University of Guelph
Department of Animal & Poultry Science
ANSC *2340 Structure and Function of Farm Animals
Winter, 2009
Second Midterm Examination: March 10, 2009

Name (PRINT): _____

Student Number: _____

Lab section (day of week and time): _____

This examination has a total of 100 possible marks and is worth 25% of the final grade for the course.
Please enter your name and ID number on both this examination paper and the computer card. Both must be handed in after the exam has been completed.

There are 2 sections to this exam.

Section 1 of the exam includes 35 multiple choice questions that are each worth 2.0 marks for a total of 70 marks. You must answer multiple choice questions 1 to 35 to qualify for full marks.

Section 2 of the exam includes Section 2 a (10 short answer questions worth 30 marks in all that can be answered using anywhere from several words up to a few sentences) and Section 2 b (15 additional multiple choice questions worth 30 marks in all). Please fully complete Section 2 a to qualify for full marks or complete Section 2 b to qualify for full marks.
DO NOT COMPLETE BOTH PARTS OF SECTION 2

You will have up to 1 hour and 20 minutes to complete this exam.

1) Which of the following best describes organization of the neuron?
a) The dendrite conducts impulses from the soma to another neuron or cell.
b) The axons are extensively branched in most cases to aid information transfer to the soma.
c) Schwann cells refer to gaps between adjacent glial cells.
d) Myelin sheaths help speed up transfer of impulses in afferent nerves to tissues (muscles and organs).
e) Myelin sheaths help speed up transfer of impulses in efferent nerves to tissues (muscles and organs).

2) What happens when neurons get excited?
a) Results in membrane depolarization, which differs from depolarization of the muscle fiber membrane.
b) Results in potassium leaving the cell after sodium influx to follow a concentration gradient and the electrical charge outside the cell.
c) Requires the action of the Na/K pump during depolarization and repolarization.
d) Results in generation of an action potential during repolarization of the membrane.
e) Results in sodium leaving the cell during repolarization via passive diffusion to follow a concentration gradient.

3) Synaptic transmission involves:
a) Na/K pump for active transport of the neurotransmitter across the synaptic cleft.
b) A chemical transmitter or direct contact between the nerve and a target tissue.
c) Chloride and calcium ions on the postsynaptic membrane for inhibitory neurotransmitters.
d) A requirement for influx of calcium into the presynaptic knob for neurotransmitter release.
e) Epinephrine as both an excitatory or inhibitory neurotransmitter.

4) Which of the following is true about the Autonomic Nervous System?
a) Is completely controlled by the Central Nervous System.
b) Involves skeletal, cardiac, and smooth muscles.
c) Is responsible for regulation of many body functions without CNS control.
d) Includes the Parasympathetic Nervous System which originates from the thoracic and lumbar regions of the spinal cord.
e) Includes the Sympathetic Nervous System which originates from the brain and sacral regions of the spinal cord.

5) What are some of the similarities and differences between nerves and muscles?
a) While nerves require a threshold stimulus to fire, a subliminal stimulus will cause a muscle to contract.
b) The all of none principal refers to firing of a nerve but not to contraction of a muscle.
c) The absolute refractory period refers to when a larger than normal stimuli will enable a second depolarization to develop in a nerve or muscle.
d) While nerves must follow the all or none principle, not all muscle fibers in a muscle need to contract when a single motor unit is stimulated.
e) While muscles require a threshold stimulus to fire, a subthreshold stimulus will cause a nerve to contract.

6) Which of the following is true about the Parasympathetic Nervous System?
a) Is responsible for helping the body deal with emergency situations.
b) Increases heart rate to pump more oxygen and dilates arteries to increase blood flow.
c) Decreases activity of the gastrointestinal tract.
d) Reduces blood flow to the skin and kidney.
e) Works to restore the body to normal.

7) Which of the following accurately describes muscle characteristics or actions of muscles?
a) The biceps brachii acts to extend the elbow.
b) A possible role as an synergist to stabilize joints when another muscle contracts.
c) An abductor muscle will pull the limb away from the median plane.
d) The insertion refers to the muscle attachment that doesn't move with muscle contraction.
e) A flexor acts to straighten out a joint.

8) Which of the following best describes white fibers?
a) Have large numbers of cytochromes.
b) Tend to be slow twitch.
c) Have high amounts of glycogen used only for aerobic metabolism.
d) Have high phosphorylase activity.
e) Have high myoglobin concentrations.

9) Rank in order from longest to shortest sarcomere length for conditions of the whole muscle live or postmortem
a) Resting, stretched, cold shortened, contracted, thaw rigor.
b) Stretched, resting, cold shortened, contracted, thaw rigor.
c) Resting, stretched, only a few muscle fibers contracting, thaw rigor, cold shortened.
d) Stretched, resting, contracted, cold shortened, thaw rigor.
e) Resting, stretched, contracted, cold shortened, thaw rigor.

10) Other characteristics of muscle include:
a) Fat droplets present in the sarcoplasm of white fibers.
b) Large numbers of mitochondria in white fibers.
c) The presence of epimysium surrounding individual muscle fibers.
d) Function as either a primer mover or antagonist but not both.
e) The presence of lysosomes in the sarcoplasm of red and white fibers.

11) Which of the following best describes organization of the muscle?
a) Order of organization includes fasiculi, myofibers, myofibrils, myofilaments
b) Order of connective tissue organization includes endomysium, epimysium, perimysium.
c) Myofilament with full A band and 2 half I bands.
d) Light meromyosin consisting of the two myosin heads.
e) F actin polymerized into G actin.

12) How do injections of Bo tox affect the muscle contraction process?
a) Acts to stimulate the break down of acetyl choline.
b) Causes paralysis by blocking receptors on the sarcolemma.
c) Stimulates muscle contraction by blocking break down of acetyl cholinesterase.
d) Causes paralysis by blocking release of acetyl choline from the end of the nerve fiber.
e) Causes paralysis by blocking break down of acetyl cholinesterase.

13) During muscle contraction:
a) Length of the A band changes with strength of contraction.
b) Involves the action of the 4 myofibrillar proteins, meromyosin, G Actin, troponin, and tropomyosin.
c) The thin filaments slide between the thick filaments.
d) The actin filaments are pulled away from the center of the sarcomere.
e) The I band becomes shorter.

14) Which of the following occurs before muscle contraction can begin?
a) The action potential must travel down the sarcoplasmic reticulum into the T tubules to stimulate release of Ca^{+2}.
b) Epinephrine depolarizes the sarcolemma which causes the membrane potential to increase.
c) The sarcoplasmic reticulum must detect Ca^{+2} in the sarcoplasm before it will be stimulated to release stored Ca^{+2}.
d) Troponin-T binds Ca^{+2} which results in a configurational change in tropomyosin.
e) The ryanodine receptor releases Ca^{+2} from the T-tubules.

15) Which of the following occurs during muscle contraction?
a) Troponin-T undergoes a configurational change that enables Troponin C to bind Ca+2 before muscle contraction can begin.
b) Tropomyosin moves to uncover the active sites on actin so that myosin can attach.
c) Troponin-I binds Ca^{+2} before muscle contraction can begin.
d) Actin changes position to enable movement of tropomyosin.
e) Troponin-C binds Mg^{+2} before muscle contraction can begin.

16) In the contraction process:
a) Stimulation of myosin head ATPase activity is the only activity resulting from the release of Ca^{+2} from the sarcoplasmic reticulum.
b) Acetyl choline depolarizes the sarcolemma which decreases the membrane potential.
c) Troponin-I must bind Ca^{+2} before muscle contraction can begin.
d) Myosin heads will tilt towards the Z line when they pull actin
e) Filament sliding will be accompanied by sarcomere shortening.

17) Which of the following is required for muscle relaxation?
a) Calsequestrin stores Ca^{+2} in the T tubules.
b) Ca^{+2} flows down a concentration gradient for storage into the sarcoplasmic reticulum.
c) Repolarization of the sarcolemma.
d) Action of anticholinesterase at the myoneural junction.
e) Breakdown of the troponin T- Ca^{+2} complex.

18) How does fused tetany compare to incomplete tetany?
a) The frequency of stimulation is lower in fused versus incomplete tetany.
b) Ca^{+2} is being provided at one level for fused tetany and two levels for incomplete tetany.
c) Partial relaxation occurs between stimuli in fused tetany while no relaxation occurs in incomplete tetany.
d) Ca^{+2} levels remain above the threshold for muscle contraction with fused tetany.
e) Incomplete tetany initially involves a stair step effect for increases in force generated.

19) What happens with a treppe contraction?
a) It is an extension of unfused tetanus.
b) Due to failure of the T tubules to sequester Ca^{+2}.
c) See a stair step effect for increases in force generated from increasing the strength of the stimulus.
d) Due to increased binding of Ca^{+2} by Troponin-T.
e) Relaxation will occur between stimuli.

20) Which of the following is correct regarding muscle tone or muscle fatigue?
a) Continuous impulses from the spinal cord are responsible for muscle tone.
b) There is no muscle tension at rest as part of the survival strategy for animals in the wild.
c) Adequate ATP levels are the only requirement to maintain muscle contraction.
d) Development of fatigue is a major factor impacting nerve impulses or action potentials.
e) Development of fatigue is not affected by calcium supplies.

21) What are the predominant sources of energy for ATP generation?
a) Anaerobic metabolism of carbohydrates, amino acids, and free fatty acids.
b) Free fatty acids in the fed state.
c) Aerobic metabolism of carbohydrates, amino acids, and free fatty acids.
d) Glycogen as a back-up source only in the fed state for both aerobic and anaerobic metabolism.
e) Free fatty acids as a back-up source in the fasted state.

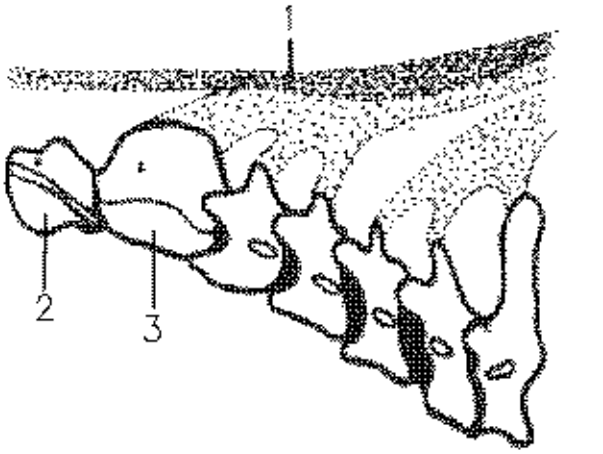
22) How does exsanguination affect muscle cell function?
a) Immediately stops muscle function due to effects on the nervous system.
b) Forces lactic acid to remain in the muscle fiber cell with resultant increases in pH.
c) Increases activity of fast twitch fibers.
d) Increases activity of slow twitch fibers.
e) Immediately eliminates the use of creatine kinase to replenish ATP supplies.

23) How should you chill the carcass after slaughter?
a) Keep the carcass is the same cooler for 48 hours using high air speed and high humidity.
b) Chill at low air speed and humidity for the first 24 hours in one cooler and then move the carcass to another chill cooler with high air speed and high humidity.
c) Chill mammalian and avian carcasses with a high air speed and humidity for the first 24 hours after slaughter with the same conditions used in a second cooler.
d) Use cooler conditions to maximize evaporative losses for the 48 hours of chilling.
e) Chilling with a high air speed and humidity for the first 24 hours after slaughter followed by chilling in another cooler at low air speed and humidity.

24) Which of the following is true regarding stunning?
a) All red meat species (beef, pork, lamb) are usually stunned using captive bolt
b) Electrical stunning renders an animal unconscious by causing a concussion.
c) Stunning always kills the animal.
d) Pigs are usually stunned using electrical or carbon dioxide stunning.
e) Stunning of cattle is usually performed by electrical stunning in North America.

25) Which of the following statements best describes development of PSE pork?
a) Results in protein denaturation due to low carcass temperatures and rapid pH decline.
b) Can be caused by similar genetics that can produce DFD pork.
c) Only occurs when 1 hour pH values drop below 6.0.
d) Usually occurs in pigs that tend to strongly retain Ca^{+2} in the sarcoplasmic reticulum.
e) Ultimate pH values for PSE pork will never be similar to pH values for normal pork.

26) Which of the following best describes Porcine Stress Syndrome?
a) Can produce acidosis in the live pig.
b) Only produces PSE pork.
c) Can produce hypothermia in both the live animal and the carcass after death of the pig.
d) Is due to a single nucleotide being replaced in the dihydropyridine receptor of the T tubule.
e) Is due to an autosomal, dominant gene which can be detected within minutes by exposing pigs to an anesthetic.



27) Identify these structures:
a) 1 = ligamentum nuchae, 2 = atlas cervical vertebrate, 3 = axis cervical vertebrate.
b) 1 = cutaneous muscle, 2 = axis cervical vertebrate, 3 = atlas cervical vertebrate.
c) 1 = ligamentum nuchae, 2 = atlas thoracic vertebrate, 3 = axis thoracic vertebrate.
d) 1 = cutaneous muscle, 2 = axis thoracic vertebrate, 3 = atlas thoracic vertebrate.
e) 1 = ligamentum nuchae, 2 = axis cervical vertebrate, 3 = atlas cervical vertebrate.

28) Which of the following statements is true about rigor?
a) Elasticity of the muscle will increase as the muscle develops full rigor.
b) Sarcomere length and muscle tension will increase as the muscle develops full rigor.
c) Sarcomere length will decrease while permanent crossbridges will increase as the muscle develops full rigor.
d) Muscle tension and permanent crossbridges will decrease as the muscle develops full rigor.
e) ATP levels will increase while sarcomere length will decrease as the muscle develops full rigor.

29) Which of the following relationships is true?
a) Ultimate pH is positively related to glycogen levels in the muscle.
b) Muscle extensibility is positively related to increasing time post mortem.
c) Ultimate pH is negatively related to lactate levels in the muscle.
d) Overlap between thick and thin filaments is negatively related to increasing time post mortem.
e) Muscle elasticity is positively related to increasing time post mortem.
For the above question, for a) positively related means that if ultimate pH is high, then glycogen levels in muscle are high.

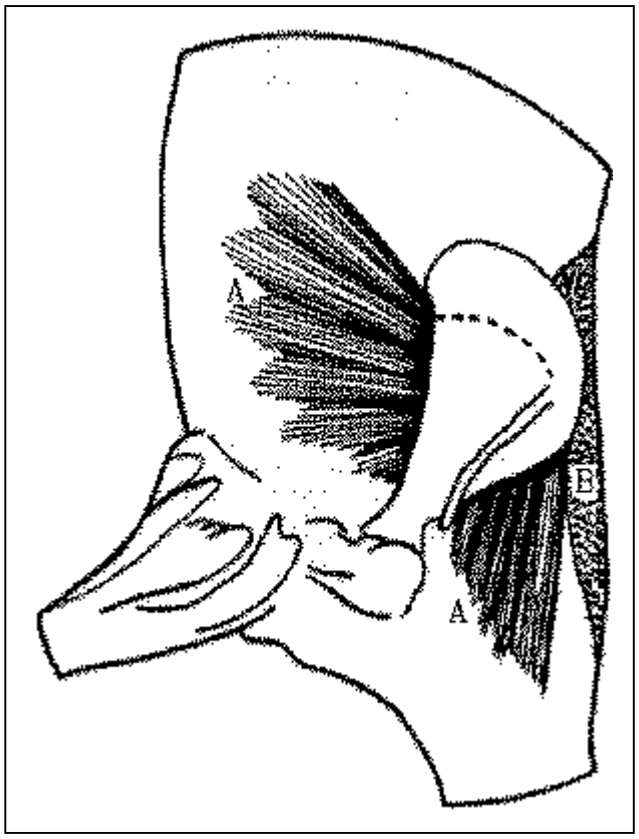
30) Which of the following is true about cold shortening?
a) Decreases sarcomere length to a greater extent than thaw rigor.
b) Is more of a problem in pork and poultry than in lamb or beef.
c) May be prevented if adequate fat cover is present on the carcass.
d) Is more of a problem in muscles that predominantly contain white fibers.
e) Occurs only due to a sudden release of Ca^{+2} from the T tubules.

31) Identify the true statement about electrical stimulation of the carcass:
a) Enhances the activity of lysosomal enzymes, the enzymes responsible for improvements in tenderness with postmortem ageing of the carcass or muscle cuts.
b) Is commonly used on meat from all red meat species (pork, beef, veal, lamb).
c) Accelerates development of rigor mortis.
d) Increases epinephrine release at the neuromuscular junction..
e) Only uses high voltage if electrically stimulating right after sticking.

32) Which of the following parasites can be found in pork and requires freezing or thorough cooking by humans to prevent infection?
a) Taenia saginata.
b) Echinococcus granulosus.
c) Trichinella spiralis.
d) Fasciola hepatica.
e) Taenia solium.

33) Which of the following is a proper procedure used in the dressing of a carcass?
a) Removal of the leaf lard before carcass weighing in pigs.
b) Use of fisting in cattle.
c) Head and feet removal prior to evisceration of chickens.
d) Removal of the kidneys before carcass weighing in sheep.
e) Removal of the oil glands from pigs.

34) Which of the following is true regarding the nervous system?
a) In saltatory conduction, unmyelinated nerve fibers help speed up transfer of the nerve impulse.
b) The movement of Na^{+1} ions out of the postsynaptic membrane and the movement of Cl^{-1} enzymes into the postsynaptic membrane are responsible for hyperpolarization.
c) Interneurons are not involved in a simple reflex.
d) A postsynaptic neuron will only have one type of presynaptic neuron across the synaptic cleft.
e) An increased number of dopamine neurons is responsible for the symptoms found in Parkinson's disease.



35) Identify muscles A, B, and the muscle immediately **DORSAL** to muscle B (not shown).
a) A = serratus ventralis, B = trapezius, **DORSAL** = rhomboideus.
b) A = serratus ventralis, B =rhomboideus, **DORSAL** = trapezius
c) A = latissimus dorsi, B = trapezius, **DORSAL** = rhomboideus.
d) A = latissimus dorsi, B =rhomboideus, **DORSAL** = trapezius.
e) None of the above

Part 2 : You have the choice of doing Part 2 a (10 short answer questions worth 30 marks) or Part 2 b (15 additional multiple choice questions worth 30 marks). Complete either Part 2 a or Part 2 b.

DO NOT COMPLETE BOTH PARTS OF SECTION 2

Short answer questions for Exam A. Please answer each question using anywhere from a few words up to a few sentences.

1) In order, name the bones of the bovine forelimb starting distal to the body (starting at the hoof) (you need to mention the 2 bones in the forearm but don't worry about their order between the 2 of them); so if they were the tibia and fibula, you can have them:
   Bone X, tibia, fibula, Bone Y or Bone X, fibula, tibia, Bone Y
   (4 marks).

2) Name 5 processes involving muscle contraction and relaxation where ATP is required. (4 marks)

3) If a rabbit is frightened by a predator, a) which nervous system kicks in and b) how and why are arterioles affected ? (3 marks)

4) What is saltatory conduction and why is it important ? (3 marks)

5) A twitch includes 3 phases. Name the phases and the role of Ca^{+2} in each of the phases. (4 marks)

6) Define dressing percentage and how it will be affected if Animal A was without feed for 24 hours before slaughter while Animal B had a full belly 2 hours before slaughter (Animal A and B both weigh 600 kg). (3 marks)

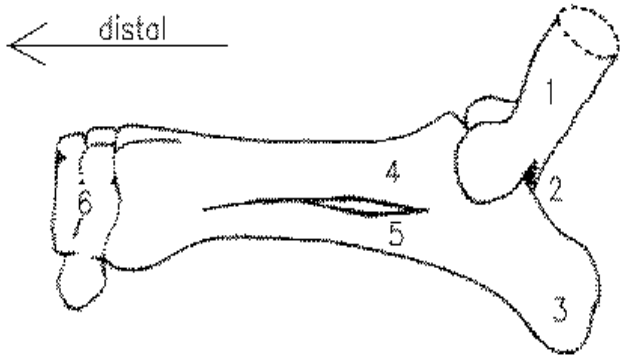
7) How does curare affect the muscle contraction process (be specific about the actions of the curare)? (3 marks)

8) In milk fever, what is the direct cause (be very specific) at the cellular level for the extreme weakness of muscle and loss of muscle tone. (1.5 marks)

9) What is the fate(s) of lactic acid produced in the living animal and how does that change with death? (3 marks)

10) List 3 structures found in the plucks (1.5 marks)

Section 2 b . Answer the multiple choice questions 37 to 51 if you have not completed the short answer questions.



37) Which bones of the forelimb are missing in the above diagram?
- a) Ulna.
- b) Scapula.
- c) Carpal bones.
- d) Humerus.
- e) Radius.

38) If we examine bones distal to bone(s) 6 in the above diagram,
- a) These bones are removed in the routine dressing of a pig.
- b) For the bones that form the joint with bone(s) 6, there are 4 in ruminants and two in pigs.
- c) The break joint in lamb carcasses is exposed when one removes the bones immediately distal to bone(s) 6.
- d) The space between bones 4 and 5 is the site of the Achilles tendon which is used to hang red meat carcasses (beef, veal, lamb, pork).
- e) The bones immediately distal to bone(s) 6 are fused in ruminants.

39) In dressing the carcass:
- a) The process of tying off the esophaghus is also known as bunging.
- b) The attempt is made to remove as much blood as possible for decreasing microbial growth, improving appearance, and increasing shelf life.
- c) The diaphragm muscle separates the thoracic and abdominal cavities in mammalian and avian carcasses.
- d) Cuts are made on the lateral face of the limbs to minimize loss of the pelt (lambs) and facilitate removal of the hide (beef).
- e) With the exception of subcutaneous fat, the skin is usually removed from the red meat species (cattle, sheep, pigs) during carcass dressing.

40) Pick out the organ (edible or inedible) that is incorrectly defined (or described):

a) The thymus is known as the sweetbreads.
b) The hanging tender is thick diaphragm muscle.
c) The plucks include the liver and the lungs.
d) Reticulum is processed into tripe.
e) None of the above are incorrectly defined (or described).

41) Which of the following is true regarding the nervous system?
a) Schwann cells are found outside the brain and spinal cord, and are glial cells that surround the dendrites.
b) The generation of an action potential is due to the membrane potential in a axon or muscle fiber becoming more negative than the resting membrane potential.
c) The presence of the myelin sheath prevents flow of Na^{+1} ions so the depolarization wave in myelinated axons travels from node to node.
d) A large enough stimulus during early Na^{+1} ion influx (relative refractory period) will enable a second depolarization to occur.
e) Large amounts of ATP are needed for the active transport of neurotransmitters across the synaptic cleft.

42) When providing energy for muscle fiber cells,
a) Intermediate fibers would require energy sources primarily geared for aerobic metabolism.
b) High succinate dehydrogenase activity would be indicative of fibers that primarily use anaerobic metabolism.
c) Pumping Ca^{+2} ions into the sarcoplasmic reticulum is one of the energy requirements for muscle contraction.
d) High ATPase activity would be indicative of fibers that primarily use anaerobic metabolism.
e) Creatinine is directly formed when creatine kinase converts ADP and phosphocreatine to ATP.

43) How does isotonic contraction differ from isometric contraction?
a) In isotonic contraction, there is minimal changes in length of muscle with contraction.
b) Lifting a weight is an example of isometric contraction.
c) In isometric contraction, there is constant tension in the muscle with contraction.
d) Muscle contractions related to posture is an example of isotonic contraction.
e) Isotonic contractions are found with locomotion in animals.

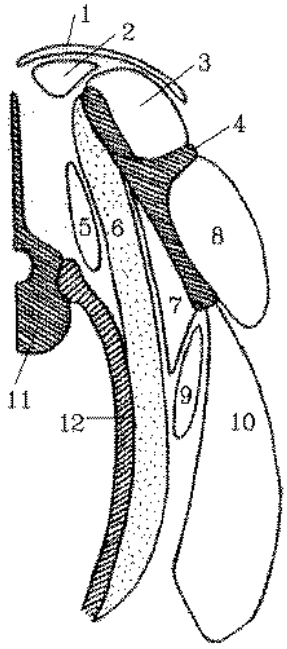
44) Which of the following does not contribute to the higher dressing percentage for pork versus beef?
a) Metacarpals
b) Head.
c) Tail.
d) Heart
e) Feet

45) Which of the following is true regarding the acidification process in muscle?

a) Once all ATP is used up, the muscle can't relax due to the inability to pump Ca^{+2} ions into the sarcoplasmic reticulum.
b) High rates of acidification are found in the production of DFD meat.
c) Rates of acidification are similar amongst species.
d) Postmortem, the acidification process ensures that all glycogen in the muscle fiber cell is used up completely for lactic acid production under all circumstances.
e) There will be no difference in effects of acidification whether the animal is alive or dead.

46) How does preslaughter management and handling affect stress in animals?

a) Long transit times can dramatically increase stress for animals marketed for slaughter.
b) In the process of marketing pigs for slaughter, the transport process is the factor first responsible for creating stress; next is handling at the packing plant.
c) Development of stress decreases muscle contraction and requirements for nutrients and O_2.
d) Whatever you do to animals, glycogen levels will not be depleted in stress resistant animals.
e) Mixing animals on a truck will have no impact on development of stress while mixing of animals during lairage will.



47) Name the major muscle that is primarily responsible for holding the forelimb onto the body.

a) Subscapularis.
b) Lattisimus dorsi
c) Serratus ventralis
d) Supraspinatus
e) Triceps brachii.

48) Where is the muscle primarily responsible for holding the forelimb onto the body located on the diagram to the left?

a) Muscle 10.
b) Muscle 8.
c) Muscle 7
d) Muscle 6
e) Muscle 9

49) Name the muscle dorsal to the ridge or spine of the scapula

a) Muscle 8 = supraspinatus.
b) Muscle 8 = infraspinatus.
c) Muscle 3 = supraspinatus.
d) Muscle 7 = supraspinatus.
e) Muscle 3 = infraspinatus.

50) Which of the following is true about the diagram?

a) Muscles 3 and 8 are located on the medial face of the scapula.
b) Muscle 10 is the biceps brachii.
c) Muscle 5 is the latissimus dorsi.
d) Muscle 7 is the serratus ventralis.
e) Muscle 9 is the latissimus dorsi.

51) The anatomy of the forequarter skeleton includes:
   a) The axis as the first cervical vertebra while the atlas is the second cervical vertebra.
   b) The neural spine of the vertebra as another name for the ventral spine.
   c) Sternal ribs referring to the ribs that connect to the sternum via costal cartilage.
   d) The scapula not being directly fused to the vertebral column.
   e) Humerus articulating with the olecranon process of the scapula.

END OF SECOND MIDTERM