STUDENT NAME: ……..……..

STUDENT NUMBER: ……..

University of Ottawa

ANP 1105A

Midterm #2

Date: November 12, 2009

Duration: 1 hr 20 min

Instructor: Joanna Komorowski

INSTRUCTIONS:

1. **50 questions including:** 48 multiple choice questions (1 mark/1 correct answer per question) plus one comparative question (2 marks) and one labeling question (1 mark). One bonus question = 2marks.

2. Please answer the multiple choice questions on the computer sheet that is provided

3. Please **put your name and student number at the top of this page** and at the top of the last two pages. **Please do not forget to put your course code (ANP 1105A), your surname (last name) and the initials, on the first page of the scantron sheet!!!**

4. Make sure this exam is complete. This exam contains **11 pages.**

5. The excuse of missing a page will not be accepted after the examination.

Good luck!!!!

1. **Select the correct statement(s):**

   A. Most of the calcium used for the cardiac muscle contraction is entering the myocardium from the extracellular space
   B. The endocardium consists of the cardiac muscle cells and the fibrous skeleton of the heart
   C. The cardiac muscle cells and slow twitch skeletal muscle fibres contain a similar number of mitochondria
   D. The AV valves of the heart are supported by chordae tendineae so that the valves do not blow back up into the atria during ventricular contraction
   E. The heart relies almost exclusively on anaerobic energy sources

2. **Which of the following questions is true?**

   A. Cardiac muscle cells are innervated by motor neurons and each motor neuron innervates several muscle fibres
   B. The T-tubules and sarcoplasmic reticulum are identical in skeletal and cardiac muscles
   C. The time needed for a single contraction and relaxation of cardiac muscle is longer than the time required for contraction and relaxation of skeletal muscle
   D. Action potentials generated by skeletal and cardiac muscles are identical

3. **The function of the intercalated discs in cardiac muscle is to:**

   A. provide the mechanism by which all of the cardiac muscle cells can contract as a functional unit
   B. separate sarcomers from each other
   C. generate the appropriate neurotransmitters to regulate heart rate
   D. store ATP

4. **Blood flows from the coronary sinus into the:**

   A. left ventricle
   B. right atrium
   C. inferior vena cava
   D. left atrium

5. **Cardiac muscle cells remain depolarized longer than skeletal muscle fibres because:**

   A. voltage-gated Na+ channels close more quickly to trap more Na+ in the cytosol
   B. cardiac muscle takes longer to reach threshold, and the duration of depolarization is directly proportional to the time it takes to reach threshold
   C. voltage-gated K+ channels open at the same time as Na+ channels, allowing more K+ ions to enter the cardiac muscle cells
   D. Ca++ enters the cardiac muscle cells from the extracellular space to continue contributing positive charges after the influx of Na+ ions has stopped
   E. they are smaller cells, so take longer to repolarize

6. **The left ventricular wall of the heart is thicker than the right ventricular wall so it can:**

A. accommodate a greater volume of blood and pump more blood to the systemic circulation than is coming back from the pulmonary circulation
B. expand the thoracic cage during diastole
C. generate higher pressure needed to overcome the greater resistance imposed by the systemic circulation than that imposed by a pulmonary circulation
D. pump blood through a smaller valve

7. **Deoxygenated blood flows back to the heart through the:**

A. vena cava
B. pulmonary arteries
C. pulmonary veins
D. major coronary vein

8. **If a patient has a stenosis of the bicuspid (mitral) valve, there is a reduced rate of blood flow:**

A. from the left ventricle to the aorta
B. from the left atrium into the left ventricle
C. from the inferior vena cava into the right atrium
D. from the right atrium into the right ventricle
E. from the right ventricle into the pulmonary artery

9. **The fossa ovalis is a remnant of the fetal foramen ovale and is seen in the:**

A. interatrial septum
B. wall of the aorta
C. interventriventricular septum
D. coronary sinus
E. semilunar valves

10. **Choose the correct sequence of current flow through the heart wall:**

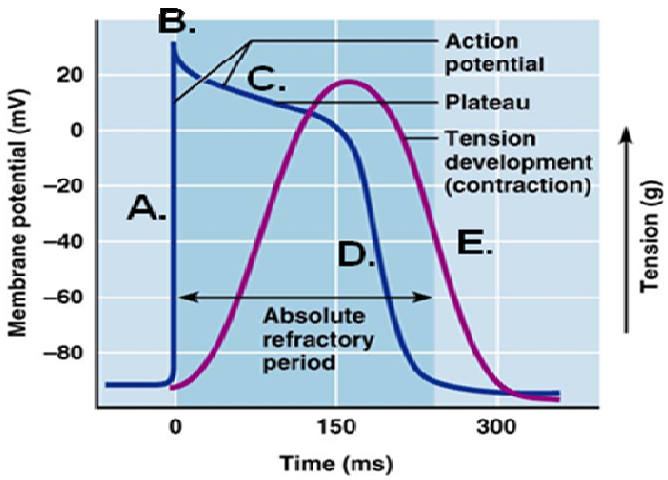
A. SA node, AV node, AV bundle of His, right and left bundle branches, Purkinje fibres
B. AV node, Purkinje fibers, AV node, AV bundle of His, right and left bundle branches
C. AV node, SA node, Purkinje fibers, AV bundle of His, right and left bundle branches
D. SA node, Purkinje fibres, AV node, AV bundle of His, right and left bundle branches

11. **John is admitted to the cardiac unit with a diagnosis of pericarditis. He asks you, the nurse, to explain what the pericardium is. You tell him that the pericardium is:**

A. the outermost muscular layer of the heart
B. the innermost lining of the heart
C. a double-walled membranous sac that encloses the heart
D. the thick muscular layer of the heart that provides pumping action

12. **Which of the following reflects an influx of calcium ions to the cardiac muscle fibres?**

The answer is **C**



13. Which of the following is NOT true?

A. Red blood cells constitute about 45% of the total blood volume
B. Bilirubin is converted to heme in the liver and spleen
C. Protein spectrin helps RBC to be flexible, change shape, and squeeze through narrow capillaries
D. Synthesis of hemoglobin molecules requires presence of vitamin B12 and folic acid (folate)

14. Which is the correct sequence for the following events associated with a vascular injury?

1. fibrinogen →fibrin
2. platelets activation
3. intrinsic & extrinsic pathways → Factor X
4. prothrombin → thrombin
5. vessel spasm initiated by thromboxan A_2 (TXA_2)

A) 5, 2, 3, 4, 1
B) 1, 2, 3, 4
C) 5, 2, 1, 3,4
D) 3, 2, 1, 4
E) 3, 2, 4, 1, 5

15. Blood doping using erythropoietin may lead to:

A) polycythemia
B) increased blood viscosity
C) decreased tissue demand for oxygen
D) both A and B
E) both A and C

16. Which of the following represents thrombocytopenia?

A) Blood platelets number higher than 200,000 in each microliter of blood
B) Blood platelets number higher than 400,000 in each microliter of blood
C) Blood platelets number lower than 100,000 in each microliter of blood
D) Blood platelets number between 150,000-400,000 in each microliter of blood

17. Which of the following may trigger erythropoiesis?

A) Moving from high altitude to low altitude
B) Loss of blood due to blood vessel injury
C) Increased number of RBCs
D) Ample oxygen availability

18. The enzyme that digests clots in our bodies and causes erosion of the clot's fibrous net is called:

A. thrombin
B. heparin
C. urokinase
D. plasmin

19. Place the following in correct developmental sequence:

1. reticulocyte
2. stem cell
3. normoblast
4. late erythroblast

A) 1, 2, 3, 4
B) 2, 1, 3, 4
C) 2, 3, 1, 4
D) 2, 4, 3, 1

20. **The megaloblastic anemia may result from:**

A) insufficient content of iron in the diet
B) insufficient content of vitamin B12 in the diet
C) insufficient content of the folic acid in the diet
D) both B and C
E) all of the above

21. **Lowered ratio of RBC per unit of blood plasma in a long distance runner most probably indicates:**

A. iron deficiency anemia
B. severe dehydration
C. polycythemia
D. sports anemia
E. blood cancer

22. Which of the following statement IS NOT true about blood?

A) Blood has a pH of 7.35 – 7.45
B) Blood has a temperature of 38 C°
C) Blood accounts for approximately 15% of body weight
D) Blood volume may be decreased by dehydration

23. **Thalassemia is a**

A) hereditary blood disorder resulting from deficient production of either α or β globin chains
B) hereditary blood diseasorder occurring in many people from the sub-Saharan Africa
C) hereditary blood disorder resulting from replacement of one amino acid in one of the haemoglobin chains
D) blood disorder resulting from overproduction of red blood cells

24. Which of the following IS NOT true?

A. Von Willenbrandt factor is needed for platelet activation
B. Thrombin is necessary for the formation of the soluble fibrin
C. Females usually have lower RBC count than males
D. Green leafy vegetables are an excellent source of vitamin B12

25. When red blood cells wear out:

A. The iron is excreted from the body as bile pigments
B. the iron is saved and stored in the body
C. the amino acids are saved in the body
D. both A and B are true
E. both B and C are true

26. Which of the following is true about hemophilia?

A. It is associated with sex chromosome X
B. It affects boys only (some exceptions with hemophilia C)
C. It is related to the lack of certain clotting factors
D. Both A and B
E. All of the above

27. Which of the following nutritional deficiencies has been associated with the microcytic anemia?

A. Vitamin K deficiency
B. Iron deficiency
C. Magnesium deficiency
D. Folate deficiency

28. Which of the following statements is true about hormones?

A. The levels of all steroid hormones produced in human body are regulated via a positive feedback system
B. Protein hormones produced by the endocrine glands are usually stored in the vesicles and, when needed, are released to blood via exocytosis
C. Protein hormones are usually transported in blood by specific carrier proteins
D. Insulin is released by the pancreatic B cells in response to dropping blood plasma glucose levels

29. When blood plasma cortisol level rises above the homeostatic requirements, the following will happen:

A. cortisol will cause an inhibition of ACTH production
B. cortisol will cause an inhibition of CRH production
C. cortisol production will decrease in response to decreased production of CRH and ACTH
D. both A and B are correct
E. all of the above are correct

30. Hormones that use a second messenger are usually_____.They bind to the receptors located_____

A. peptides/proteins; on cell membrane
B. peptides/proteins; in cytosol
C. thyroid hormones; in nucleus
D. steroids; in cytosol

31. The primary stimulus for the release of PTH is:

A. elevated blood plasma calcium level
B. low blood plasma calcium level
C. elevated blood glucose level
D. decreased blood glucose level

32. Which of the following is NOT TRUE about hormonal receptors?

A. They become down-regulated by persistently high levels of a specific hormone
B. They become up-regulated by persistently low levels of a specific hormone
C. Steroid hormone-receptor complexes activate gene transcription and lead to production of new enzymes
D. Peptide hormone-receptor complexes activate gene transcription and lead to production of new enzymes

33. The main integration center responsible for the homeostatic balance in the body is:

A. the anterior pituitary
B. the posterior pituitary
C. the hypothalamus
D. the thyroid gland

34. Which of the following statements is TRUE about the negative feedback mechanism?

A) Negative feedback mechanism helps to maintain a dynamic equilibrium within our bodies
B) Negative feedback mechanism usually potentiates (increases) the release of tropic hormones but inhibits the production of the releasing factors
C) Negative feedback mechanism attempts to prevent excessive changes within our bodies
D) Both A and b are correct
E) Both A and C are correct

35. Several hormones act via a mechanism which includes G-proteins. G-proteins_____

A) lead to the conformational change of the receptors
B) are activated when protein or peptide hormones bind to their cellular receptors
C) are activated when steroid hormones bind to their cellular receptors
D) are always stimulatory

36. Which of the following hormones is produced in the hypothalamus but stored in the posterior pituitary?

A. ADH
B. ACTH
C. TSH
D. GH

37. All somatic neurons and all _____release acetylcholine

A) preganglionic neurons of the autonomic nervous system
B) postganglionic neurons of the parasympathetic division of the autonomic nervous system
C) postganglionic neurons of the sympathetic division of the autonomic nervous system
D) both A and B are correct
E) both A and C are correct

38. Which of the following is true about hormones?

A. Thyroid hormones bind to their specific receptors located in the cell nucleus
B. All hormones are soluble in blood plasma and thus easily transported to the cells of destination
C. A small percentage of the steroid hormones travels in blood bound to protein carriers
D. Most protein and peptide hormones are fat soluble and thus can cross a phospholipid bilayer

39. **Which of the following IS NOT a function of the autonomic nervous system?**

A) Innervation of smooth muscle of the digestive tract
B) Innervation of skeletal muscle
C) Innervation of cardiac muscle
D) Innervation of glands

40. _____plays an important role in a "fight-or-flight" response.

A. Insulin
B. Testosterone
C. Norepinephrine
D. Acetylcholine

41. Which of the following hormones is called "a hormone of love"?

A) oxitocin
B) estradiol
C) cortisol
D) testosterone

42. A paracrine stimulation involves binding of a hormone produced by cell X to the receptors located on/in cell Y. The cell Y _____

A) is located at a site distant to cell X
B) can be reached via blood only
C) is adjacent to cell X
D) can be stimulated only if its receptors are on the cell surface

43. Which of the following IS NOT a result of the parasympathetic stimulation?

A. Digestion
B. Increased blood pressure
C. Decreased heart beat
D. Elimination of urine

44. Choose a correct order of the following events:

1. release of the TSH
2. exposure to cold temperature
3. release of the TRH
4. release of thyroid hormones
5.increased metabolism

A) 3, 2, 1, 4 , 5
B) 3, 1, 2, 4, 5
C) 2, 3, 1, 4, 5
D) 5, 4, 3, 2, 1

45. Smooth muscle fibres:

A. all act as pacemakers
B. contain Z discs that anchor the thin contractile proteins
C. are innervated by the autonomic nervous system
D. both A) and B)
E. all of the above

46. Which of the following statements about smooth muscle is TRUE?

E. Contractions are rapid and forceful
F. Branching of smooth muscle fibres is common
G. Contraction of smooth muscle fibres can be voluntary under certain physiological conditions such as during the asthma attack
H. Multiunit smooth muscle fibres of aorta and large airways of the respiratory system are connected by gap junctions and contract simultaneously in response to stimuli
I. Smooth muscle fibres rely mainly on the extracellular calcium for their contraction

47. Smooth muscle fibres_____

A. can stretch up to four times of their length
B. contract or relax depending on the neurotransmitter and/or type of the neurotransmitter receptor
C. have high metabolic demand and rely mainly on carbohydrates for energy production
D. undergo hypertrophy but do not have the ability to divide in response to stimuli

48. Smooth muscle fibre contractions:

A. last longer than contractions of the skeletal muscle
B. can, in some smooth muscle fibres, be stimulated by changes in pH and oxygen level
C. can be spontaneous and caused by self-excitation of some smooth muscle fibres
D. both A and B
E. all of the above

49. **Please compare (in a table form) four differences between the contractile and autorhytmic cells of the heart or functional differences between the cardiac and skeletal muscle cells (0.5 mark per correct comparison; 2 marks total)**

Comparison of the **autorhytmic** (myogenic) and **contractile** heart muscle fibers

Autorhythmic cells:

- 1-2% of muscle cells
- Smaller than the contractile cells; very few myofibrils
- Automaticity- spontaneous depolarization towards threshold
- Responsible for initiating and distributing the stimulus (electrical impulses) to contract
- Initiate action potentials
- ***Have unstable resting potentials called pacemaker potentials***
- **Use Ca^{++} influx** (rather than Na^{+}) for rising phase of the action potential
- Action potentials do not have plateau

Contractile cells:

- 98-99% of muscle cells
- Larger, branching, striated cells with many contractile fibres (actin and myosin)
- Need to be stimulated by the autorhytmic cells to depolarize
- Respond to stimulus (electrical impulses) by contracting
- ***Have stable resting potentials***
- **Use Na^{+} influx** for rising phase of the action potential
- Action potentials have plateau

Functional Differences Between Cardiac & Skeletal Muscle

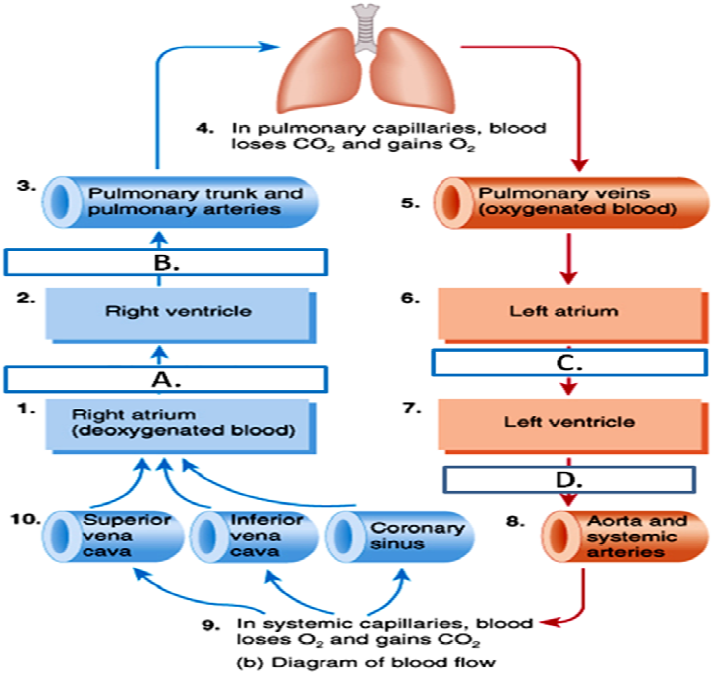
Cardiac

- **involuntary** contractions
- all cells contract at once synchronously (**syncytium**: "all or none")
- resting membrane potential = -85 to -35 mV
- depolarization at +20 mV
- **prolonged action potentials** with plateau (plateau is 200-300 ms)
- **Ca^{2+}** from both intra- and extracellular sources
- **Aerobic** energy sources

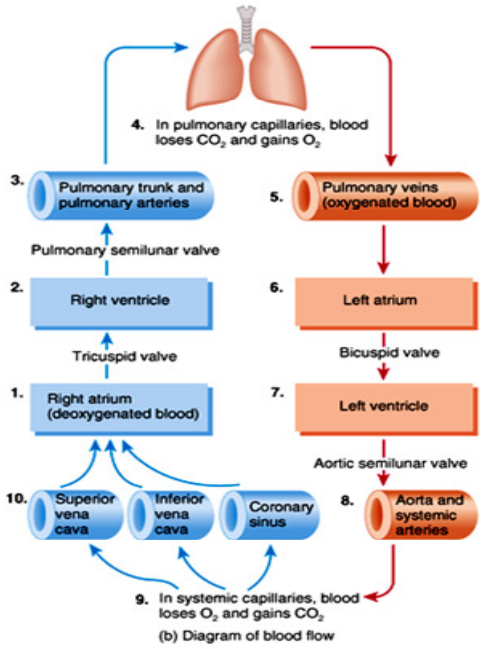
Skeletal

- **voluntary** contractions
- fibers of stimulated **motor unit** contract simultaneously
- resting membrane potential of -70 mV
- depolarization at +35 mV
- **short, spike action potentials** (0.4-2 ms)
- **Ca^{2+}** from the sarcoplasmic reticulum only (intracellular)
- Both **aerobic** and **anaerobic** energy sources (depend on the fiber types)

50. Please label the following valves (A, B, C, D) (1 mark)

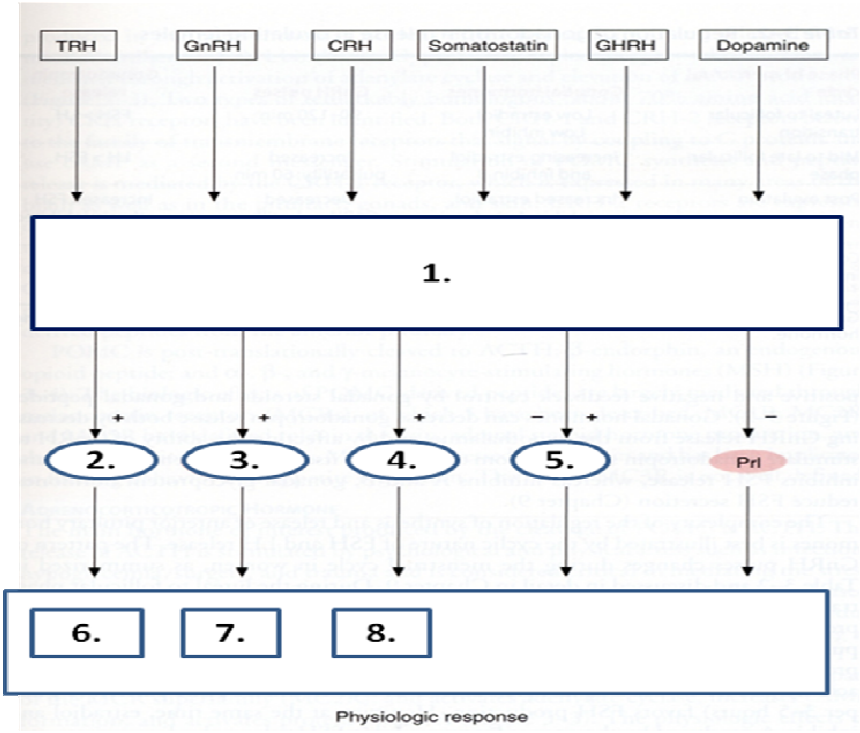


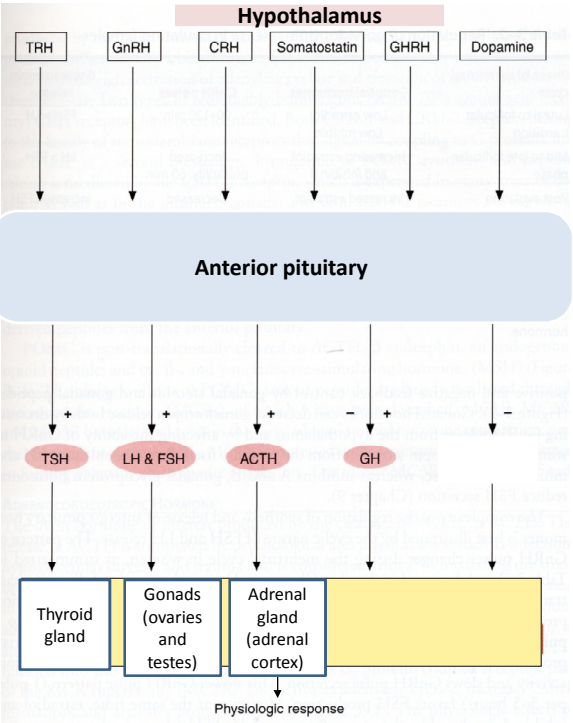
Two side-by-side pumps



BONUS

52. Please label the following endocrine glands (1, 6, 7, 8) and hormones (2, 3, 4, 5). (0.25 mark per label; 2 marks total)





Hypothalamic releasing and inhibiting hormones

Modified after Molina, Endocrine Physiology, McGraw-Hill, 2004