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 _____

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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 _____

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3. The blastocyst is a _____
   a. The biastoceie 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.

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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? _____

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_____

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 _____

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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 _____

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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. lt 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 _____

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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. _____ 3. _____

2. _____

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 _____ 3. _____

2. _____

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? _____

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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 _____

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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

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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 _____

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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 mesonepheric 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

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_____

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. _____ c. _____

b. _____

g. Testes also secrete _____ hormone which causes the _____ to degenerate

h. If neither testosterone or mollerian-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 _____

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k. In the female, in the absence of testosterone:

1. Genital tubercie becomes the _____

2. Urethralgroove _____

3. Urogenital folds _____

4.The urethra opens _____ to the 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 aproached the growth rate _____
   b. Growth of the placenta essentially stops at _____ restricting _____
6. At about 38 weeks of development _____

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_____

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 _____ _____

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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 _____

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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. _____

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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 _____

_____

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1. This enzyme sys tem 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. Lactose 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?

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_____

3. Progesterone causes development of _____
   a. Which enlarge but _____
4. The other hormones involved in breast development include:
   a. _____ d. _____
   b. _____ e. _____
   c. _____
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? _____

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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. _____

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

VII. Aging

A. Cell Proliferation
   1. During eariy 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 _____

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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. _____ d. _____
   b. _____ e. _____
   c. _____

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 _____

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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 _____&

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

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