak between _____ and _____
3. The macromolecules of muscle undergo _____ and render the muscle _____
 - a. A good exercise program can _____
4. The heart loses _____ & _____
 - a. Total cardiac output _____
 1. Results in less _____ & fewer _____ reaching cells in tissues contributing to _____
 2. May result in decreased blood flow to _____
 - a. Contributes to a decrease in _____

E. Blood Vessels

1. What is atherosclerosis? _____

 - a. When these deposits are calcified or fibrotic it results in _____
2. Arteriosclerosis interferes with _____
 - a. What is a thrombus? _____
 - b. What is an embolus? _____
3. Atherosclerosis is more likely to occur in people with _____

F. Free Radicals

1. What is a free radical? _____
2. A free radical can _____ with & _____ the structure of molecules that are _____
3. Free radicals are produced as _____ and introduced to the body _____
4. Damage by free radicals may _____
5. Antioxidants can donate _____ to _____ without themselves _____

G. Immune System

1. The aging immune system:
 - a. Loses _____
 - b. Becomes _____
2. Autoimmune changes add to _____ and may be responsible for such things as:
 - a. _____
 - b. _____
 - c. _____
3. T lymphocytes tend to lose _____ and cannot _____
 - a. This may be one reason that _____

VIII. Death

A. Definitions

1. Death was once defined as the loss of _____ & _____
2. Modern definitions of death are based on the _____

3. Brain death, a widely accepted indication of death in humans, is defined as:
 - a. Irreparable _____ manifested clinically by the:
 1. Absence of _____
 2. Absence of _____ &

3. Isoelectric (flat) _____ in
the absence of known _____