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Physiology of Human Development (MCB 135E)

MIDTERM 1
October 4, 2006

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Points Received

Part I: Multiple Choice (30 points)

40

Part II: True and False (20 points)

Part III: Short Answer (50 points)

47

SCORE

47
48
96 + 1

96 PST
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Physiology of Human Development

Midterm I
October 4, 2006.

I. Multiple choice questions (30 points, 2 points each correct answer) There is only one correct answer.

1. Which of the following statements on Growth and Development are correct?
   A. Growth and development continue throughout the lifespan
   B. Growth and development follow a precise, predictable timetable
   C. Growth and development can be influenced by both genetic and environmental factors
   D. All of the above are correct
   E. None of the above are correct

2. Fertilization occurs:
   A. In the ovary
   B. In the section of the oviduct, close to the ovary
   C. In the section of the oviduct, close to the uterus
   D. In the uterus
   E. In the corpus luteum

3. Sperm and ovum have several characteristics different from each other. Indicate *the characteristic that is the same* for both of them:
   A. At fertilization, each gamete has a haploid number of chromosomes
   B. At the moment of fertilization, the sperm is a very small cell
   C. After puberty sperm production continues throughout life
   D. Maturation of sperm and ovum depends on estrogens
   E. At the moment of fertilization, the ovum is a very large cell

4. The results of fertilization, include:
   A. Association of male and female chromosomes
   B. Determination of the sex of the new individual
   C. Activation of the ovum into meiotic cell division
   D. Reestablishment of the diploid number of chromosomes
   E. All of the above are correct

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5. At implantation, the **mother provides**:
   A. A hyperplastic/hypertrophic uterine mucosa under the influence of high estrogen levels from the corpus luteum of the maternal ovary
   B. A hyperhemic /hypervascularized uterine mucosa under the influence of high levels of progesterone from the corpus luteum of the maternal ovary

   The **embryo provides**:
   C. hCG from the trophoblast (or chorion) to keep the corpus luteum of the maternal ovary to produce high levels of estrogens and progesterone
   D. From the trophoblast, a number of enzymes (proteinases) and proteins (adhesions molecules) that facilitate trophoblast invasion
   E. All of the above is correct

6. Male sex differentiation depends on:
   A. The presence of gene(s) (SRY gene) in the Y chromosome. These genes are responsible for the production of molecules capable of inducing differentiation of the bipotential, undifferentiated gonad into a testis
   B. The testis starts to secrete testosterone that induces the differentiation of the Wolffian ducts into male secondary sex organs
   C. The development of the enzyme 5-alpha reductase promotes the production of dehydrotesterone (DHT) that induces differentiation of the external genitalia into the male type
   D. The Mullerian ducts regress via the action of the Mullerian Inhibitory Substance or factor (MIF) secreted by the Sertoli cells
   E All of the above is correct

7. With regard to the placenta, the following statements are correct, EXCEPT:
   A. Maternal and fetal blood mix in the maternal sinuses
   B. Maternal and fetal blood do not enter into direct contact but they are separated by the thin tissue that surrounds the floating fetal villi
   C. Exchange of gases occurs by diffusion from maternal to fetal blood
   D. Delivery of nutrients occurs by diffusion or facilitated transport from mother to fetus
   E. Removal of waste products occurs from fetus to mother

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8. The following are some of the major cardiovascular adjustments of the fetus to avoid " Everest in utero," EXCEPT
   A. The establishment of organ priority for the best blood carried by the umbilical arteries to the liver
   B. The ductus venosus shifts the blood from the liver to the inferior vena cava
   C. The foramen ovale, in the wall between right and left cardiac atria, shifts the blood from the inferior vena cava to the right atrium and from there to the right ventricle and to the aorta,
   D. The ductus arteriosus shifts the blood from the pulmonary artery to the descending aorta
   E. Embryonal and fetal hemoglobins have different physico-chemical properties than adult hemoglobin and these favor a better oxygen uptake from maternal blood and better release to the fetal tissues.

9. Major germ layers include:
   A. Ectoderm
   B. Endoderm
   C. Mesoderm
   D. All of the above
   E. None of the above

10. The tissue/organs that derive from the ectoderm include:
   A. The skin, hair and nails
   B. The nervous system
   C. The neuro-epithelium of sense organs
   D. The epithelium of GI tract
   E. All of the above

11. Major hormones of pregnancy include:
   A. hCG
   B. Estrogens
   C. Progesterone
   D. Human chorionic somatomammotropin (hCS)
   E. All of the above

12. Thyroid hormones are necessary for the following functions, EXCEPT:
   A, Normal development and maturation of the brain
   B. Promotion of body growth (bone and muscle) (postnatally)
   C. Promotion of myelinogenesis
   D. Reduction of dendritic branching
   E. Increased excitability of neurons

13. During gestation the placenta:

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A. Undergoes aging changes
B. Reaches peak size and function around 4-5 months
C. With aging, the placenta may be responsible for a decline (small-for-date) in newborn size
D. All of the above are correct
E. None of the above are correct

14. Glucocorticoids from the adrenal cortex are necessary for:
A. Production of surfactant to decrease surface-tension in alveoli postnatally
B. Formation of glycogen from glucose
C. Storage of glycogen in the liver
D. All of the above are correct
E. None of the above are correct

15 Pseudohermaphrodites are individuals with:
A. A normal genetic sex
B. Females with XX, may have a male phenotype
C. In the case of B, the females were exposed *in utero* to high levels of androgens
D. Males with XY, may have a female phenotype due to androgen deficiency or abnormalities of steroid-receptor binding
E. All of the above is correct

II. (20 Points total) True or False (In the scantron, True is **A**, False is **B**).

16. Turner syndrome or ovarian disgenesis is characterized by an XO sex chromosome pair

17. The fetus and newborn are more resistant to hypoxia (low or lack of oxygen) than adults

18. GH (Growth Hormone) is present in the embryo and fetus because it is necessary for fetal growth

19. The fetal CNS functions essentially through reflex mechanisms

20. Prenatally, the pressure in the right side of the heart is greater than that in the left side. After birth the reverse is true

21. Estrogen increase motility (contractions) of uterine muscle

22. Progesterone decreases motility (contractions) of uterine muscle

23. Ovulation occurs at the end of the menstrual cycle

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24. Ovulation depends on a surge of pituitary LH to occur at the middle of the menstrual cycle (day 14th -15th day

25 If the ovulated ovum is not fertilized, the corpus lutem regresses and involutes

III. Short Essay Questions

1. (10 points total) Under the left side, are listed the ***major embryonic neural vesicles***. On the right side, the neural structure derived from those vesicles. Please indicate which neural structure comes from which neural vesicle. (Each vesicle may have more than one answer)

(1 point for each correct answer)

Neural Vesicle:

Telecephalon Retina, D, E, A, B

Diencephalon G, H

Mesencephalon F

Rhombencephalon I, J

A. Limbic System
B. Cerebral Cortex
C. Retina
D. Olfactory Bulbs
E. Corpus Striatum
F. Superior and Inferior Colliculi
G. Thalamus
H. Hypothalamus
I. Cerebellum
J. Medulla

* Glucocorticoid: increase in synaptogenesis
* Thyroid: increase in dendrite branching.

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2. (10 points total) What are the characteristics of newborns with anencephaly with respect to:

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A. Size of the brain (2 points)

2 the brain size is smaller because they only have their brainstem, and miss anterior part of their brain as well as their thelamus and hypothelamus.

B. Areas of the brain which are retained (2 points)

2 just the brainsten (pons, Medullen oblongata) which are neccesary for circulation and Respiration.

C. Life expectancy (2 points)

1 it is very short, since they don't have their cerebral cortex, their Hypothelamus, thalamus.

D. Size of the body at birth and implication for hormonal control of fetal body growth (4 points)

4 their body size is exactly the same as a normal baby. This finding shows that hormones from thelamus and hypothelamus (GH, T_3, T_4) are not involved in the body growth prenatally.

3. (10 points total) Explain how the organizing "actions of androgens" manifest themselves at:

10

A. At the level of the Gonads (3 points)

~~(Androgenic hormone (Testostron) promotes the differentiation of male secondary sex organs)~~ (X) At the level of Gonad: the presence of SRY Gene and HY androgen promotes the differentiation of Gonads to testestis

B. At the level of the secondary sex organs (3 points)

At the level of secondary " " : the secretion of testosterone from testes promotes the differentiation of male secondary sex organs. and testostron also promote the differential of Wolfian ducts and Testostron secretion promts the secretion of (MIS) from Sertoli cells which regress Mullerian ducts.

C. At the level of the hypothalamus and lower portion of the spinal chord (4 points)

in male: Androgenic hormones cause the enlargement of the SDN-POA and also the enlargement of the Spinal Nucleus bulbocavernouses.

but for female the absence of ~~Androgenic hormone~~ (SRY gene) and HY androgen cause the bipotential gonads to differentiate into ovaries and then again lack of testostron cause the differentiation of female secondary sex organs.

and in female due to the lack of Androgen SDN-POA and SNB are smaller.

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4. (10 points total) Explain the following effects education has on:

A. Life Expectancy (2 points)

it increase the life expectancy since they have better access to medical care, have higher salary, they abstain from risky behaviors such as alcohol drinking or smoking, they have better access to recreational activity.

+2

B. Quality of Life (2 points)

+2 they will have better brain reserve capacity, or.

they have better quality of life since all the actions that was done during early ages effect the longevity and quality of life during old ages (since development is a continuous process)

C. Anatomical changes observed in the brain (4 points)

+3 Anatomical changes are increase in total # of dendritic segment count, ↑ mean dendritic length, better synaptogenesis, better blood flow to cerebra cortex, higher efficiency of neurons, better dendritic branching.

D. Define neural plasticity and give an example (2 points)

+2 neural plasticity is the ability of the neurons to be modified and and change its structure/or function in response to genetic or environmental factor example: in humans some people can perfectly learn during their old ages.

5. (4 points total) Compare and contrast the following in an adult and newborn. Explain your answers:

A. Pathways used for 0_2 breakdown (2 points)

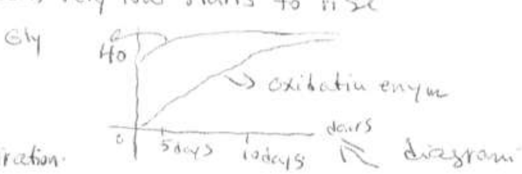
+2

Compare: in adult the major pathway for O_2 breaking is a oxidative reaction) about 85 % and the concentration of oxidation enzyme through such as succinic dehydrogenase is high in adult. in (fetus) Prenataly the major pathway (during post natal was) is Glycolysis, but during birth and the entrance of O_2 into the lungs this shifts and oxidatation enzy which was very low starts to rise.

Contrast:

B. Resistance to hypoxia (2 points)

+2 the New born babies are more resistance to hypoxia since they can restore to their prenatal method which was Glycolysis, but adult can only resist hypoxia for 1 or 2 minutes since they need O_2 for their oxidative respiration.



6. (6 points total) List the 3 major priorities of fetal circulation and explain why they receive that priority.

+6 1) liver 2) Heart 3) Brain

1) liver is the first priority since it makes protein and necessary material for the growth.

2) Heart is the second because it circulates blood and nessary material to all around the body which is a vital function

3) Brain is the third and that is because prenatally fetus don't have that much brain functioning and don't need the first (or the high-oxygenated) blood.

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