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Developmental Anatomy, Postnatal Growth, and Inheritance

Answers and Explanations

I. Fertilization

A. Multiple Choice Questions

1. (c) – Except for the external genitalia, the body organs form during the 6-week embryonic period.
2. (c) – Capacitation within the acidic environment of the vagina activates sperm cells so that they can fertilize an ovum.
3. (b) – Digestive enzymes contained within the acrosome of the sperm cell can digest the egg's protective covering so as to allow entry into the cell.
4. (b) – As fertilization occurs, the ovum is stimulated to complete its second meiotic division.

B. True–False Questions

1. True – Freshly ejaculated sperm cells must be capacitated before fertilization can occur.
2. True – The acrosomal reaction permits penetration of a sperm cell through the corona radiata and the zona pellucida of an egg cell.
3. False – A secondary oocyte that is ovulated but not fertilized does not complete its second meiotic division, but instead disintegrates 12 to 24 hours after ovulation.
4. False – Chromosome pairing does not occur until the nuclear membrane in the ovum disappears. This does not happen until after about 12 hours following the entry of a sperm cell through the cell membrane.
5. False – Ejaculated sperm cells can survive up to 5 days in the female reproductive tract.

II. Preembryonic Period

A. Multiple Choice Questions

1. (e) – The uterine tube is the usual site of fertilization and formation of the zygote.
2. (a) – Cleavage occurs approximately 24 hours after fertilization.
3. (d) – The formation of the zygote, cleavage, and additional cell divisions for the completion of the morula occur within the uterine tube. The morula enters the cavity of the uterus where the blastocyst forms and implants in the endometrium.
4. (b) – Human chorionic gonadotrophin (hCG) is secreted by the embryonic trophoblast tissue into the mother's bloodstream. Excessive amounts are filtered from the mother's body in her urine, where hCG is an indicator of pregnancy.
5. (c) – The preembryonic period lasts 2 weeks and ends when the germ layers are formed.
6. (e) – Once the germ layers are formed (at 14 days), the embryonic period begins.
7. (d) – Mesenchymal cells of the mesoderm migrate throughout the developing embryo giving rise to connective tissues (including cartilage and bone), muscles, the kidneys, and the dermis of the skin.

B. True–False Questions

1. False – The preembryonic period is initiated upon fertilization of the egg and formation of the zygote.
2. True – The trophoblast assists in the formation of the placenta and secretes human chorionic gonadotrophin.
3. False – A blastocyst implants, not a zygote.
4. False – Implantation does not usually occur in the uterine tube because of the ciliary action that moves the morula or blastocyst toward the uterine cavity.
5. True – When the corpus luteum is maintained, menstruation is repressed.
6. False – The GI tract and the organs that outpouch from it (liver, gallbladder, and pancreas) derive from endoderm. The lungs also derive from endoderm. Other visceral organs derive from mesoderm.

III. Embryonic Period

A. Multiple Choice Questions

1. (c) – The 6-week embryonic period is the most crucial period of human development because all of the vital body organs form at this time.
2. (a) – The extraembryonic membranes support and provide nutrients to the embryo or fetus.
3. (c) – By the sixth week, the liver is sufficiently developed to produce blood cells.
4. (d) – The villi from the chorion frondosum penetrate into the decidua basalis of the uterine wall. The chorion frondosum and the decidua basalis form the placenta, from which nutrients for the embryo and fetus are obtained.
5. (d) – Amniotic fluid is formed initially as an isotonic fluid absorbed from the maternal blood in the endometrium. Later, the volume is increased and the concentration changed by urine excreted from the fetus into the amniotic sac.
6. (e) – Although the placenta is somewhat selective in permitting substances to enter the bloodstream of the embryo or fetus, a number of potentially harmful agents can cross the placental barrier.
7. (b) – The umbilical vein carries oxygenated blood and nutrients toward the heart of the fetus. There are two umbilical arteries that carry deoxygenated blood and fetal wastes toward the placenta.
8. (d) – Mucoïd connective tissue provides the umbilical cord with structural support.
9. (c) – It is through the process of induction that undifferentiated cells and tissues transform into specific organs during embryonic development.
10. (b) – The heart starts beating in an embryo approximately 25 days after conception.
11. (e) – The digital rays that will form the hands and feet develop during the fifth week.
12. (c) – During the sixth week following conception, most of the vital organs of the body are being formed, and many of them start functioning.

B. True–False Questions

1. True – The placenta and its attached fetal membranes, collectively called the afterbirth, are delivered shortly after the birth of the infant.
2. False – Amniocentesis is a technique used to obtain a small sample of amniotic fluid with a syringe so that the fluid can be assessed.
3. False – Unlike that of other vertebrates, the human yolk sac contains no nutritive yolk, but it does produce blood for the embryo until the liver is formed.
4. False – Blood is produced by the yolk sac until the liver is formed.
5. True – Differentiation of the chorion is necessary to establish the embryonic component of the placenta.
6. False – The umbilical vein transports oxygenated blood to the fetal heart.
7. False – Depressant drugs taken by a pregnant woman readily cross the placenta.
8. True – The glycoprotein hormones maintain pregnancy and ensure optimal nutrition to the fetus. Steroid hormones secreted by the placenta in a later stage of pregnancy stimulate the development of the mammary glands.
9. True – Among the placenta's many physiological functions, a very interesting one is that of protecting a developing female from becoming overly masculinized by the influence of androgens.
10. True – The primitive line is one of the first embryonic structures to undergo differentiation.
11. False – The genitalia are not developed to the point of sex determination until the twelfth week.
12. False – The embryonic period is complete at the end of the eighth week, when the vital organs have been formed.

IV. Fetal Period

A. Multiple Choice Questions

1. (d) – The term *fetus* applies to the developing individual only during the period lasting from 9 weeks until birth.
2. (a) – Most skeletal elements develop first as cartilage and then ossify into bone. Ossification centers begin to appear in most bones during the ninth week.
3. (e) – The descent of the testes into the scrotum is a gradual process that has usually been completed by 28 weeks of development.
4. (a) – In a vertex (head-first) presentation, the upper back part of the fetal head is the presenting part.
5. (d) – Lanugo hair, or fetal hair, is present for a short time during the fetal period and is usually gone, for the most part, at the time of a full-term delivery.

B. True–False Questions

1. False – The external genitalia are not distinguishable as male or female until the twelfth week of development.
2. False – By the end of the twelfth week, a fetus can defecate and urinate into the amniotic fluid.
3. True – Although the heart begins beating during the fourth week of development, the sounds are too faint to be detected with a stethoscope until the sixteenth week.
4. False – Quickening is the detection of fetal movement.
5. False – Fetal posture is flexion of the body. Vertex position refers to the rotation of the fetus with the head down, prior to delivery.

V. **Labor and Parturition**

A. Multiple Choice Questions

1. (a) – Dilation of the cervix is accompanied by a “show” of blood-containing mucus.
2. (c) – Within the uterus, the developing fetus is in an environment rich with estrogen, and thus this hormone does not influence labor.
3. (c) – Labor follows the sequence presented in (c).
4. (c) – Expulsion is the actual delivery of the baby as it passes through the vagina.
5. (e) – Natural childbirth is hormonally instigated. It can be artificially induced using synthetic products.

B. True–False Questions

1. False – Normal gestation is usually 266 days, or about 280 days from the beginning of the last menstrual period to parturition.
2. True – Labor is the series of events accompanying parturition and is divided into the dilation stage, expulsion stage, and placental stage.
3. False – The dilation stage of labor is usually the longest, generally lasting 8 to 24 hours.
4. True – Hemorrhage can be a serious threat to a woman giving birth. Vasoconstriction of uterine vessels minimizes the danger of hemorrhage.

VI. **Periods of Postnatal Growth**

A. Multiple Choice Questions

1. (a) – During the neonatal period of growth from birth to the end of the fourth week, the infant undergoes many physiological changes to ensure survival.
2. (d) – Homeostasis is maintained by the physiological changes that take place during the first 4 weeks of life.
3. (c) – Since the respiratory system is the last vital body system to mature (the reproductive system matures at puberty) and is not called to duty until birth, it is critical that the lungs become functional at the moment of birth.
4. (b) – A newborn respiratory rate of 30 to 40 respirations per minute is just right to meet the metabolic demands of the body.
5. (b) – Of the several reflex actions characteristic of a newborn, the grasping reflex is the least significant in terms of survival.
6. (b) – The anterior fontanel is the largest and is the last to close at about 18 months.
7. (c) – Generally, the incisors are the first teeth to erupt. In most infants, this occurs between 5 and 9 months.
8. (c) – Pubescence is the hormonally determined physical change that occurs in males and females during adolescence.
9. (c) – The development of breast buds is the first physical indication of puberty in females. It generally occurs in healthy girls at about 11 years, but may occur at any time from 9 to 13 years.
10. (c) – The metabolic rate of adult females is lower than that of adult males.

B. True–False Questions

1. False – The heart of a newborn is enlarged with respect to the thoracic cavity.
2. True – Because the kidneys are underdeveloped in a newborn, high fluid intake is especially important.
3. False – Newborns weighing less than 2,500 g (5.5 lb) are considered premature.

4. False – Postmature babies frequently weigh less than they would have if born on their calculated due date.
5. True – The first year of birth is characterized by tremendous growth. The baby has doubled its birth weight by 5 months and tripled it by 12 months.
6. False – Lymphatic tissue is at its peak of development during midchildhood.
7. True – Childhood obesity is a major health concern in the United States.
8. True – The surge in sex hormones during adolescence initiates puberty.
9. True – Physical changes during adulthood are generally correlated with a decrease in physiological functions, which may become clinically important.
10. False – Body size and physical capabilities are genetic, and are only indirectly related to the influence of sex hormones.

VII. Inheritance

A. Multiple Choice Questions

1. (c) – Genetic inheritance begins with fertilization and the pairing of chromosomes to establish the diploid compilation.
2. (c) – The twenty-third pair of chromosomes consist of two X chromosomes in a female and one X and one Y chromosome in a male.
3. (c) – One allele of each pair originates with the female parent and the other with the male parent.
4. (a) – It is the combination of dominant and recessive alleles that determines a person's hereditary traits.
5. (c) – In a simple dominant-recessive match, the probability that a particular trait will be expressed is 50%.

B. True–False Questions

1. True – The phenotype is the physical expression of a genetic trait.
2. False – Recessive genotypes are not apparent in phenotypes.
3. True – Hybrids result from the matching of two different genotypes and are usually infertile.
4. True – Sex-linked traits are more likely to be associated with male offspring.
5. True – Hemophilia is a serious blood disorder that is sex-linked to the male.

VIII. Clinical Considerations

A. Multiple Choice Questions

1. (a) – The embryonic period, within the first trimester, is when the vital body organs are forming and when most congenital abnormalities occur.
2. (b) – The fetal heartbeat can usually be detected with a stethoscope during the sixteenth week of development.
3. (c) – An ectopic pregnancy is most likely to occur in the uterine tube, in which case it is called a tubular pregnancy.
4. (c) – The major risk of placenta previa is hemorrhage.
5. (c) – Dizygotic twins are fraternal, not identical, and may have separate or fused placentas.

B. True–False Questions

1. True – Monozygotic twins are identical, having been formed from one sperm cell and one egg.
2. False – Triplets can form from the same egg, just as monozygotic twins form from the same egg.
3. True – The techniques of ultrasonography and fetoscopy are important noninvasive techniques for assessment of fetal development and position.
4. True – Most congenital malformations occur during the embryonic period. For many of these conditions, the cause is not well understood.
5. True – Being autosomal recessive means that they are not linked to the sex chromosomes and are not dominantly expressed.

IX. Chapter Review

A. Completion Questions

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|----------------------------|------------------------------|
| 1. capacitation | 11. chorion |
| 2. 2 | 12. placenta |
| 3. blastomeres | 13. decidua basalis |
| 4. trophoblast | 14. erythroblastosis fetalis |
| 5. chorionic gonadotrophin | 15. estriol |
| 6. fifth/seventh | 16. Intraembryonic mesoderm |
| 7. endoderm | 17. quickening |
| 8. conceptus | 18. oxytocin/prostaglandins |
| 9. Amniotic | 19. pudendal |
| 10. allantois | 20. karyotype |

B. Matching Questions

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| 1. (a) | 7. (b) |
| 2. (b) | 8. (c) |
| 3. (a) | 9. (a) |
| 4. (c) | 10. (c) |
| 5. (b) | 11. (b) |
| 6. (c) | 12. (c) |