STUDENT NAME: ……..……..

STUDENT NUMBER: ……..

University of Ottawa

ANP 1105C

Midterm #2

Date: November 10, 2009

Duration: 1 hr 20 min

Instructor: Joanna Komorowski

INSTRUCTIONS:

1. **50 questions including:** 49 multiple choice questions (1 mark/1 correct answer per question) plus one comparative question (2 marks). 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 1105), 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. **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 as well as the source of calcium for muscle contraction 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

2. **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

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

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

4. **The bicuspid valve is located between the:**

   A. right ventricle and the aorta
   B. right ventricle and the pulmonary trunk
   C. left atrium and the left ventricle
   D. right and left atria
   E. right and left ventricles

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. **Oxygenated blood flows back to the heart through the:**

A. superior vena cava
B. pulmonary arteries
C. pulmonary veins
D. coronary veins

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

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

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

A. accommodate a greater volume of blood
B. expand the thoracic cage during diastole
C. pump blood against a greater resistance
D. pump blood through a smaller valve

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

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

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. **Jeanne.is admitted to the cardiac unit with a diagnosis of pericarditis. She asks you, the nurse, to explain what the pericardium is. You tell her 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 is true about the autorhythmic cardiac cells?**

A. their action potentials have a plateau
B. their auto-rhythm can be modulated by the autonomic nervous system
C. their depolarization is initiated by the influx of calcium through the leaky channels
D. they have stable resting potentials

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

1. fibrinogen →fibrin
2. release of the Von Willebrandt factor by the endothelium
3. Intrinsic & extrinsic pathways → Factor X
4. prothrombin → thrombin
5. vascular spasm

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

14. **Which of the following is NOT a phase of erythropoiesis?**

A. production of ribosomes
B. mitosis of reticulocytes
C. ejection of the nucleus
D. synthesis of hemoglobin molecules

15. Thrombocytopenia is a condition with:

A) a decreased number of circulating platelets
B) an increased number of red blood cells
C) an increased number of circulating platelets
D) a decreased number of red blood cells

16. Why is blood doping dangerous? Because it:

A) raises oxygen delivery to all tissues to unnaturally high levels
B) increases the blood concentration of white blood cells
C) increases blood viscosity
D) raises the blood concentration of platelets to unnaturally high levels

17. Which of the following may trigger erythropoiesis?

A) Moving from high altitude to low altitude
B) Decreased tissue demand for oxygen
C) Increased number of RBCs
D) Increased tissue demand for oxygen

18. The enzyme that can digest clots and cause erosion of the clot's fibrous net is called:

A. thrombin
B. heparin
C. urokinase
D. streptokinase
E. 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. **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 35C
C) Blood accounts for approximately 8% of body weight
D) Blood volume may be increased in the regularly training endurance athletes

22. **Thalassemia is a** (Both are correct, I included it in my calculations)

A) hereditary blood disorder resulting from deficient production of either α or β globin chains
B) hereditary blood disease common in people living around the Mediterranean sea
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

23. High hematocrit in a person that lived for 3 months in a high mountain settlement, most probably indicates:

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

24. Which of the following IS NOT true?

A. Von Willenbrandt factor is needed for prevention of the excessive clotting
B. Thrombin is necessary for the formation of the insoluble fibrin
C. Plasmin is needed for the lysis and liquidation of blood clot
D. Thromboxane (TXA_2) is needed for the initiation of vasoconstriction of injured blood vessel

25. 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

26. When red blood cells wear out:

A. the iron is excreted from the body as bile pigments
B. the iron is saved 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

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

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

28. How long do erythrocytes normally stay in the circulation?

A. About 120 days
B. About 60 days
C. About 10 days
D. About one year
E. About only a few hours

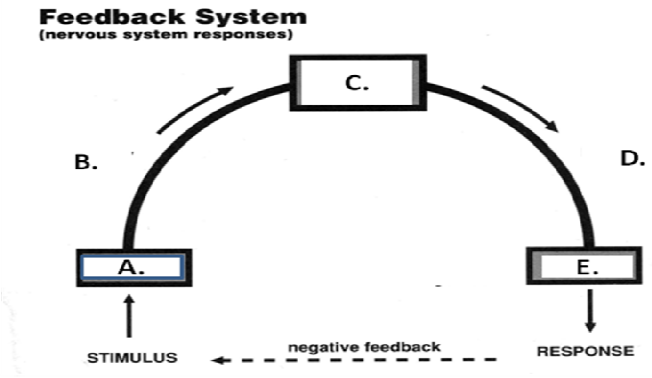
29. Hormones that use a second messenger are usually_____.They bind to the receptors located_____

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

30. **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

31. **Which of the following represents the motor neuron? Answer D**



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. Peptide hormone-receptor complexes activate gene transcription and lead to production of new enzymes
D. Steroid hormone-receptor complexes activate gene transcription and lead to production of new enzymes

33. 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

34. 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

35. 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

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

A. ADH
B. ACTH
C. LH
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. Only free hormones (not associated with carrier proteins) can bind to cellular receptors and act on target tissues
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. Preparing the body for a "fight-or-flight" response is the role of the:

A. parasympathetic nervous system
B. cerebrum
C. sympathetic nervous system
D. somatic nervous system

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

A) testosteron
B) estrogen
C) cortisol
D) oxitocin

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

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

43. Which of the following hormones is/are produced by the hypothalamus?

A) GHRH
B) TSH
C) FSH
D) ACTH

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

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

45. 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

46. Smooth muscle is characterized by all of the following EXCEPT:

A. there are no T-tubules
B. It lacks troponin
C. there are non-contractile intermediate filaments that attach to dense bodies
D. It uses mainly intracellular calcium for muscle contraction
E. there are no sarcomeres

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

A. Contractions are rapid and forceful
B. Sheets of the single unit smooth muscle fibres of most of the hollow organs contract simultaneously in response to stimuli
C. Branching of smooth muscle fibres is common
D. Smooth muscle is striated and contracts involuntarily
E. Multiunit smooth muscle fibres of aorta and large airways of the respiratory system contract simultaneously in response to stimuli

48. Which of the following is true about smooth muscle fibres?

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

49. 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

50. Please compare (in a table form) five characteristics that differ between the skeletal and smooth muscle fibres or between the skeletal and cardiac muscle fibres (0.4 mark per correct comparison; 2 marks total)

For the answers check the comparative tables in the chapter on muscles and in my slides.

Anatomical Differences Between Cardiac and Skeletal Muscle

Cardiac

- shorter cells connected by ***intercalated discs*** and ***gap junctions***
- Only one or two centrally located nuclei
- T-tubules 5x greater in size than in skeletal muscle (only 1 T-tubule per sacromere)
- poorly developed sarcoplasmic reticulum
- lots of mitochondria (40% of the cytoplasmic volume)
- special electrical conduction system

Skeletal

- elongated cells
- ***myotendinous junctions***
- Lots of nuclei
- T-tubules smaller but 2 per sacromere
- well developed sarcoplasmic reticulum holding lots of Ca^{2+}
- Mitochondria, only 2%-6% of cytoplasm volume
- motorneurons

Functional Differences Between Cardiac & Skeletal Muscle

Cardiac

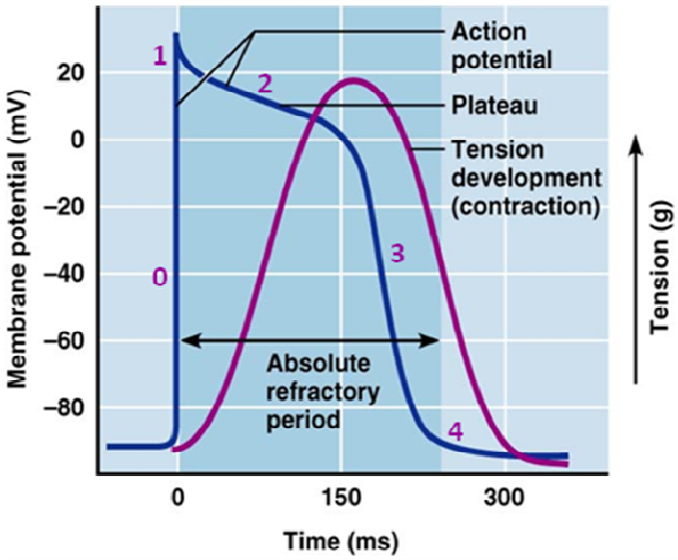
- **involuntary** contractions
- all cells contract at once synchronously (**syncytium**: "all or none")
- resting membrane potential = -85 to -35 mV
- depolarization at +20 mV
- **prolonged action potentials** with plateau (plateau is 200-300 ms)
- **Ca^{2+}** from both intra- and extracellular sources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

BONUS

51. Please write down which of the channels are open or opening and which ones are closed or closing during each of the phases (0, 1, 2, 3, 4)(0.4 mark each label; total = 2marks)



Mechanism of Contraction - Cardiac Muscle Cells

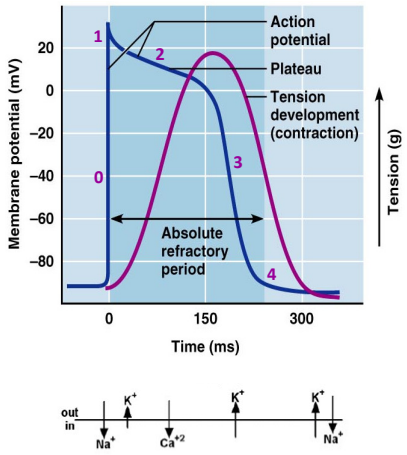
Phase 0 - rapid upstroke (fast depolarization; overshoots 0); brief opening of *voltage-gated* **fast Na^+** »» Na^+ rushes **in**

Phase 1 - dip; ***Na^+ channels close,*** a few channels permeable to K^+; K^+ starts moving out

Phase 2 - **plateau**; membrane steady at ~0mV [***Ca^{++} influx via slow channels*****)** ~= K^+ channels open, K^+ out]

Phase 3 - **repolarization** (permeability to Ca^{++} declines, ***closing of Ca^{++} channels***; K^+ permeability increases and K^+ continues out to repolarize membrane

Phase 4 - **resting** (***Ca^{++} pumped back into SR***; K^+ permeability decreases, **K+ gates close**)



Absolute refractory period: about 250 msec while K^+ leaves cells; prevents tetanic contractions & allows heart to function as a pump