Answer Key

MCB 135E, Final Exam, December 15, 1998

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I. (102 points) Multiple choice 3 points for each correct answer out of 5 statements (A-E) #1-34

1. The primary factor responsible for puberty (i.e. maturation of reproductive function) is:

A. maturation of the limbic-hypothalamic connections
B. maturation of the ovary
C. maturation of the anterior pituitary
D. maturation of the testis
E. none of the above

A

2.The release of GnRH (gonadotropin releasing hormone) from the hypothalamus :

A. depends on the negative feedback from the circulating androgens
B depends on the negative feedback from the circulating estrogens
C. just before mid-menstrual period, depends on positive feedback of estrogens
D. is no longer inhibited by the low levels of androgens or estrogens starting from puberty and through adulthood
E. all of the above

E

3. There are close, direct, relations between the following functions, EXCEPT:

A. second peak of accelerated growth and menarche
B. the development of breast and menarche
C. the descent of testes in the scrotum, prenatally, and testosterone secretion at puberty
D. the decreased cardiac output at puberty and secretion of androgens
E. the increased secretion of androgens/estrogens at puberty and the incidence/severity of acne

D

4. As the baseball single-season record of 70+ runs was established, several reporters and fans have speculated on the possible role of the steroid ANDROSTENEDIONE ("Andro") in this achievement. The following statements represent some of what we know about this hormone, EXCEPT:

A. androstenedione is an androgen.
B. it is converted in the body to testosterone
C. it is a dietary supplement
D. too much androgen can shut-off the body's own production of testosterone
E. the use of androgens is especially dangerous among adolescents in whom it may stunt growth

C

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5. The following statements about he neurotransmitter at the myoneural junction are correct, EXCEPT

B

A. the neurotransmitter is acetylcholine
B. the neurotransmitter is norepinephrine
C. before birth, acetylcholine is diffused throughout the muscle
D. after birth, acetylcholine is localized to the myo-neural junction
E. with development, myoneural junctions in a muscle increase in number and in neurotransmitter levels

6. Adaptation to a variety of environmental changes induces the following responses, EXCEPT:

B

A. specific physiologic responses that vary with the stimulus
B. non-specific physiologic responses that vary with the stimulus
C. non-specific physiologic responses that are the same for all stimuli
D. stimulation of the adrenal cortex to secrete cortisol
E. stimulation of the adrenal medulla to secrete epinephrine

7. Examples of some consequences of stress include the following EXCEPT:

D

A. muscle wasting
B. non-Insulin dependent Diabetes
C. ulcers, colitis, diarrhea
D. stimulation of growth (in childhood)
E. gonadotropin inhibition

8. Major hormones of the adrenal cortex are:

E

A. cortisol
B. aldosterone
C. ACTH (Adrenocorticotropic Hormone)
D. epinephrine
E. A and B

9. The beneficial action of education in promoting development, longevity and good health are mediated by:

E

A. better access to medical care
B. better nutrition
C. greater responsibility to health behaviors
D. increased brain reserve capacity
E. all of the above

10. Body weight is regulated by:

E

A. caloric intake
B. energy expenditure
C. stimulation of the feeding center of the hypothalamus
D. stimulation of the satiety center of the hypothalamus
E. all of the above

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11. Cardiac output:
E
A. is regulated by stroke volume and cardiac rate
B. at puberty, stroke volume becomes stronger and more effective in pumping the blood in the circulation than at earlier ages and reaches adult values
C. at puberty, cardiac rate decreases as compared to earlier ages and reaches adult values
D. at puberty, pulse pressure increases and reaches adult values and reaches adult values
E. all of the above

12. Leptin:
E
A. is a peptide
B. is synthesized in adipocytes
C. is regulated by the *ob* gene
D. it decreases appetite in mice but not in humans
E. all of the above

13. Anorexia in young girls is characterized by all of the following manifestations EXCEPT:
B
A. loss of appetite
B. early onset of puberty
C. growth retardation
D. amenorrhea (lack of menses)
E. neurologic/psychiatric abormalities

14. Major complications of undernutrition in marasmus include:
E
A. thin muscle with very little adipose tissue
B. increased incidence of infections
C. dehydration
D. lethargy (mental sluggishness) or irritability
E. all of the above

15. Sexual identity and sexual orientation are believed to be determined:
E
A. before birth
B. in dimorphic areas of the hypothalamus
C. before 20 weeks of gestation
D. by genes and hormones
E. all of the above

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16. During the fetal period the hormones secreted first and in the largest amounts from the adrenal cortex are:
A. cortisol
B. aldosterone
C. androgens
D. ACTH (adrenocorticotropic hormone)
E. none of the above

17. Muscle tissue derives embryologically from:
A. the mesoderm
B. the ectoderm
C. the entoderm
D. all of the above
E. none of the above

18. The major energy source for fetal metabolism derives from:
A. proteins
B. lipids
C. carbohydrates (glucose)
D. none of the above
E. all of the above

19. Respiratory distress syndrome is due to:
A. late reabsorption of water from the neonatal lung
B. toxic effects of oxygen administered to the newborn
C. insufficient amounts of surfactant
D. delayed closure of the Foramen Ovale
E. premature closure of the Ductus Arteriosus

20. In the newborn, the rapid heart rate (100 beats per minute) is higher due to:
A. the need to compensate for a lower cardiac stroke volume than in the adult
B. decreased pulmonary circulation
C. the need to compensate for a higher cardiac stroke volume than in the adult
D. the closure of the Ductus Arteriosus
E. none of the above

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21. In the newborn and infant, normal renal function is necessary to:
A. to maintain normal water content of blood and tissues
B. to be able to compensate for faster loss of water through diarrhea
C. to maintain acid-base balance
D. to be able to compensate for alterations in acid-base balance due to respiratory insufficiency
E. all of the above

22. Some problems of prematurity include:
A. intraventricular hemorrhage (stroke)
B. retinopathy
C. patent Ductus Arteriosus
D. anemia of prematurity
E. all of the above

23. Major hormones of parturition include:
A. oxytocin
B. relaxin
C. prolactin
D. antidiuretic hormone
E. A and B

24. Statements of renal function in the newborn/infant compared with that at later ages are correct, EXCEPT:
A. the loop of Henle is shorter
B. the urine pH is less acid
C. the amount of ammonia secreted by the distal tubule is greater
D. the response to a water load is less rapid and efficient
E. the capacity to concentrate urine is less efficient

25. Implantation of the fertilized ovum on the uterine walls is possible because:
A. the uterine mucosa proliferates due to high levels of estrogens
B. the uterine mucosa secretes mucus and is hyperemic due to high levels of progesterone
C. uterine muscles are quiescent due to high levels of progesterone
D. the corpus luteum continues to secrete high levels of progesterone and estrogen
E. all of the above

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26. Certain features characterize the different age periods of life. Which of the following periods is INCORRECTLY matched to its characteristics?

A. embryonic period first trimester of prenatal life with rapid differentiation and establishment of organ systems
B. early fetal period second trimester of prenatal life with accelcrated growth and elaboration of structures
C. late fetal period third trimester of prenatal life with rapid increase in body mass and cessation of placental function
D. neonatal period newborn; birth to end of second week
E. pubertal period of adolescence; maturation of secondary scx characters

C

27. Thalidamide is a drug with the following actions, EXCEPT:

A. has sedative and tranquilizer actions
B. was taken by pregnant women to overcome morning sickness in the first trimester of pregnancy
C. has teratogenic actions for the embryo, particularly between the 3rd and 8th week of gestation
D. induces masculinization of the fetus
E. induces a type of malformation called phocomelia

D

28. Which of the following statements about sperm is TRUE?

A. The spermatozoa contain lipids in the acrosome which help it to penetrate the ovum.
B. In order for the Sertoli cells to produce sperm the temperature of the testes must be at least 36 degrees.
C. Spermiogcnesis is the process by which spermatagonia develop into spermatids.
D. Spermatogenesis is a process which begins at puberty and continues through to old age.
E. Capacitation is the process by which spermatozoa become more mature in the epididymis.

D

29. Regarding the ovaries and ovulation, which of the following statements is FALSE?

A. The ovaries contain a limited number of oocytes at birth which then decline with age.
B The primary oocytes do not begin the first meiotic division until puberty.
C. The ovulation of the ovum occurs after a surge in LH, around 14 days after the onset of menstruation.
D. After ovulation, the secretory cells of the follicle develop into the corpus luteum which secretes progesterone and estrogen.
E. In a normal pregnancy, the ovum is usually fertilized within the uterus one week after ovulation.

E

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30. Regarding the fetal and placental membranes, which statement is FALSE?

A. The spiral arteries of the endometrium spray oxygenated blood into the sinuses surrounding the chorionic villi..
B. The decidua basalis is the part of the endometrium where the placenta forms to join the mother and fetus.
C. Transport of materials such as waste products, glucose, oxygen, and red blood cells between the mother and fetus takes place by simple diffusion and active transport.
D. The placenta reaches its maximal weight and diameter and midgestation(4-5 months).
E. A decline in HCS levels may be indicative of placental insufficiency and malfunction of the placenta.

31. Which of the following statements about the hormones of pregnancy is TRUE?

A. HCG secreted by the placenta stimulates the corpus luteum to secrete LH and FSH.
B. HCG stimulates steroid synthesis in the developing fetal thyroids.
C. Estrogen suppresses maternal lymphocytes and reduces possibility of immunorejection of fetus.
D. HCS is similar in function to growth hormone (GH) and causes increased glucose utilization and decreased lipolysis in the mother, resulting in decreased glucose to the fetus.
E. Progesterone decreases the contractility of the uterine muscles to prepare for the implantation of the fertilized ovum.

32. Which of the following statements regarding embryology of the reproductive system is FALSE?

A. The Sertoli cells secrete androgen binding protein (ABP), inhibin, and MIS.
B. Mullerian Inhibiting Substance (MIS) causes regression of the Mullerian ducts in males during fetal life.
C. Male and female reproductive tracts do not begin to differ until the seventh week of gestation, even though the genetic sex of the embryo is determined by fertilization.
D. In a normal female fetus, the Wolffian duct system develops into uterine tubes (oviducts) and a uterus.
E. The Leydig cells secrete testosterone, which induces formation of external male genitalia.

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33. The following are biochemical changes that occur in prenatal CNS development EXCEPT:

A. development of specific enzymes
B. development of neurotransmitter systems
C. changes in RNA and proteins
D. free fatty acid (FFA) utilization in the brain
E. lipids and myelination

34. The following statements regarding the growth, differentiation, and migration of neurons and glial cells are true EXCEPT:

A. The neural plate is an undifferentiated, proliferative epithelium that become specialized into neuroblasts and spongioblasts.
B. The neuroblasts develop into the neurons
C. The spongioblasts develop into ependymal and neuroglial cells.
D. The ependymal cells further differentiate into microglia cells that help nurture the neurons.
E. The neuroglial cells eventually become astrocytes and oligodendrocytes.

II. (33 points) Multiple choice 3 points for each correct answer out of 4 statements (A-D) #35-45

35. According to the prenatal theory of brain sexualization, the prenatal production of gonadal steroids is necessary for the sexualization of dimorphic brain areas in the;

A. male
B. female
C. neither the male nor female
D. both the female and male

36. The sexual and social behaviors associated with male adolescence are related to escalating blood levels of:

A. DHT
B. testosterone
C. aromatase
D. estrogen

37. Parental and survival skills are determined by neurons located in the:

A. hypothalamus
B. spinal cord
C. pituitary
D. cerebral cortex

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38. Choose the true statement:
A. DHT, testosterone, and 5-alpha-reductase are sex steroids
B. Onuf's nucleus is larger in females than in males
C. To have action within dimorphic neurons in the hypothalamus, testosterone must be converted to estradiol.
D. External genital development in males depends on the conversion of testosterone to estrogen.

39. Which statement is FALSE?
A. T-cells and B-cells are lymphocytes unlike macrophages.
B. macrophages and neutrophils have similar phagocytic and antigen processing and persentation activities.
C. T-cells can be found in most tissues throughout the human body.
D. natural killer cells and T-killer cells have cytotoxic activities.

40. Which statement is FALSE?
A. B-cells can be stimulated to differentiate into plasma cells.
B. The CD-4 receptor is a component of T-helper cells.
C. Complement factors are present in significant quantities by 28 months gestation.
D. In the newborn the liver is the primary site of stem cells production.

41. With development (choose the CORRECT statement):
A. there is an overproduction of antibodies.
B. T-cells become B-cells.
C. Ig G from the mother can cross the placental barrier to provide protection to the developing embryo and fetus.
D. T-cells are not present until birth.

42. The thymus (choose the CORRECT statement):
A. reaches its maximum weight at puberty.
B. reaches its maximum weight to body weight ratio at birth.
C. is composed of thymocytes, epithelial cells, fat and connective tissue
D. all of the above

43. With regard to development (choose the FALSE statement):
A. Ig M is the first immunoglobulin to reach adult levels after birth.
B. the thymus develops at around 7-10 weeks gestation.
C. complement factors and B-cells are first observed at birth
D. the spleen develops at around 14-16 weeks gestation.

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44. Choose the INCORRECT statement:
A. Ig A is present in breast milk and may provide protection to the newborn.
C B. all the lymphocytes and neutrophils are derived from stem cells.
C. all immunoglobulins are antibodies
D. T-killer cells are often involved in destroying cells infected by active virus.

45. The caracteristics of the slow muscle fibers include all of the following EXCEPT:
A. have larger diameter than fast mucle fibers
A B. are prominent in muscles of posture
C. receive richer blood supply than fast muscle fibers
D. rely on high oxidative capacity for ATP generation

III. TRUE/FALSE (true: A; false: B) 3 points each (21 points total)

A 46. A or B. During the process of neurulation, the neural tube that is formed will eventually become the central nervous system.
A 47. A or B. The three germ layers of the gastrula (mesoderm, ectoderm, and endoderm) will eventually differentiate into all the embryos tissues and organs.
B 48. A or B. The startle reflex found in the five year old is a sign of normally functioning higher centers.
A 49. A or B. Gonadal steroids (estrogens/progesterone and androgens), are present in the blood in free and bound (to blood proteins) forms.
B 50. A or B. The cervical and thoracic parts of the spinal cord mature later than the caudal portion while the medulla develops later than the cortex in the brain.
A 51. A or B. Neurons will continue to replicate after differentiation, a process critical for growth and adaptation.
B 52. A or B. The newborn is significantly more susceptible to hypoxia than the adult due to its reliance on the glycolytic respiration.

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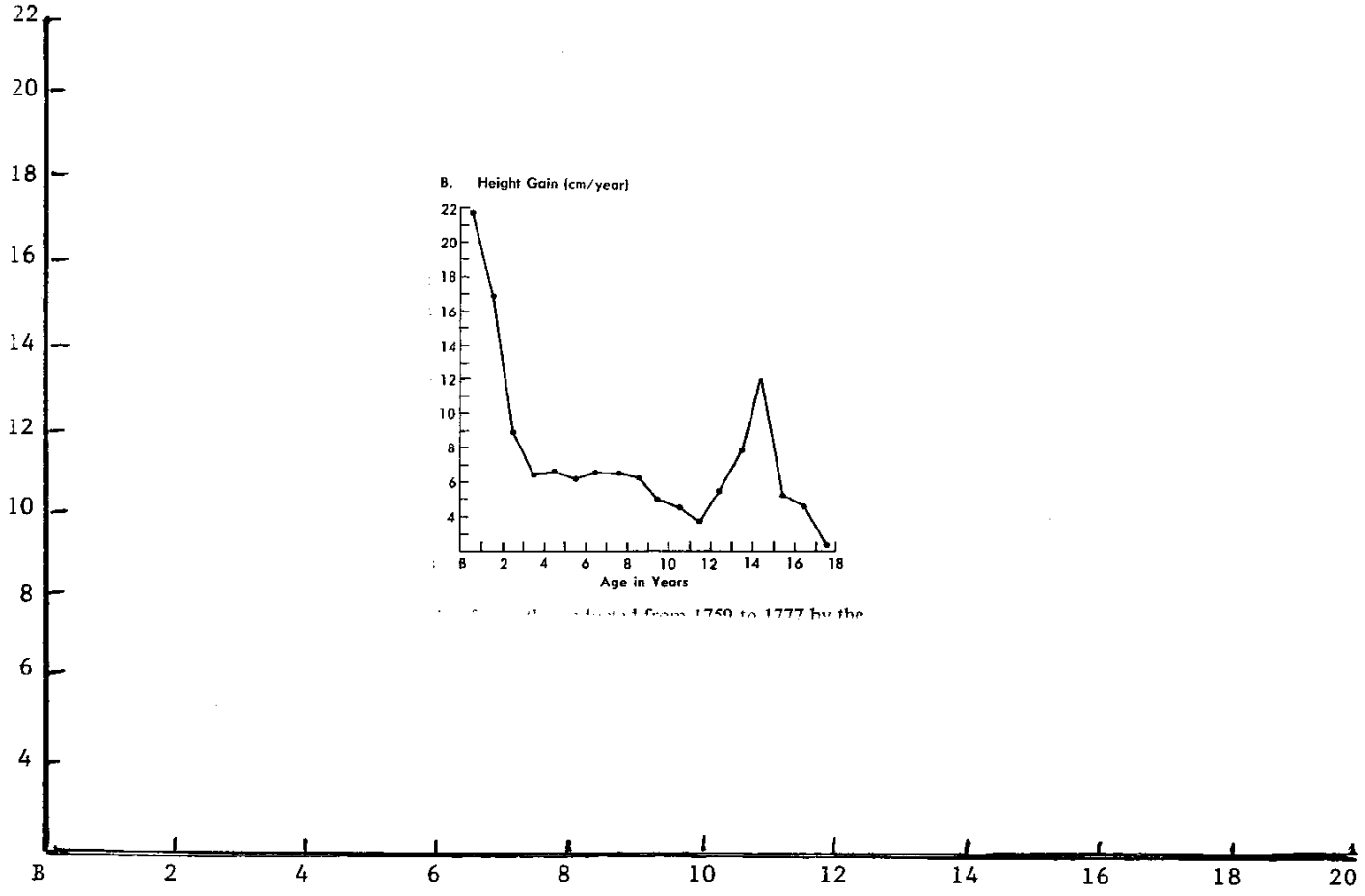
IV.(10 points). Utilizing the coordinates prepared here, draw the curve of height gain (i.e. height rate)

FROM THE LATE FETAL PERIOD TO THE END OF ADOLESCENCE and explain the factors that regulate this growth pattern

4 points for drawing the correct curve

6 points for explaining the factors that influence this curve until the end of adolescence

HEIGHT GAIN (cm/year)



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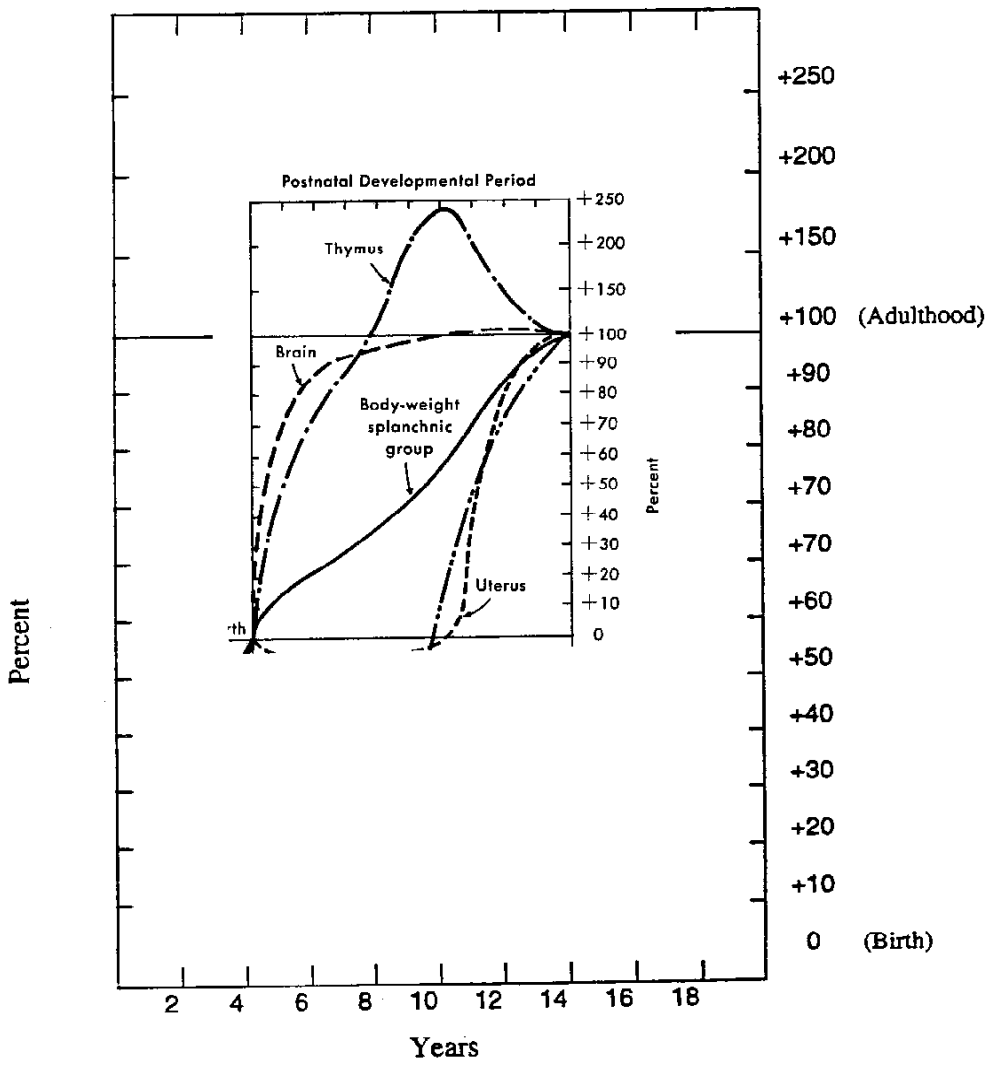
V. (12 points) Utilizing the coordinates prepared here draw the curves that represent the percent changes FROM BIRTH TO END OF ADOLESCENCE for the following organs and indicate one important consequence of each change:

brain (3 points)
thymus (3points)
uterus (3 points)
splachnic organs and body weight (3 points)

Postnatal Developmental Period



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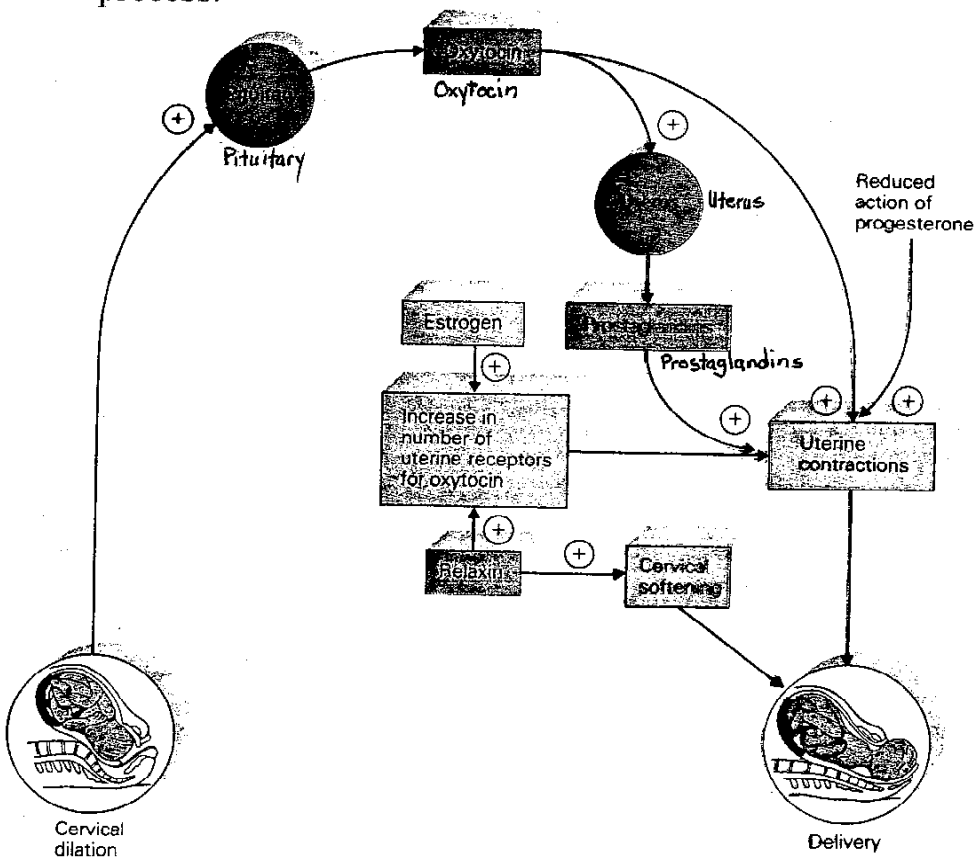
VI (6 points) SHORT ANSWER (2 points each):

A. List in correct order the anatomical structures in which the spermatozoa are produced and must travel through to reach the urethra of the penis.

B. Describe the steps of fertilization in a few sentences.

C. Describe or draw a diagram of the role of different hormones in parturition. Briefly describe what the function/effect of each hormone is in the process.



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VII (16 points) ESSAY QUESTIONS:
A. (6 points) What is cretinism? (Be sure to identify the major deficiency involved) (2 pts) What are the important developmental actions of the missing hormone (2 pts). Describe how and when cretinism can be prevented. (2 pts)

A. 1. Cretinism is a condition of severe mental retardation characterized by thick skin, mixedema, short individual. Neonatal hypothyroidism leads to cretinism (2 pt)
2. Thyroid hormones help in the growth and maturation of neurons and possibly glia cells in myelinogenesis. (2 pts)
3. It can be avoided by early detection (at birth measurements of blood levels of TSH, T3, T4) and early administration of the hormone, within 1-3 months of birth. The best results are found within the first two weeks.

B. (10 pts) Explain the actions of neonatal androgens by using the example of an experimental protocol discussed in class that looked specifically at the Sexually Dimorphic Nucleus of the Preoptic Area (SDNPOA) and the Spinal Nucleus of the Bulbocavernosus (SNB).

Discuss how the treatment was varied between male (2 points) and female (2 points) subjects, and be sure to discuss the significance of when the treatments are administered (2 points). What were the conclusions/findings with regard to sexual differentiation (4 points)? Please be as detailed as possible; you may use a table to describe the protocol but you must explain the results in complete sentences.

1. Male rats with no treatment within 0-4 days after birth displayed male behavior, larger SDN POA, and large SNB after puberty. (2 pts)
2. Male rats that were castrated within 0-4 days after birth displayed lordosis, small SDNPOAs and small SNB when reactivated after puberty. (2 pts)
3. Female rats without treatment within 0-4 days after birth displayed lordosis, small SDNPOA, small SNB. (2 pts)
4. Female rats that were injected with androgens(testosterone) within 0-4 days after birth displayed no lordosis, large SDNPOA, and large SNB. (2 pts)
Giving androgen hormones early in the critical period of neonatal life "masculinized" by permanently changing structure or organizing the brain of the female rat, thus modifying her behavior later in life. This "window" of the organizing activity of androgens is in the first four postnatal days in the rats and possibly the third trimester of humans. (2 pts)