NROSCI / BIOSC 1070 — MSNBIO 2070
Final Exam
December 13, 2018

Total POINTS: 100 20% of grade in class

1) Individuals with alcohol-related liver disease often exhibit jaundice, which results in yellow coloration of the skin.

a) Which substance builds-up in the blood to cause jaundice? ***(5 points).***

b) Briefly describe how this substance is normally removed from the blood. **(*5 points).***

2) Both low (e.g., *Mirena*) and high doses of progesterone (e.g., Depo-Provera) are commonly used as chemical contraceptives in women. Combinations of moderate doses of estradiol and progesterone are also commonly used, but high doses of estradiol are not used as a chemical contraceptive.

a) What is the primary mechanism through which the intrauterine delivery of progesterone (e.g., Mirena) prevents pregnancy? ***(4 points).***

b) Through which additional mechanisms, if any, do high systemic doses of progesterone (e.g., Depo-Provera) act to prevent pregnancy that are lacking for contraceptives such as Mirena? ***(4 points).***

c) What are the potential complications of using a high dose of estradiol alone as a chemical contraceptive? ***(4 points).***

3) Surgeons often discontinue their practice when they reach the age of 70, as manual dexterity deteriorates with aging. Describe the primary mechanism explaining a decline in manual dexterity during aging. ***(7 points).***

4) A child is born with a disease causing high levels of the hormone fibroblastic growth factor 23 (FGF23). The child is eventually noted to have softening of the bones (Osteomalacia) leading to rickets.

a) Describe the physiologic mechanisms through which excess of FGF-23 leads to rickets. ***(6 points).***

b) In addition to calcium, what other ion would be highly abnormal in the blood of a patient with excess FGF-23? Briefly describe the mechanism leading to the change in plasma concentration of this ion. ***(4 points).***

5) The synthetic glucocorticoid prednisone has often been used to treat inflammatory conditions. Two of the major side effects of the drug are to cause high blood glucose and fluid retention in the body. Briefly describe the mechanisms through which each of these side effects are generated. ***(3 points each; 6 points total).***

a) High blood glucose

b) Fluid retention

6) A standard thyroid test battery includes an assay for blood levels of both TSH and thyroid hormone. A patient is identified with abnormally high levels of both hormones. What is the most likely cause of this medical condition? Provide a brief justification for your answer. ***(5 points)***.

7) During stomach bypass surgery (also called bariatric bypass surgery), a small pouch that bypasses the stomach and attaches to the intestine is created. Since the stomach cannot accommodate much food, the procedure leads to weight loss.

There are many side effects of stomach bypass surgery, including anemia. Briefly describe why the surgery can cause this condition. ***(5 points).***

8) Following surgery to treat thyroid cancer, a patient experiences muscle spasm as reflected by spasm of the muscles of the hand and forearm when a blood pressure cuff is placed on the arm (Trousseau sign). Why did the thyroid surgery result in this response? ***(6 points).***

9) Drugs such as aspirin and Tylenol are often taken to reduce fever.

a) Which specific enzyme do the drugs inhibit to cause fever reduction? ***(2 points).***

b) Discuss how inhibition of this enzyme leads to fever reduction. ***(5 points).***

10) Prior to gastrointestinal surgery, a patient is given large doses of a powerful but unabsorbed antibiotic, neomycin, to kill all the bacteria in his gastrointestinal tract. What dietary modification, if any, would need to be made following destruction of gastrointestinal tract bacteria? ***(6 points).***

11) Activating mutations in the luteinizing hormone receptor (LHR) gene are one of the most common mutations found in the gonadotropin receptor genes. The LH receptor is active from birth in individuals with this condition, as though high levels of LH were always present. The following questions relate to individuals with this condition.

a) What physiological differences would be noted in an 8-year-old boy with an activating mutation of the LH receptor, relative to a boy without such mutations. ***(7 points)***.

b) After the male individual matures to the age of 20, what differences in hormones would be present relative to a normal individual of the same age? What would be the physiological effect of these hormonal changes? ***(6 points)***.

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c) What physiological changes would be noted in an 8-year-old girl with an activating mutation of the LH receptor, relative to a girl without such mutations. ***(7 points)***.

12) A professional athlete takes high doses of anabolic steroids as a "performance enhancer." The athlete believes that the steroid use will enhance his ability to father a child, since testosterone levels in his blood are higher than normal. Is the athlete correct in his assumption? Provide a brief explanation for your answer. ***(6 points).***