

Answer Key

NROSCI/BIOSC 1070 and MSNBIO 2070

Exam # 4

December 12, 2014

Total POINTS: 100	20% of grade in class
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- 1) A type of drug that is commonly used to treat gastroesophageal reflux disease is also sometimes used in emergency rooms to treat patients with low blood pressure due to anaphylaxis (shock related to an allergic reaction). Briefly describe the mechanism of action of a drug that can be used to treat both conditions. **(5 points)**.

H₂ receptor antagonists are effective in reducing acid secretion by parietal cells in the stomach. In addition, H₂ receptors exist on vascular smooth muscle, and are responsible for mediating the effects of histamine release on vasodilation. Thus, H₂ receptor antagonists will prevent the drop in blood pressure during anaphylaxis.

- 2) A patient undergoes a resection (removal) of a 6-inch segment of the small intestine as part of a treatment for cancer. Would the migrating action potential complex (migrating motor complex) likely be evident in the patient a week following the surgery? Provide a brief explanation for your answer. **(4 points)**.

Resection of the small intestine will damage the enteric nervous system, and will disconnect enteric neurons in the proximal and distal GI tract. Thus, it will be impossible for the enteric nervous system to coordinate a wave of smooth muscle contraction that sweeps from the stomach through the colon.

Answer Key

3) A variety of drugs are available to reduce stomach acid in patients, but all use one of three mechanisms. Describe **three** distinct routes of actions of antacid drugs that are in common use. **(6 points)**.

- 1) Substances that directly neutralize acidity, such as CaCO_3 , MgCO_3 , or NaHCO_3 . Popular drugs in this class include Tums, Peptol-Bismol, and Roloids.
- 2) H_2 receptor blockers, including cimetidine (Tagamet) and ranitidine (Zantac).
- 3) Proton pump blockers, including omeprazole (Prilosec), lansoprazole (Prevacid), and esomeprazole (Nexium).

4) Patients with a stomach ulcer (peptic ulcer) are typically prescribed an antacid, and are told to avoid certain foods and beverages. In addition, they are told to discontinue taking one type of drug. Which drugs are contraindicated in patients with peptic ulcers? **(4 points)**.

NSAIDs that inhibit cyclooxygenase-1 (COX-1) reduce the secretion of stomach mucus, and thus increase the risk of acid damaging the stomach lining.

5) In addition to antacids, many patients with stomach ulcers receive one additional type of medication. What is the most common medication (other than antacids) provided to these patients? **(4 points)**.

Most patients with stomach ulcers are infected with *H. pylori*, which break-down stomach mucus. To effectively treat the disease, it is essential to eliminate the bacteria with an antibiotic such as amoxicillin or tetracycline.

Answer Key

- 6) Some medical conditions can result in metabolic acidosis or alkalosis, although most do not. For the medical conditions listed below, indicate whether a change in blood gas levels will likely result as a consequence of metabolic acidosis or alkalosis. Provide a justification for your answer. **(4 points each; 12 points total).**

Medical Condition	Will the Condition Alter Blood Gases by Producing Metabolic Acidosis or Alkalosis? (Include justification).
<i>Cholecystokinin-Secreting Tumor</i>	Patients with excessive CCK production will also have excessive release of bicarbonate, especially from the pancreas. Since bicarbonate comes from carbonic acid, the residue (H^+) is pumped into the bloodstream. Thus, patients with CCK-secreting tumors will likely have metabolic acidosis.
<i>Gastrin Secreting Tumor</i>	Patients with excessive gastrin secretion will have overproduction of stomach acid. A side product of the generation of stomach acid is bicarbonate, which is released into the bloodstream. Although overproduction of stomach acid will lead to production of more bicarbonate by the pancreas and intestine, it is unlikely that acid and bicarbonate secretion will be balanced. Thus, a mild metabolic alkalosis will likely occur.
<i>Type 1 Diabetes</i>	The absence of insulin leads to the release of free fatty acids from adipose tissue (lipolysis), which are converted in the liver into ketone bodies. Although ketone bodies can substitute for glucose in metabolism, they also acidify the blood. Thus, type-1 diabetics often suffer from metabolic acidosis.

Answer Key

- 7) Following menopause, women are at risk for osteoporosis. Thoroughly explain why osteoporosis is more common in post-menopausal women than women of reproductive age. **(5 points)**.

Estrogen inhibits osteoclast activity and bone resorption. As estrogen levels drop, bone resorption increases, and bones become weaker.

- 8) An individual has been treated with cortisol with several months, and while traveling in a different country is admitted to a hospital. The hospital runs a blood test on the person, without being told about the patient's cortisol treatment. They are surprised that some blood values are abnormal. Indicate two blood values that are likely abnormal in the patient, and briefly justify your answer. **(5 points)**.

Cortisol increases gluconeogenesis, and thus patients taking cortisol may have elevated blood glucose levels.

The number of many white blood cells, including lymphocytes, eosinophils, monocytes, and basophils, decrease in number after administration of glucocorticoids.

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- 9) Parathyroid cancer is relatively common. Discuss the major physiological consequence of parathyroid cancer. **(5 points)**.

Parathyroid cancer usually results in hypercalcemia. Consequences of this condition include osteoporosis, mental disorders (due to changes in synaptic physiology), changes in muscle activity, and kidney stones.

- 10) Men with varicocele have reduced venous drainage from the scrotum. This problem is also associated with male infertility. Briefly describe why varicocele results in male infertility. **(5 points)**.

Variocoele results in elevated testicle temperatures, which has a negative effect on spermiogenesis.

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11) A combination of estrogen and progesterone has been used for decades as a contraceptive for women.

a) Would providing testosterone to a man also serve as a chemical contraceptive? **(5 points)**.

Yes, as it would result in decreased LH and FSH release from the anterior pituitary. As a result, testicular levels of testosterone would be reduced to a level that is inadequate to maintain spermiogenesis.

b) What negative side effect could result from a testosterone contraceptive in males? **(5 points)**.

Studies have shown that high levels of testosterone are needed to block testicular testosterone production. This can result in the side effects of anabolic steroid use, including "roid rage."

c) An effective chemical contraceptive without appreciable side effects has been generated for males. What chemical or chemicals would constitute such a contraceptive? Provide a brief rationale for your answer. **(5 points)**.

A combination of progesterone and testosterone completely blocks FSH and LH secretion by the anterior pituitary. Progesterone does not induce female secondary sexual characteristics, and the testosterone can be maintained at a moderate level.

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- 12) A female is born with a genetic mutation such that the FSH receptor is dysfunctional (will not bind FSH). Would such an individual develop secondary sexual characteristics? Provide an explanation for your answer. **(4 points)**.

No—FSH stimulation is required to induce aromatase, which converts androgen to estrogen. In fact, the female may be masculinized.

- 13) The placenta provides direct nourishment of the fetus, and in addition secretes hormones that are critical for the maintenance of the pregnancy. List **three** hormones that are secreted by the placenta and maintain pregnancy. **(6 points)**.

HCG
Estrogen
Progesterone

Answer Key

- 14)** Medical intervention is sometimes necessary to induce parturition (childbirth). What drug or drugs are used to induce parturition. Provide a brief description of the physiological action of the drug(s) that you indicated. **(5 points)**.

Oxytocin, sometimes in combination with prostaglandins, is used to induce labor. Both cause uterine contractions.

- 15)** Galactagogues are drugs that induce or increase lactation. One such galactagogue is domperidone, a dopamine receptor antagonist that does not cross the blood brain barrier. Briefly describe the mechanism of action of domperidone that serves to increase lactation. **(5 points)**.

Dopamine inhibits the release of prolactin from the anterior pituitary. Thus, dopamine antagonists stimulate prolactin release.

Answer Key

16) Preeclampsia and eclampsia are the most common severe complications of pregnancy. If not managed properly, these conditions can sometimes result in death of the mother.

- a) What is the major indicator of preeclampsia that obstetricians look for during pregnancy? **(3 points)**.

High blood pressure

- b) In general, what is the etiology of preeclampsia (i.e., what “goes wrong” during pregnancy to result in the condition)? **(4 points)**.

The condition starts with a failure to provide adequate blood flow to the placenta. The placenta fails to implant normally into the uterine wall, such that normal pattern of placental blood flow is not established. Hypoxia of the placenta results in the release of a variety of chemical toxins such as tumor necrosis factor- α and interleukin-6, which may result in endothelial cell changes throughout the mother’s circulatory system.

- c) What is the definitive treatment for preeclampsia? **(3 points)**.

The only definitive treatment is removal of the fetus and placenta.