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Developmental Anatomy, Postnatal Growth, and Inheritance

I. Fertilization

☞ *Concept:* Upon fertilization of a secondary oocyte by a spermatozoon in the uterine tube, meiotic development is completed and a diploid zygote is formed.

A. Multiple Choice Questions

- ___ 1. What happens during the embryonic period of development?
(a) The blastocyst implants in the uterus.
(b) The germ layers are formed.
(c) The organ systems are formed.
(d) The second trimester is completed.
(e) All of the above occur.
- ___ 2. A mature sperm cell undergoes capacitation upon
(a) ejaculation.
(b) mixing with additives from the seminal vesicles.
(c) passing through the acidic vagina.
(d) penetrating the zona pellucida of an ovum.
- ___ 3. The head of a sperm cell contains digestive enzymes within an organelle called
(a) the basal plate. (c) the flagellum.
(b) the acrosome. (d) the corona radiata.
- ___ 4. Which of the following events immediately precedes the second meiotic division of an ovum?
(a) implantation (c) the first meiotic division
(b) fertilization (d) disintegration of a polar body

B. True–False Questions

- ___ 1. Freshly ejaculated sperm cells must spend several hours in the female reproductive tract before they can fertilize an ovum.
- ___ 2. An acrosomal reaction must take place before a sperm cell can fertilize a secondary oocyte.
- ___ 3. Immediately following ovulation, an egg cell completes its second meiotic division.
- ___ 4. Chromosome pairing follows fertilization within minutes, so that a diploid number is established.
- ___ 5. Ejaculated sperm cells can survive only about 12 hours in the female reproductive tract.

II. Preembryonic Period

☞ *Concept:* The events of the 2-week preembryonic period include fertilization, transportation of the zygote through the uterine tube, mitotic divisions, implantation, and the formation of primordial embryonic tissue.

A. Multiple Choice Questions

- ___ 1. A zygote is usually formed within
(a) the ovary. (d) the uterus.
(b) the vagina. (e) the uterine tube.
(c) the cervix.
- ___ 2. Cleavage is
(a) the first event following the formation of the zygote.
(b) the pairing of the chromosomes.
(c) cellular differentiation.
(d) a meiotic division.
- ___ 3. Which of the following preembryonic events/structures are in the correct sequence?
(a) cleavage, zygote, morula, implantation, and blastocyst
(b) zygote, cleavage, blastocyst, morula, and implantation
(c) zygote, cleavage, morula, implantation, and blastocyst
(d) zygote, cleavage, morula, blastocyst, and implantation
- ___ 4. All pregnancy tests assay a woman's blood or urine for the presence of
(a) follicle-stimulating hormone.
(b) human chorionic gonadotrophin.
(c) amniotic fluid.
(d) progesterone/estrogen at certain levels.
- ___ 5. The preembryonic period of development lasts
(a) 1 day. (d) 6 weeks.
(b) 1 week. (e) 1 trimester.
(c) 2 weeks.
- ___ 6. The preembryonic period of development ends when
(a) the blastocyst becomes implanted.
(b) the morula enters the uterine cavity.
(c) the placenta is formed.
(d) the chromosomes are aligned in the zygote.
(e) the primary germ layers are formed.
- ___ 7. All connective tissue, the dermis of the skin, the kidneys, and muscle tissue derive from
(a) ectoderm. (d) mesoderm.
(b) endoderm. (e) the embryonic disc.
(c) myoderm.

B. True–False Questions

- ___ 1. The preembryonic period is initiated upon ovulation.
- ___ 2. The trophoblast gives rise to a portion of the placenta.
- ___ 3. Implantation of the zygote occurs between the seventh and tenth days following conception.

- ___ 4. Implantation in the uterine tube is rare because of the presence of proteolytic enzymes that repel the blastocyst.
- ___ 5. The effect of human chorionic gonadotrophin (hCG) is identical to that of LH in maintaining the corpus luteum.
- ___ 6. All of the visceral organs in the thoracic and abdominal cavities derive from the endodermal germ layer.

III. Embryonic Period

☞ *Concept:* The events of the 6-week embryonic period include the differentiation of the germ layers into specific body organs and the formation of the placenta, the umbilical cord, and the extraembryonic membranes. Through these morphogenic events, the needs of the embryo are met.

A. Multiple Choice Questions

- ___ 1. The embryonic period of development lasts
- (a) 2 weeks. (d) 8 weeks.
(b) 4 weeks. (e) 1 trimester.
(c) 6 weeks.
- ___ 2. Which of the following are extraembryonic membranes?
- (a) the yolk sac, allantois, amnion, and chorion
(b) the chorion, amnion, yolk sac, and placenta
(c) the yolk sac, amnion, placenta, and allantois
(d) the allantois, amnion, chorion, and placenta
- ___ 3. The yolk sac produces blood for the embryo until
- (a) the spleen develops. (c) the liver develops.
(b) the kidneys develop. (d) the heart begins to function.
- ___ 4. The decidua basalis is
- (a) a component of the umbilical cord.
(b) the embryonic conceptus.
(c) the embryonic portion of the villous chorion.
(d) the maternal portion of the placenta.
(e) a vascular membrane derived from the trophoblast.
- ___ 5. Which of the following is *not* a function of the placenta?
- (a) production of steroids and hormones
(b) diffusion of nutrients and oxygen
(c) removal of waste products
(d) production of amniotic fluid
- ___ 6. Which of the following could *not* diffuse across the placenta?
- (a) a rubella virus (d) alcohol
(b) nicotine (e) none of the above (all could diffuse)
(c) heroin
- ___ 7. The umbilical cord contains
- (a) one umbilical artery and two umbilical veins.
(b) two umbilical arteries and one umbilical vein.
(c) one umbilical artery and one umbilical vein.
(d) two umbilical arteries and two umbilical veins.

- ___ 8. Mucoïd connective tissue is found within
 (a) the placenta. (c) the fetal heart.
 (b) the amniotic sac. (d) the umbilical cord.
- ___ 9. Embryonic induction occurs when
 (a) an osmotic gradient exists across the placental barrier.
 (b) the mother's nutritional intake is not sufficient for both her and the fetus.
 (c) a tissue stimulates an adjacent tissue to differentiate.
 (d) the amniotic sac is ruptured.
- ___ 10. The human embryonic heart begins pumping blood
 (a) 3 weeks after conception.
 (b) 4 weeks after conception.
 (c) 5 weeks after conception.
 (d) 6 weeks after conception.
 (e) 7 weeks after conception.
- ___ 11. Changes during the fifth week include development of
 (a) the amnion. (d) the heart.
 (b) the head. (e) the digital rays.
 (c) the jaws.
- ___ 12. The developing body organs are most vulnerable during
 (a) the third week. (d) the eighth week.
 (b) the fourth week. (e) the tenth week.
 (c) the sixth week.

B. True–False Questions

- ___ 1. The placenta and fetal membranes are expelled from the uterus following childbirth.
- ___ 2. During amniocentesis, a small sample of fetal tissue is excised so that it can be examined for genetic abnormalities.
- ___ 3. The human yolk sac contains nutritive yolk to sustain the embryo until the placenta is formed.
- ___ 4. Blood for the embryo is produced by the chorion until the liver forms during the sixth week.
- ___ 5. The chorion is an extraembryonic membrane involved in the formation of the placenta.
- ___ 6. Oxygenated blood is transported from the placenta to the fetal heart through the umbilical artery within the umbilicus.
- ___ 7. Depressant drugs are safe to give to a woman in labor because they cannot cross the placenta.
- ___ 8. The placenta secretes both steroid hormones and glycoprotein hormones.
- ___ 9. In order to protect a female embryo from becoming masculinized by the androgens secreted from the mother's adrenal glands, the placenta converts androgens into estrogen.
- ___ 10. During the third week, the primitive line gives rise to the notochord and intraembryonic mesoderm.
- ___ 11. Distinction of the genitalia as male or female is possible by the end of the seventh week of development.
- ___ 12. The embryonic period is complete when the heart begins pumping blood.

IV. Fetal Period

☞ *Concept:* The fetal period, beginning at week 9 and culminating at birth, is characterized by tremendous growth and the specialization of body structures.

A. Multiple Choice Questions

- _____ 1. The fetal period
- (a) is the last trimester of development.
 - (b) begins when the fetal heartbeat can be detected.
 - (c) begins when the fetal quickening can be detected.
 - (d) starts at the beginning of the ninth week and ends at birth.
- _____ 2. Ossification centers appear in most bones during
- (a) the ninth week.
 - (b) the twelfth week.
 - (c) the sixteenth week.
 - (d) the twentieth week.
 - (e) the third trimester.
- _____ 3. Which of the following relationships between week and fetal event is *incorrect*?
- (a) seventeenth week, quickening
 - (b) twelfth week, distinct genitalia
 - (c) sixteenth week, heartbeat detected with a stethoscope
 - (d) twentieth week, appearance of vernix caseosa
 - (e) fifteenth week, descent of testes into the scrotum in a male fetus
- _____ 4. As the time of birth approaches, the fetus rotates into
- (a) a vertex position.
 - (b) a crowning position.
 - (c) an apex position.
 - (d) a parturition position.
 - (e) a breech position.
- _____ 5. An average (normal) “full-term” baby would have all of the following characteristics *except*
- (a) a total length of 50 cm (20 in.).
 - (b) a weight of 3,400 gm (7.5 lb).
 - (c) a pinkish-blue skin color.
 - (d) dense lanugo hair.
 - (e) a prominent chest and swollen external genitalia.

B. True–False Questions

- _____ 1. All of the structures of the body are formed and distinguishable at the beginning of the fetal period.
- _____ 2. Defecation and urination are physiological processes that do not occur prenatally.
- _____ 3. Although the heart becomes functional during the fourth week of development, it cannot be detected with a stethoscope until the sixteenth week.
- _____ 4. Quickening is the onset of labor.
- _____ 5. Fetal posture has the same meaning as vertex position.

V. Labor and Parturition

☞ *Concept:* Parturition, or childbirth, involves a sequence of events called labor. The uterine contractions of labor require the action of oxytocin, released by the posterior pituitary, and prostaglandins, produced in the uterus.

A. Multiple Choice Questions

- _____ 1. A reliable indication of true labor would be
(a) dilation of the cervix. (c) contraction of the myometrium.
(b) abdominal pain. (d) all of the above.
- _____ 2. Which of the following hormones does (do) *not* influence labor?
(a) relaxin (c) estrogen
(b) oxytocin (d) prostaglandins
- _____ 3. The physiological events of labor include
(1) separation of the placenta from the uterine wall, (2) rupture of the amniotic sac, and (3) forceful uterine contractions and abdominal compression. In which order do these events occur?
(a) (3), (2), (1) (c) (2), (3), (1)
(b) (1), (2), (3) (d) (1), (3), (2)
- _____ 4. The period of parturition, or actual childbirth, is called
(a) the pudendal stage. (c) the expulsion stage.
(b) the crowning stage. (d) the dilation stage.
- _____ 5. Labor can be artificially induced by
(a) the injection of relaxin.
(b) the injection of oxytocin.
(c) the insertion of prostaglandins into the vagina.
(d) the injection of prolactin.
(e) both b and c.

B. True–False Questions

- _____ 1. The normal gestation period is about 286 days, or 300 days from the first day of the last menstrual period.
- _____ 2. The sequence of physiological and physical events accompanying parturition is called labor.
- _____ 3. The expulsion stage of labor is usually the longest stage and may take up to 24 hours.
- _____ 4. Forceful uterine contractions during the placental stage constrict the uterine blood vessels to prevent hemorrhage.

VI. Periods of Postnatal Growth

☞ *Concept:* The course of human life after birth is seen in terms of physical and physiological changes and the attainment of maturity in the neonatal period, infancy, childhood, adolescence, and adulthood.

A. Multiple Choice Questions

- _____ 1. The period of growth from birth to the end of the fourth week is
(a) the neonatal period. (c) the infancy period.
(b) the fetal period. (d) the suckling period.
- _____ 2. The most drastic changes in the first 4 weeks of life are
(a) anatomical. (c) psychological.
(b) environmental. (d) physiological.
- _____ 3. Most critical for the newborn is
(a) adjusting to the colonization of bacteria.
(b) an adequate supply of liquids to combat dehydration.
(c) the establishment of an adequate respiratory rate.
(d) adaptation to thermal stress.
(e) adjusting to nocturnal sleeping patterns.
- _____ 4. The normal newborn respiratory rate is
(a) 20–30 respirations per minute. (c) 40–50 respirations per minute.
(b) 30–40 respirations per minute. (d) 50–60 respirations per minute.
- _____ 5. The reflex action of newborns that is *not* critical for survival is
(a) the suckling reflex. (c) the rooting reflex.
(b) the grasping reflex. (d) the crying reflex.
- _____ 6. The last fontanel to close in the skull is
(a) the posterior fontanel. (c) the posterolateral fontanel.
(b) the anterior fontanel. (d) the anterolateral fontanel.
- _____ 7. Deciduous teeth begin to erupt in most infants between
(a) 2 and 3 months. (c) 5 and 9 months.
(b) 3 and 5 months. (d) 12 and 18 months.
- _____ 8. The continuum of physical changes relating to the growth of body hair in adolescence is called
(a) puberty. (c) pubescence.
(b) the pubal stage. (d) dimorphism.
- _____ 9. The first physical indication of puberty in females is generally
(a) an alkaline vaginal secretion.
(b) widening of the pelvis.
(c) the development of breast buds.
(d) the appearance of axillary hair.
- _____ 10. Which of the following is *not* characteristic of the adult female as compared to the adult male?
(a) a lower blood pressure.
(b) a lower red blood cell count.
(c) a higher basal metabolic rate.
(d) a faster heart rate.
(e) a greater percentage of body fat.

B. True–False Questions

- ___ 1. The heart of a newborn appears to be underdeveloped with respect to the thoracic cavity and compensates by beating 120 to 160 times per minute.
- ___ 2. Dehydration is a serious threat to newborns because the kidneys are unable to excrete concentrated urine.
- ___ 3. Prematurity is defined by due (delivery) date rather than by neonatal body weight.
- ___ 4. Postmature babies are those born 2 or more weeks after the due date and frequently weigh significantly more than babies born at term.
- ___ 5. A full-term baby will generally double its birth weight by 5 months and triple it in a year.
- ___ 6. Adulthood is characterized by a peak in the development of the lymphatic system.
- ___ 7. It is estimated that 5% of American children are obese.
- ___ 8. Significant levels of sex hormones are present in the blood of 10-year-old females and 11-year-old males.
- ___ 9. Adulthood is the final stage of human physical change.
- ___ 10. All of the differences between adult males and females directly relate to sexual reproduction.

VII. Inheritance

☞ *Concept:* Inheritance is the acquisition of characteristics or qualities by transmission from parent to offspring. Hereditary information is transmitted by genes.

A. Multiple Choice Questions

- ___ 1. The genetic inheritance of an individual begins at
 - (a) nidation.
 - (b) implantation.
 - (c) conception.
 - (d) parturition.
 - (e) coitus.
- ___ 2. The twenty-third pair of chromosomes are called
 - (a) the alleles.
 - (b) the autosomal chromosomes.
 - (c) the sex chromosomes.
 - (d) the homozygous chromosomes.
 - (e) the homologous chromosomes.
- ___ 3. Alternative forms of a gene that control the same characteristic but produce different phenotypes are called
 - (a) loci.
 - (b) genotypes.
 - (c) alleles.
 - (d) sex-linked.
- ___ 4. An allele that is *not* expressed in a heterozygous genotype is called
 - (a) recessive.
 - (b) dominant.
 - (c) genotypic.
 - (d) phenotypic.

- ___ 5. Given that the gene for free earlobes (E) is dominant, what is the probability that a child will have free earlobes if the father is genotype Ee and the mother is genotype ee?
- (a) 0% (d) 75%
(b) 25% (e) 100%
(c) 50%

B. True–False Questions

- ___ 1. The phenotype is an expression of the genotype.
- ___ 2. A person’s phenotype for a certain trait is an accurate indicator of his or her genotype for that same trait.
- ___ 3. The term *hybrid* refers to an offspring descended from parents who have different genotypes.
- ___ 4. In sex-linked inheritance, a male child is more likely to have the sex-linked characteristic than a female child.
- ___ 5. Hemophilia is a sex-linked condition caused by a recessive allele.

VIII. Clinical Considerations

A. Multiple Choice Questions

- ___ 1. Congenital abnormalities occur most frequently during
- (a) the first trimester. (c) the third trimester.
(b) the second trimester. (d) the period of parturition.
- ___ 2. The fetal heartbeat can be first detected with a stethoscope applied to the mother’s abdomen during
- (a) the first trimester. (c) the third trimester.
(b) the second trimester.
- ___ 3. The most frequent location of an ectopic pregnancy is
- (a) the vagina. (c) the uterine tube.
(b) the cervix. (d) the peritoneal lining.
- ___ 4. Placenta previa
- (a) is a premature separation of the fetus and the placenta.
(b) causes complications at birth because the placenta is delivered before the fetus.
(c) is the clinical condition in which the developing placenta blocks the cervical opening.
(d) is a “sneak preview” of the fetus using modern fetal-monitoring technology.
- ___ 5. Twins that develop from two zygotes resulting from the fertilization of two ova by two sperm cells in the same ovulatory cycle are called
- (a) monozygotic. (d) identical.
(b) conjoined. (e) none of the above.
(c) dizygotic.

B. True–False Questions

- ___ 1. In monozygotic twins, there are two amnions, one chorion, and one placenta.
- ___ 2. Triplets cannot develop from the same ovum.

- _____ 3. Ultrasonography and fetoscopy both use sound waves to examine the fetus.
- _____ 4. Teratology is the branch of developmental biology concerned with abnormal development and congenital malformations.
- _____ 5. Phenylketonuria (PKU), cystic fibrosis, familial cretinism, and galactosemia are all autosomal recessive disorders.

IX. Chapter Review

A. Completion Questions

1. In order for a sperm cell to fertilize an ovum, it must undergo _____, which takes place in the acidic environment of the vagina.
2. The preembryonic period of development lasts _____ weeks.
3. The two identical daughter cells resulting from the mitotic division of the zygote are called _____.
4. A morula consists of an inner cell mass and a layer of outer cells called the _____ cells.
5. Upon implantation, the trophoblast cells secrete human _____ hormone, which maintains the corpus luteum, and therefore the secretion of estrogen and progesterone.
6. Implantation of the blastocyst normally occurs between the _____ and _____ days.
7. Ectoderm, mesoderm, and _____ constitute the primary germ layers.
8. The term _____ refers to the embryo, or fetus, and all of the extraembryonic structures.
9. _____ fluid surrounds and cushions the embryo, or fetus, while giving it freedom of movement.
10. The _____ gives rise to the embryonic umbilical arteries and umbilical vein.
11. The _____ is the extraembryonic membrane that functions in the formation of the placenta.
12. Metabolic exchange between the vessels of the mother and those of the fetus occurs at the _____.
13. The maternal component of the placenta consists of the _____ portion of the uterine wall.
14. Maternal antibodies cross the placenta and cause the breakdown of fetal red blood cells in the condition called _____.
15. The measurement of _____ in the urine of a pregnant woman is an indication of the health of the placenta.

16. _____ is the embryonic connective tissue that differentiates into all the various kinds of connective tissue found in the adult.
17. Fetal movements that can be detected by the mother are known as _____.
18. The uterine contractions of labor are stimulated by _____, secreted by the posterior pituitary, and by _____, produced within the uterus.
19. A _____ nerve block may be administered during the early part of the expulsion stage of labor to ease the trauma of delivery.
20. In a _____, the homologous pairs of chromosomes are photographed (or illustrated) and identified.

B. Matching Questions

Match the tissue or structure with its derivation.

- | | |
|--|--------------|
| _____ 1. nervous system | (a) ectoderm |
| _____ 2. dermis | (b) mesoderm |
| _____ 3. hair, nails, and skin glands | (c) mesoderm |
| _____ 4. epithelium of GI tract | |
| _____ 5. gonads | |
| _____ 6. liver and pancreas | |
| _____ 7. connective tissue | |
| _____ 8. urethra | |
| _____ 9. epidermis | |
| _____ 10. epithelium of trachea, larynx, and lungs | |
| _____ 11. muscle tissue | |
| _____ 12. urinary bladder | |