Exam Key

# NROSCI/BIOSC 1070 and MSNBIO 2070
# FINAL EXAM
# December 13, 2019

**1)** Mutations in the CYP19A1 gene cause aromatase deficiency. The gene is on Chromosome 15, and is expressed in an autosomal recessive pattern (the defective gene must be inherited from both parents to be expressed). Indicate below the manifestations for a male or female who has inherited the defective gene from both parents. ***(1 point each; 8 points total).***

**Male:**

Sexual Organ Development in Adolescence

| | | |
|---|---|---|
| Normal | | Inhibited (remains like child) |

Growth

| | | |
|---|---|---|
| Taller than Normal | Normal | Shorter than Normal |

Fertility

| | |
|---|---|
| Infertile or Less Fertile | Normal Fertility |

**Female:**

Breast Development in Adolescence

| | |
|---|---|
| Normal | Inhibited |

Fertility

| | |
|---|---|
| Infertile or Less Fertile | Normal Fertility |

Acne during Adolescence

| | |
|---|---|
| Similar as Normal | More than Normal |

Growth

| | | |
|---|---|---|
| Taller than Normal | Normal | Shorter than Normal |

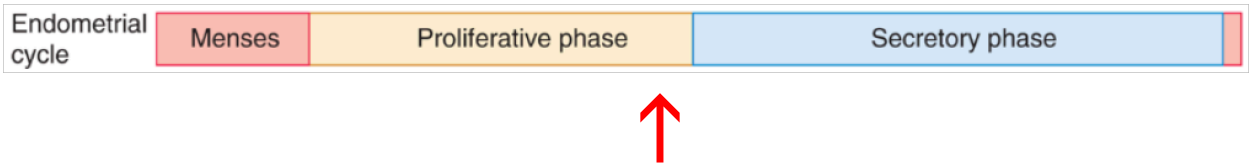
Facial Hair

| | |
|---|---|
| Similar as Normal | More than Normal |

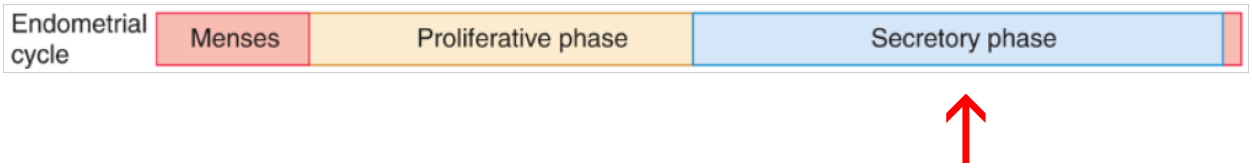
# Exam Key

**2)** In each panel below, indicate when in the menstrual cycle each hormone is in peak (highest) concentration in plasma. ***(2 points each; 10 points total).***

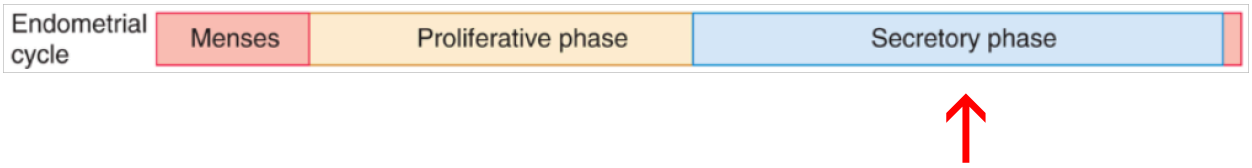
**a)** Estradiol



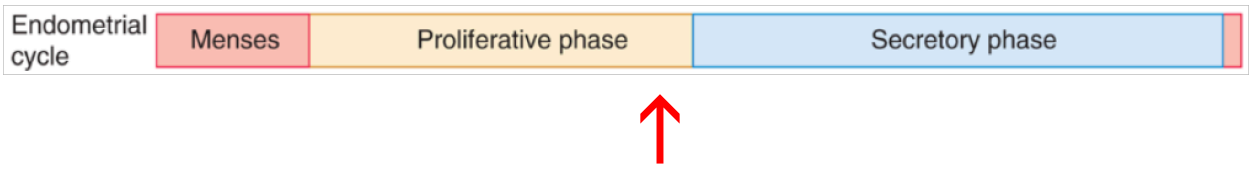

**b)** Progesterone



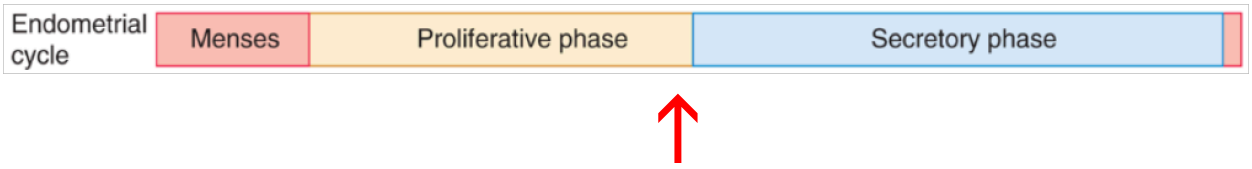

**c)** Inhibin




**d)** LH




**e)** FSH



**3)** A patient has tumor that secretes excessive amounts of parathyroid hormome. What changes in the following physiologic responses would be expected in this patient? ***(2 points each; 8 points total)***

**a)** Q-T Interval of ECG

Shorter than Normal | Normal | Longer than Normal

**b)** Neural Activity

Higher than Normal | Normal | Less than Normal

**c)** Water Loss in Urine

Higher than Normal | Normal | Less than Normal

**d)** Phosphate Reabsorption in Proximal Tubule

Higher than Normal | Normal | Less than Normal

**4)** An individual who has recently moved to high altitude is experiencing lightheadedness and a slow heart rate. When a physician attempted to check their blood pressure, the arm on which the cuff was placed began to spasm. Describe why high altitude exposure resulted in these signs and symptoms. ***(10 points).***

High altitude results in hyperventilation (2 points) and alkalosis (3 points).

Alkalosis reduces $H^+$ bound to albumin, opening binding sites for $Ca^{2+}$ (2 points). This results in hypocalcemia (reduced free calcium). The reduced blood $Ca^{2+}$ results in lightheadedness, slow heart rate, and hyperactive reflexes. (3 points).

**5)** Agonists for glucocorticoid receptors are often used to treat ulcerative colitis. Briefly describe why such drugs are used to treat this condition. ***(10 points).***

Ulcerative colitis is an inflammatory disease, due to immune system actions on the colon. Glucocorticoids reduce immune system actions and inflammatory responses.

**6)** Contraceptives taken by women are typically either a combination of estrogen and progestin or progestin alone. Indicate below the physiologic changes associated with each type of contraceptive. ***(2 points each; 10 points total).***

**a)** Inhibits ovulation

Progestin Only  Estrogen + Progestin  Both Types

**b)** Thickens cervical mucus

Progestin Only  Estrogen + Progestin  Both Types

**c)** Associated with negative side effects such as weight gain, nausea, and mood changes

Progestin Only  Estrogen + Progestin  Both Types

**d)** Lightens menstrual bleeding by keeping the endometrium thin

Progestin Only  Estrogen + Progestin  Both Types

**e)** The contents of most emergency contraceptives such as Plan B

Progestin Only  Estrogen + Progestin

**7)** For each of the following, indicate the most important factor that causes its release. ***(3 points each; 15 points total).***

**a)** Gastrin

Peptides and amino acids in stomach

**b)** Pepsin

Acid in the stomach

**c)** Cholecystokinin

Fats in small intestine

**d)** Bile

CCK (also OK to say fats in small intestine)

**e)** Secretin

Acid in small intestine

**8)** A patient develops a tumor of d-cells in the stomach, which secrete excessive amounts of somatostatin. How would this hormone effect stomach physiology? ***(10 points).***

The somatostatin will inhibit stomach acid secretion, which will result in less pepsin formation (5 points) and poorer digestion of proteins (5 points).

Exam Key

**9)** PITT pharmaceuticals develops a new drug that completely inhibits the COX-1 enzyme, without any effects on the COX-2 enzyme. What would be the beneficial effects of the drug, and what negative side effects would likely occur? ***(9 points).***

It might be used to prevent platelet aggregation in patients at risk of heart attack. (5 points). However, the drug would almost completely abolish stomach mucus secretion, making the patient susceptible for ulcers (4 points).

**10)** A patient develops a tumor that secretes large amounts of glucagon (glucagonoma). How would the tumor affect the following aspects of the patient's physiology? ***(2 points each; 10 points total).***

**a)** Blood Glucose Levels

Lower than Normal | Normal | Higher than Normal

**b)** Body Weight

Lower than Normal | Normal | Higher than Normal

**c)** Prevalence of Ketoacidosis

Lower than Normal | Normal | Higher than Normal

**d)** Urine Volume

Lower than Normal | Normal | Higher than Normal

**e)** Muscle Mass

Lower than Normal | Normal | Higher than Normal