CHAPTER 2 • Tissue Types and Functions

Answers to Review Questions

1. Define any 10 of the following terms:

tissue—**a collection of cells organized for a particular function**

organs—**collections of tissue** displaced abomasum—**a condition commonly called a twisted stomach in which the fourth stomach of a cow fills with gas and is pulled upward; displaced abomasums commonly occur shortly after calving**

foot-and-mouth disease—**highly infectious viral disease that selectively attacks epithelial tissue in cloven-hoofed animals**

epithelial tissues—**a collection of cells that line the body's surface and openings**

basement membrane—**collection of fibers that tie the epithelial layer to the underlying membrane**

integument—**skin**

keratin—**specialized protein deposited in cells giving a typical hardness and durability**

tendons—**connective tissue that attaches muscles to bones**

ligaments—**connective tissue that attaches bones to bones**

adipose tissue—**fat**

myofiber—**muscle cell**

porcine stress syndrome—s**wine condition in which calcium leaks from the endoplasmic reticulum, causing pigs to shake involuntarily**

rigor mortis—**muscle stiffness occurring after death**

hypocalcemia—**a condition commonly referred to as milk fever caused by low blood calcium occurring at parturition**

sweeny—**nerve damage and resultant shoulder muscle shrinkage occurring in draft horses from pulling harnesses**

central nervous system—**brain and spinal column**

peripheral nervous system—**all nerves outside the brain and spinal column**

neurons—**nerve cells**

tying up, or Monday-morning disease—**cramping, with potential muscle damage in working horses that occurs the Monday after a weekend of rest and full feed**

Horner's syndrome—**nerve damage that causes several eye malfunctions including pupil constriction, eyelid drooping, protrusion of the third eyelid, and sunken eyes**

2. True or False: Hair is epidermal tissue. T**rue**
3. True or False: Kidney damage may occur in Monday-morning disease. **True**
4. Which of the four stomachs of a cow becomes displaced when a twisted stomach occurs? a**bomasum, also known as the fourth stomach**
5. What type of tissue lines the body's surface and openings? **epithelial**
6. What type of epithelial tissue lines the urinary tract? **transitional**
7. What type of tissue is under attack in foot-and-mouth disease? **epithelial**
8. Name the hair-like extension from the nerve cell body that carries the nerve impulse. **axon**
9. After death, the body lacks energy to pump calcium back into the endoplasmic reticulum. Consequently, the body stiffens. Name this condition. **rigor mortis**
10. Why do light-colored horses have a higher incidence of melanoma than dark-colored horses? **they contain less pigment in their skin**
11. Describe the shape of squamous cells. **very flat**
12. Differentiate between tendons and ligaments. **tendons attach muscles to bones while ligaments attach bones to other bone**s
13. List the three muscle types. **skeletal, smooth, cardiac**
14. List two involuntary muscle types. **smooth, cardiac**
15. List three types of neurons. **sensory, interneurons, and motor neurons**
16. Describe the functions of the three different muscle types: skeletal, smooth, and cardiac. **(1) Skeletal muscle attaches to the skeleton and allows motion. The animal controls the movement of skeletal muscle with nerve signals from the nervous system. The animal can control which muscles it will move.**

    (2) Smooth muscle (involuntary muscle) is located in many of the hollow organs of the body, including the gastrointestinal tract, urinary bladder, and blood vessels.

    (3) Cardiac muscle is found in the heart. This type is an involuntary muscle as well. Involuntary muscle functions without the conscious thought of the animal. These muscles continue to work at all times, even while the animal sleeps

Chapter 2: Tissue Types and Functions

Learning Domain - Cognitive

Level of Learning – Comprehension

Time Allocation – Approximately 45 minutes

Learning Objectives:

- Describe the properties, locations, functions, and varieties of epithelial tissues.
- Describe the properties, locations, functions, and varieties of connective tissues.
- Describe the properties, locations, functions, and varieties of muscle tissues.
- Describe the properties, locations, functions, and varieties of nerve tissues.
- Link knowledge of tissues to clinical practice.

Vocabulary Introduced:

- organs
- displaced abomasum
- foot-and-mouth disease (FMD)
- epithelial tissues
- basement membrane
- integument
- keratin
- tendons
- ligaments
- adipose tissue
- myofiber
- rigor mortis
- porcine stress syndrome
- hypocalcemia
- Sweeny
- central nervous system
- peripheral nervous system
- neurons
- tying up, or Monday-morning disease

- Horner's syndrome

Needed Equipment/Materials:

Instructor: PowerPoint presentation equipment
Student: paper, pencil

References:

Introduction to Veterinary Science, Third Edition

I. Introduction

[Time Allocation: 5 min.]

A. Cells develop specialized structure and function
B. A collection of cells, organized for a particular function, is called a tissue
C. Collections of tissues are then arranged into organs
D. Mammals have four basic tissue types: epithelial, connective, muscle, and nerve

Reference: *Introduction to Veterinary Science,* p. 18
Slide(s): 2-2

II. Epithelial Tissues

[Time Allocation: 10 min.]

A. Describe the properties, locations, functions, and varieties of epithelial tissues
    1. Epithelial tissues
        a. Are collections of cells packed together in sheets
        b. Line the body's surface and openings
        c. Cover all the openings of the intestinal, reproductive, and urinary tracts
        d. Line tubes in the body, such as blood vessels and the heart
    2. Functions
        a. Skin protects the body from trauma, the sun's ultraviolet light, extremes of temperature, drying, and bacterial invasion
        b. Cells lining the respiratory, intestinal, urinary, and reproductive tracts also provide protection
        c. Epithelial tissues produce a variety of secretions
            i. Tears
            ii. Saliva
            iii. Urine
            iv. Sweat
            v. Milk
        d. Certain cells prevent excessive loss of fluid and nutrients
        e. Specialized cells within the epithelial tissues provide sensory input
    3. Classifications
        a. Number of layers
            i. Simple, with one cell layer
            ii. Stratified, with multiple layers
            iii. Transitional, with multiple layers

b. Shape of cells
    i. Squamous (very flat)
    ii. Cuboidal (cube shaped)
    iii. Columnar (more tall than wide)
c. Layers and shapes are used together to describe epithelium
    i. Simple squamous: associated with secretion or absorption
    ii. Simple cuboidal: found in exocrine and endocrine glands
    iii. Simple columnar: found in glands, stomach, and intestines
    iv. Stratified squamous: skin
        a. Offers a two-way barrier over the body
        b. Maintains a stable body temperature
        c. Synthesizes vitamin D
        d. Protects (with pigment) against ultraviolet radiation
        e. Provides the first visible impression of an animal's health
    v. Stratified squamous: modified epidermis (hair, claws, hooves, horns)
    vi. Transitional epithelium: specific to the urinary tract

Reference: *Introduction to Veterinary Science,* pp. 20-23
Slide(s): 2-3 through 2-5

III. Connective Tissues

[Time Allocation: 5 min.]

A. Describe the properties, locations, functions, and varieties of connective tissues
    1. Tendons
        a. Connect muscles to bones
        b. Composed of a protein called collagen
    2. Ligaments
        a. Connects bones to bones
        b. Composed of collagen and elastin
    3. Bone and cartilage
        a. Hyaline cartilage
            i. Provides a durable contact surface between the bones of a moveable joint
            ii. Found in the rings that support the shape of the trachea
            iii. Found in the growth plates of bones in immature animals
        b. Elastic cartilage
            i. Found in regions where repeated movement occurs
        c. Bone
            i. Has a matrix that is mineralized
            ii. Has functions similar to those of cartilage

4. Adipose tissue
    a. Consists of cells filled with lipid
    b. Found between muscles, behind the eye, within bone marrow, and in the abdomen
5. Blood
    a. Considered a special type of connective tissue
    b. Suspended in a large volume of liquid matrix

Reference: *Introduction to Veterinary Science,* pp. 24-25
Slide(s): 2-6 and 2-7

IV. Muscle Tissues

[Time Allocation: 5 min.]

A. Describe the properties, locations, functions, and varieties of muscle tissues
    1. Smooth muscle (involuntary muscle)
        a. Located in the hollow organs of the body
        b. Functions without conscious thought of the animal
        c. Lacks the striated appearance of other muscles
        d. Arranged in sheets around hollow openings such as those in the gastrointestinal tract
        e. Contracts more slowly than skeletal muscle
        f. Controlled by the autonomic nervous system
    2. Skeletal muscle
        a. Is a striated voluntary muscle
        b. Contracts using a very complicated system including nerve stimulation
    3. Cardiac muscle
        a. Uses the same mechanism for contraction as in skeletal muscle
        b. Is an involuntary muscle and is striated in appearance
        c. Does not require nerve cell stimulation for contraction to begin
    4. Calcium and muscle
        a. Porcine stress syndrome: genetic disease in pigs; calcium is not transported back into the endoplasmic reticulum
        b. Hypocalcemia or milk fever: so much calcium is excreted in the milk that the cow's calcium levels becomes too low
        c. Eclampsia: low blood calcium levels in dogs following parturition

Reference: *Introduction to Veterinary Science,* pp. 25-28
Slide(s): 2-8 and 2-9

V. Nerve Tissues

[Time Allocation: 5 min.]

A. Describe the properties, locations, functions, and varieties of nerve tissues
   1. Nerves and nervous systems
      a. Nerves allow communication among areas of the body by receiving and transmitting electrical signals
      b. Together the brain and spinal cord are called the central nervous system
      c. The peripheral nervous system includes all the nerves outside the brain and spinal cord
   2. Neurons
      a. Sensory neurons
         i. Have receptors that are stimulated in response to changes in the animal's environment
         ii. Give feedback on changes occurring outside and within the animal
      b. Interneurons
         i. Found within the central nervous system
         ii. Provide the pathways that allow the central nervous system to control the animal's activities
      c. Motor neurons
         i. Begin in the central nervous system and extend to a muscle or gland
         ii. When stimulated by the motor neuron, an action occurs
   3. Nerve impulse
      a. The nerve impulse occurs as a flow of ions passes through the cell membrane
      b. Once stimulated, the ions flow rapidly across the membrane
      c. Using microelectrodes, the nerve impulse can be measured as an electrical event

Reference: *Introduction to Veterinary Science,* pp. 28-29
Slide(s): 2-10

VI. Clinical Practice

[Time Allocation: 10 min.]

A. Link knowledge of tissues to clinical practice
   1. Foot-and-mouth disease
      a. Selectively attacks epithelial tissue
      b. Spreads rapidly by contact with infected animals

c. Last diagnosed in the United States in 1929 but has been present in other countries since then

2. Traumatic injury
   a. Lacerations need repair
   b. Can destroy the connective tissue bond to skin
   c. To avoid dead space during repair, close with a layer of sutures and/or place a drain
3. Tying up or Monday-morning disease
   a. Often occurs after a rest when the horse consumes a full diet
   b. As the horse begins working or exercising, it develops severe cramping
   c. Products leak from the muscle into the bloodstream; the breakdown of these products can damage the kidneys
4. Horner's syndrome
   a. Results from damage to a nerve in the autonomic nervous system
   b. Observed signs include:
      i. Constricted pupil
      ii. Upper eyelid droops
      iii. The third eyelid protrudes
      iv. Eye is sunken in the socket
5. Foot rot
   a. Persistent exposure to wet and dirty conditions works to soften the skin and hoof
   b. Combining the soft skin with trauma allows bacteria to invade the skin between the claws of the hoof

Reference: *Introduction to Veterinary Science,* pp. 29-30
Slide(s): 2-11

VII. Summary

[Time Allocation: 5 min.]

- Epithelial tissues line the body's surfaces; openings, including the intestinal, reproductive, and urinary tracts; and tubes, such as the blood vessels and the heart
- Connective tissues vary in type but share the common feature of specialized cells embedded in vast amounts of extracellular material
- Three types of muscle tissue exist: skeletal, cardiac, and smooth
- Nerve tissues provide for communication within the body

Reference: *Introduction to Veterinary Science,* p. 30
Slide(s): 2-12 and 2-13

VIII.Assignment – Read Chapter 3 in *Introduction to Veterinary Science*