

Integumentary System

Course

Anatomy and Physiology

Unit V

Integumentary System

Essential Question

How does the integumentary system function in the human body?

TEKS

130.206 (C)
1(A)(B) 3(E)
5(D)6(B)
10(A)(B)

Prior Student Learning

n/a

Estimated time
4-5 hours

*Teacher Note

Pig's feet may be purchased from grocery stores specializing in Mexican food. Pig's feet may be purchased either whole or sawn in half. Either would be acceptable. They should be

Rationale

The skin and certain accessory organs make up the integumentary system, which provides the first line of defense for the body, excretes wastes, and regulates body temperature.

Objectives

Upon completion of this lesson, the student will be able to:

- Describe biological and chemical processes that maintain homeostasis
- Analyze forces and the effects of movement, torque, tension, and elasticity on the human body
- Associate the disease process with changes in homeostasis
- Identify changes in structure and function due to trauma and disease
- Identify normal and abnormal anatomy and physiology
- Demonstrate a suturing technique and analyze its use in wound healing
- Identify the basic anatomy of the integumentary system
- Describe the functions of skin
- Identify the layers of the skin and the accessory structures associated with the skin

Engage

How are you going to maintain your youthful appearance?
(Share and discuss pictures of a little girl, mother and grandmother.)

Key Points

- I. Skin
 - A. The largest organ of the body
 - B. Composed of sweat and oil glands, nails, hair, and the three layers of cells that make up the outer covering of the body
 - C. A system of specialized tissue
 1. Glands that secrete fluids
 2. Nerves that carry impulses
 3. Blood vessels that assist in the regulation of body temperature
 - D. The body's covering
 - E. Protector

kept refrigerated until just before use as they can have considerable odor.

As an alternative to pig's feet, sutures could be practiced on a banana.

Suture material is more difficult to obtain. You may try contacting the emergency medicine or OB/GYN department of your local hospital and ask if they have any suture material that has passed its expiration date.

If unable to obtain actual sutures, you can improvise with heavy-duty thread and special curved sewing needles designed for quilting. These are available at most fabric stores.

1. A barrier against microorganisms
2. Protects the organs from injury
3. Maintains and regulates body temperature
4. Acts as a receptor for sensation (hot, cold, touch, pain)
5. Guards the deeper tissues against excessive loss of water, salts, and heat

F. Removes bodily waste products

II. Three layers of skin

- A. Epidermis – a thin, cellular membrane layer
- B. Dermis – a dense, fibrous connective tissue
- C. Subcutaneous tissue – a fat-containing tissue that joins the skin to the underlying muscle

III. Epidermis

- A. Outer layer of the skin
- B. Cellular layer of the skin
- C. Composed of epithelium – covers both the internal and external surfaces of the body
- D. No blood vessels, lymphatic vessels, connective tissue, cartilage, or fat
- E. Depends on the deeper dermis (or corium) layer and its network of capillaries for nourishment
- F. The deepest layer of the epidermis is the basal layer
 1. Cells in the basal layer are always growing and multiplying.
 2. As basal layer cells divide, they are pushed upwards and away from the blood supply of the dermis layer by a steady stream of younger cells.
 3. These cells shrink, lose their nuclei, die, and become filled with a hard protein called *keratin*. They are then called *horny cells*, reflecting their keratin composition.
 4. Within 3 to 4 weeks after living as a basal cell in the deepest part of the epidermis, the horny keratinized cell is sloughed off from the surface of the skin.
- G. Constantly renewing itself
 1. Cells die at the same rate at which they are born.
 2. As new cells rise to the surface, old cells are sloughed off.
- H. *Melanocytes* are found in the basal layer of the epidermis
 1. Contain melanin, a black pigment
 2. The amount of melanin accounts for the color differences in skin.
 3. Darker skin possesses more active melanocytes, not a

- greater number of melanocytes.
4. Melanin in the epidermis is vital for protection against harmful ultraviolet radiation, which can manifest as skin cancer.
 5. People who are incapable of forming melanin are called *albino*, meaning white.
 - a. Their skin and hair are white.
 - b. Their eyes are red; due to the absence of pigment, the tiny blood vessels are visible in the iris.

IV. Dermis

- A. Second layer of the skin, the *corium*
- B. Located just below the epidermis
- C. A living tissue composed of blood, lymph vessels, and nerve fibers
- D. Contains hair follicles, sweat glands, and oil glands
- E. Contains connective tissue cells and fibers
- F. Composed of several types of connective tissues
 1. *Histiocytes* – protect the body by surrounding foreign materials
 2. *Fibroblasts* – act to repair injury
 3. *Mast cells* – contain histamine, a substance released in allergic reactions that causes itching
- G. Fibers in the dermis are composed of *collagen*
 1. “Glue”
 2. A fibrous protein material found in bone, cartilage, tendons, and ligaments, as well as the skin
 3. Tough but flexible
 4. In infants, collagen is loose and delicate, but it becomes harder as the body ages.
 5. Supports and protects the blood and nerve networks that pass through the dermis
- H. Hair shafts are located in the dermis
 1. Hair shafts have bundles of involuntary muscles called *arrector pili* attached to the hair follicles.
 2. When you are frightened or cold, these muscles contract, the hair stands up, and “goose bumps” appear.

V. Subcutaneous layer

- A. Made of connective tissue that specializes in the formation of fat
- B. *Lipocytes* – plentiful in the subcutaneous layer, manufacture and store large amounts of fat

- C. Important in protecting the deeper tissues of the body
 - D. Acts as a heat insulator
 - E. Connects the dermis to the muscles and organs below it
 - F. Fat tissue insulates the inner structures from temperature extremes.
- VI. Sebaceous glands
- A. Produce an oily secretion called *sebum*
 - B. Carried to the edges of the skin by ducts and excreted through openings in the skin called pores
 - C. Lubricates the skin
 - D. Closely associated with hair follicles; their ducts open into the hair follicle
 - E. Influenced by sex hormones
 - 1. Causes them to be over active at puberty resulting in excess oil production of the skin at puberty
 - 2. Causes them to be underactive in old age resulting in drying of skin as we age
- VII. Sudoriferous glands
- A. Tiny coiled glands found on almost all body surfaces
 - B. Produce a watery solution called *sweat*
 - 1. Helps cool the body
 - 2. Carried to the edges of the skin by ducts and excreted through openings in the skin called pores
 - 3. Perspiration (sweat) is almost pure water, dissolved materials such as salt making up less than 1%.
 - 4. Colorless and odorless
 - 5. The odor produced when sweat accumulates is due to the actions of bacteria.
 - C. Certain sweat glands, only active from puberty onward, are larger than ordinary sweat glands.
 - D. *Ceruminous glands* are classified as modified sweat glands
 - 1. Found in the ear canal
 - 2. Produce a yellow waxy substance called *cerumen* (ear wax)
 - E. *Diaphoresis*
 - 1. comes from the Greek *dia*, meaning “through,” and *phoreo* meaning “I carry”
 - 2. “The carrying through of perspiration”
 - 3. Perspiration, especially when copious and medically induced.

VIII. Hair

- A. Composed of a network of *horny cells*
- B. Hair growth is similar to the growth of the skin's epidermal layer.
- C. Deep-lying cells in the hair roots move forward through the hair follicles (or shafts) that hold the hair fiber.
- D. *Melanocytes* located at the root of the hair follicles supply the melanin pigment for the hair fiber.
- E. Hair color depends on the amount of melanin present.
- F. Because hormone production decreases as we get older, hair loses color and become transparent (gray).

IX. Nails

- A. Harder keratin plates that cover the dorsal surface of the last bone of each toe and finger
- B. Composed of horny cells that are cemented together and can extend indefinitely until cut or broken
- C. Nails grow in thickness and length by the division of the cells of the nerve root at the base of the nail plate.
- D. Grow approximately 1mm a week
- E. May re-grow completely in 3-5 months
- F. Toenails grow more slowly than do fingernails.

X. Skin Injuries

- A. Excessive sun exposure
 - 1. Clumps elastin fibers → "leathery" skin
 - 2. Temporary depression of immune system
 - 3. DNA alteration → cancer
 - 4. Sun types
 - a. Type 1: always burns easily, never tans, very fair, SPF 30
 - b. Type 2: Always burns easily, tans minimally, fair skin, SPF 30 or SPF 15
 - c. Type 3: burns moderately, tans gradually, fair to medium skin, SPF 30 or SPF 15 or SPF 8
 - d. Type 4: burns minimally, always tans well, medium skin, SPF 30, SPF 15, SPF 8
 - e. Type 5: rarely burns, tan profusely, olive or dark skin, SPF 15 or SPF 8
 - f. Type 6: never burns, deeply pigmented, very dark skin, SPF 8

- B. Burns: 1st, 2nd, 3rd (superficial, partial thickness, full thickness) degree depending on depth of burn
- C. Blisters: injury damages chemical bonds of skin layers at dermal/epidermal junction
- D. Callous: abnormally thick stratum corneum

XI. Skin Lesions

- A. Bullae: blebs, blisters with serous fluid
- B. Desquamation: peeling of skin
- C. Macule: level, circumscribed areas on the skin, i.e. freckles
- D. Nodules: large circumscribed solid elevations
- E. Papules: smaller circumscribed solid elevations
- F. Pustules: small elevations that contain pus
- G. Tumors: soft or firm masses that are either freely movable or fixed
- H. Vesicles: small blisters
- I. Wheals: edematous elevations with itching (pruritis)
- J. Crusts: dried pus/blood, i.e. scabs
- K. Furuncles: boils, usually staph in hair follicles
- L. Carbuncles: groups of fused boils
- M. Urticaria: hives due to allergic reaction
- N. Eczema: inflammatory dermatitis with papules and vesicles
- O. Excoriation: skin with shallow ulcers due to scratching
- P. Fissure: linear break in skin
- Q. Exudate: drainage
 - 1. Serous = watery
 - 2. Purulent = pus
 - 3. Sanguineous = blood

XII. Skin Diseases/Disorders

- A. Acne: overactive secretion of sebaceous glands
 - 1. Inflamed plug = comedo
 - 2. Pimples and blackheads
 - 3. Teens to early twenties
 - 4. Treatment: thorough washing, steroid creams, UV light, Isoretoin, avoidance of certain foods, chemical face peel and dermabrasion (for scarring)
- B. Seborrheic Dermatitis
 - 1. Dandruff: oily scalp, itching, irritation, greasy scales

2. Treatment: frequent shampooing (tincture of green soap), brushing hair, massaging scalp
- C. Eczema
1. Vesicles on reddened skin which burst and weep → crusts
 2. Treatment: tranquilizers (stress aggravates condition), antihistamines, steroids, wet dressings, starch baths
- D. Urticaria
1. Hives → allergy or emotional stress
 2. Treatment: steroids, antihistamines
- E. Contact Dermatitis
1. Redness, itching, blisters, edema
 2. Causes: poison ivy, poison oak, poison sumac, cleansing agents, cosmetics, metals
 3. Treatment: clean with soap and water then apply alcohol, antipruritic lotions, cold and wet dressings, desensitization
- F. Psoriasis
1. Patchy erythema and scales
 2. Chronic inflammatory disease, genetic
 3. Treatment: ointments, UV light, low fat diets, steroids, antihistamines, tranquilizers
- G. Impetigo
1. Very contagious
 2. Erythema, vesicles with sticky yellow crusts
 3. Infection with staph or strep
 4. Treatment: remove crusts then apply antibiotic ointment
- H. Warts
1. Painless except for Plantar warts
 2. Caused by a virus
 3. Treatment: nitric or sulfuric acid applications deep into root of wart or freezing with liquid nitrogen
- I. Herpes simplex I (cold sores)
1. Caused by virus
 2. Blisters, inflamed skin around mouth
 3. Treatment: tincture of benzoin, acyclovir
- J. Herpes zoster (shingles)
1. Viral infection with fever and malaise
 2. Erythema and vesicles along the course of a nerve
 3. Treatment: analgesics, calamine lotion, acyclovir orally
- K. Tinea (dermatophytosis)
1. Fungal infections i.e. athlete's foot, ringworm, jock itch
 2. Infectious, contagious
 3. Treatment: antifungal agents, dry feet, change socks and

shoes frequently

- L. Furuncles (boils) and Carbuncles (large, swollen erythematous lesions)
 - 1. Staph or Strep infection
 - 2. Treatment: hot, moist compresses; incise and drain lesion; antibiotics
- M. Decubitus ulcer: bedsores due to decreased circulation to a specific area
- N. Paronychia
 - 1. Infected hangnail
 - 2. Treatment: soak frequently in warm water, remove nail surgically
- O. Sebaceous Cysts
 - 1. Blockage of duct of sebaceous gland
 - 2. Treatment: lance and drain
- P. Diaper rash
 - 1. Treatment: antibacterial cream, mineral oil cleansing, exposure to air to dry the rash
- Q. Corns (hard, raised painful areas) and Callouses (flat, thickened patches)
 - 1. Caused by friction of poorly fitted shoes
 - 2. Treatment: relieve friction, keratolytic agents i.e. salicylic acid
- R. Infestations and Bites
 - 1. Pediculosis (lice): scalp hair, body hair, pubic hair
Treatment: ointments, powders, lotions with benzylbenzoate or benzene hexachloride
 - 2. Scabies (mites):
Treatment: thorough bathing then benzyl benzoate or benzene hexachloride
- S. Lupus erythematosus
 - 1. Erythematous macular lesions in butterfly pattern on face
 - 2. Dysfunction of kidneys, joints, lungs, and heart
 - 3. Treatment: aspirin, steroids
- T. Scleroderma
 - 1. Systemic autoimmune disease of skin, muscles, bones, heart, lungs
 - 2. Skin → smooth, hard, tight
 - 3. Progressive
 - 4. Treatment: ointments, massage, heat, steroids
- U. Pilonidal Sinus
 - 1. Sac containing a hair that becomes infected and develops

- into a draining sinus
 - 2. Treatment: warm water compresses, sitz baths, deep wide V-shaped incision packed with gauze
- V. Carcinoma: cancerous tumor
 - 1. Squamous cell: slow growing, hard, raised nodule
 - 2. Basal cell: papules that erode in center
- W. Malignant melanoma
 - 1. Nevus.mole becomes dark, spreads unevenly, bleeds some
 - 2. Death in 1:4 cases
 - 3. Metastatic
 - 4. Cause = overexposure to UV radiation (sun or tanning bed)
- X. Karposi's sarcoma: purple papules spread to lymph nodes and other organs, may be associated with AIDS
- XIII. Rationale for suturing
 - A. Heals faster because tissue is coapted.
 - 1. Holds the wound margins in close apposition
 - 2. Allows healing by primary intention vs. secondary intention
 - B. Decreased scar formation because of healing by primary intention (less formation of granulation tissue)
 - C. Reduces the chance of infection
- XIV. Needles
 - A. Eye vs. wedged on
 - B. Straight or curved – most have some degree of curvature.
 - C. Sharp point with cutting edges
- XV. Suture material
 - A. Natural vs. synthetic – “cat gut”
 - B. Absorbable vs. non-absorbable
- XVI. Suturing techniques
 - A. Simple interrupted suture
 - B. Continuous interlocking suture
 - C. Mattress suture
- Activity**
 - I. Complete the integumentary system vocabulary
 - II. Label the skin diagram
 - III. Create a 3-dimensional skin model – see activity guidelines
 - IV. Complete Suturing Laboratory Investigation
 - V. Complete case study – see activity sheet

Assessment

Laboratory Investigation Rubric

Materials

Skin diagrams

Forceps

Gloves

Scalpel or Razor Blade

Dissecting Pan

Needle Holder or Hemostat

Suture Material

Scissors

Pig's Feet or bananas

Arts and Crafts Materials

The Stars Program: The University of Texas Southwestern Medical Center at Dallas

Ethicon, Inc. 1961. *Manual of Operative Procedure and surgical Knots*. Johnson & Johnson, Somerville, New Jersey

Mackenzie, D. 1973. *Medical History*: The history of sutures. 17(2): 158-68

Niederhuber, J.E. 1998. *Fundamentals of Surgery*. Appleton & Lange, Stamford, Connecticut.

Accommodations for Learning Differences

For reinforcement, the student will practice terms using flash cards of the integumentary system.

For enrichment, the student will choose a disease related to the integumentary system and research it using the internet. They will share their findings with the class using multimedia technology.

For enrichment, the student will compare and contrast skin cancer statistics of different population groups.

National and State Education Standards

Texas College Readiness Standards

VI. Biology

A. Structure and function of cells

1. Know that although all cells share basic features, cells differentiate to carry out specialized functions.
6. Know the structure of membranes and how this relates to permeability.

F. Systems and homeostasis

1. Know that organisms possess various structures and processes (Feedback loops) that maintain steady internal conditions.
2. Describe, compare, and contrast structures and processes that allow gas exchange, nutrient uptake and processing, waste excretion, nervous and hormonal regulation, and reproduction in plants, animals, and fungi; give examples of each.

TEKS 130.206 (C)

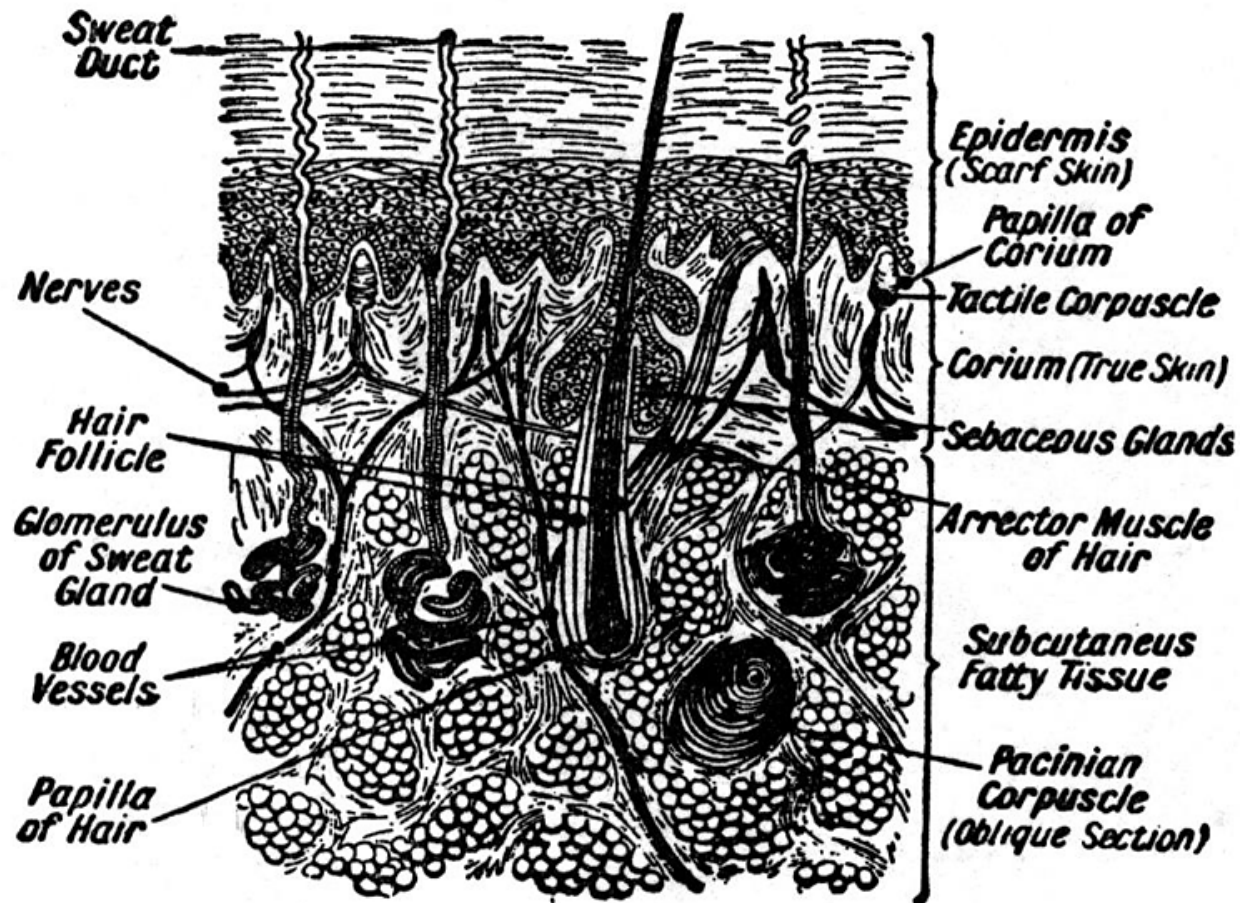
- (1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:
- (A) demonstrate safe practices during laboratory and field investigations; and
- (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.
- (3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:
- (E) evaluate models according to their limitations in representing biological objects or events; and
- (5) The student differentiates the responses of the human body to internal and external forces. The student is expected to:
- (D) analyze and describe the effects of pressure, movement, torque, tension, and elasticity on the human body.
- (6) The student examines the body processes that maintain homeostasis. The student is expected to:
- (B) determine the consequences of the failure to maintain homeostasis.
- (10) The student investigates structure and function of the human body. The student is expected to:
- (A) analyze the relationships between the anatomical structures and physiological functions of systems, including the integumentary, nervous, skeletal, musculoskeletal, cardiovascular, respiratory, gastrointestinal, endocrine, and reproductive;
- (B) evaluate the cause and effect of disease, trauma, and congenital defects on the structure and function of cells, tissues, organs, and systems

Integumentary System Vocabulary

Word	What it Means
Abrasion	
Adenoma	
Albinism	
Albino	
Adipose	
Anhidrosis	
Arrector Pili	
Bullae	
Collagen	
Cortex	
Cuticle	
Dermatitis	
Dermis	
Dermatology	
Dermatologist	
Diaphoresis	
Epithelium	
Erythema	
Hair Follicle	
Histiocytoma	
Hypodermic	
Hyperhidrosis	
Keratin	
Lipocyte	
Lipoma	
Lunula	
Melanin	
Onychomycosis	
Papillae	
Root	
Sebaceous glands	
Seborrhea	
Sebum	
Subcutaneous	

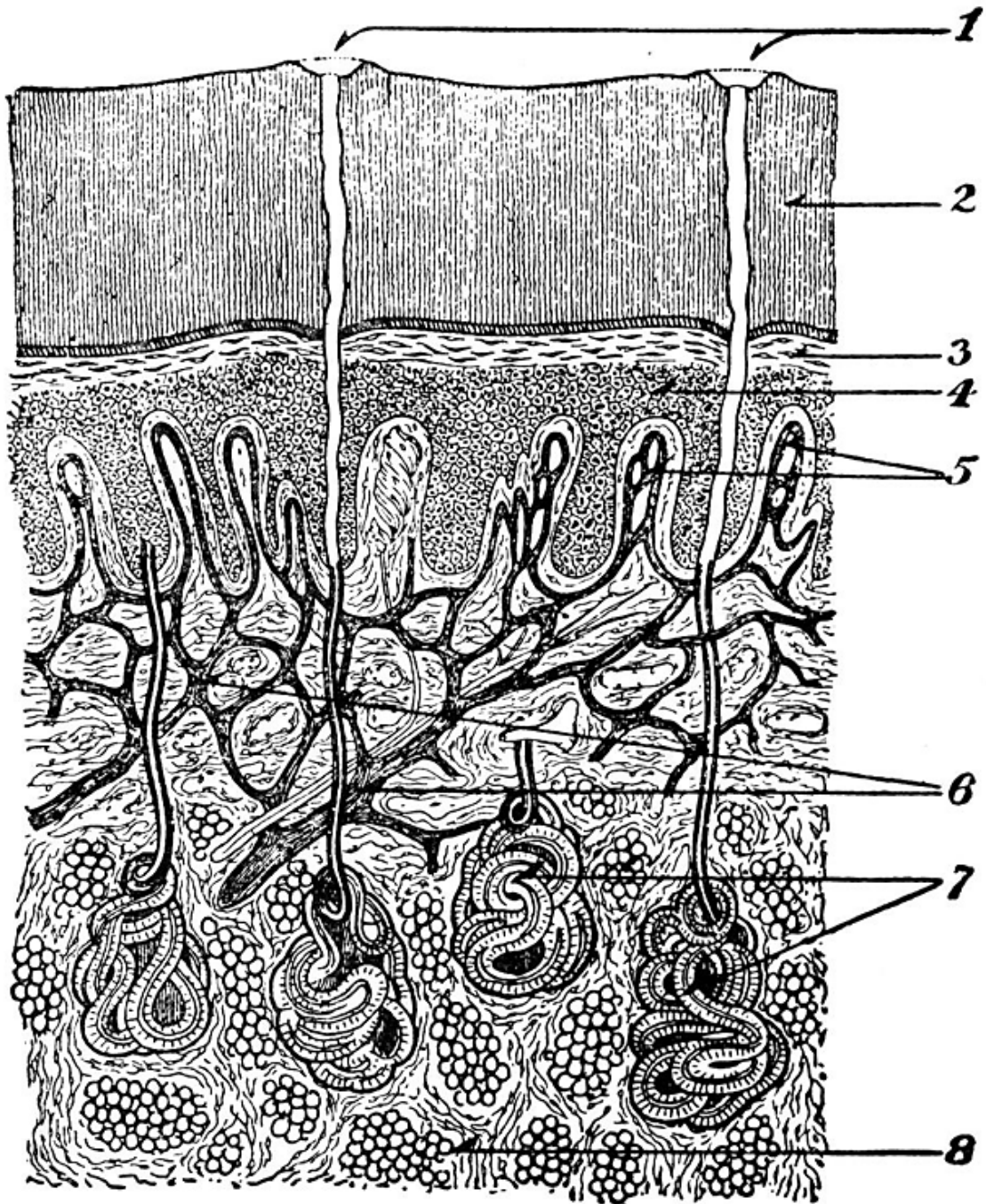
Integumentary System Vocabulary

Word	What it Means
Abrasion	Scraping away of the superficial layer of injured skin
Adenoma	Glandular tumor
Albinism	Lack of pigment in the skin, hair, and eyes
Albino	Person with skin deficient in pigment or melanin
Adipose	Pertaining to fat
Anhidrosis	Lack of sweat
Arrector Pili	Smooth muscle causing "goose bumps"
Bullae	Blisters on the skin
Collagen	Structural protein found in skin and connective tissues
Cortex	The outer cuticle layer of the hair shaft
Cuticle	Band of the epidermis extending from nail wall to nail surface
Dermatitis	Inflammation of the skin
Dermis	Considered the true layer of skin
Dermatology	Study of the skin and its diseases
Dermatologist	Physician who specialized in skin and its diseases
Diaphoresis	Profuse sweating
Epithelium	Layer of skin forming the outer and inner surfaces of the body
Erythema	Red discoloration of the skin
Hair Follicle	Tube that holds the hair root
Histiocytoma	Fatty tumor of the sebaceous gland
Hypodermic	Under the skin
Hyperhidrosis	Excessive growth of the outer layer of skin
Keratin	Hard protein material found in epidermis, hair, and nails
Lipocyte	Fat cell
Lipoma	Tissue or mass containing fat
Lunula	Half-moon shaped white area at the base of a nail
Melanin	Black pigment formed by melanocytes
Onychomycosis	Fungal infection of a nail
Papillae	Permanent ridges of the skin
Root	The part of the hair implanted in the skin
Sebaceous glands	They produce a thick, oily substance
Seborrhea	Increased discharge of sebum from glands
Sebum	Lubricates the skin, keeping it soft and pliable
Subcutaneous	Adipose layer



Skin Diagram

<http://www.clipart.com/>



<http://www.clipart.com/>

3D Skin Model

You will be creating a 3D skin model. The following list includes all of the structures that must be represented in the model. Have fun and be creative. Think of arts and craft supplies or recycled materials from home that could model these structures. Also create a legend stating the function of each structure and label all structures on the model. **Include the following structures:**

- | | | |
|------------------------------|------------------------|------------------------|
| 1. Adipose tissue | 7. Erector pili muscle | 13. Spinous cell layer |
| 2. Artery | 8. Granular cell layer | 14. Stratum corneum |
| 3. Basal cell layer | 9. Hair | 15. Subcutaneous |
| 4. Collagen & elastin fibers | 10. Hair follicle | 16. Sweat gland |
| 5. Dermis | 11. Nerve | 17. Touch receptor |
| 6. Epidermis | 12. Sebaceous gland | 18. Vein |

Project Begins on: _____ Project Due on: _____ Turned-in on: _____

Scoring Criteria	Points Worth		Points Earned
Organization of Material	0-10 points		
Attached legend (must include a definition/description of each term)	0-10 points		
Structures of the Skin	✓ Part modeled 2 points	✓ Part labeled 2 points	0-4 points each
a. Adipose tissue			
b. Artery			
c. Basal cell layer			
d. Collagen and Elastin fibers			
e. Dermis			
f. Epidermis			
g. Erector pili muscle			
h. Granular cell layer			
i. Hair			
j. Hair follicle			
k. Nerve			
l. Sebaceous gland			
m. Spinous cell layer			
n. Stratum corneum			
o. Subcutaneous			
p. Sweat gland			
q. Touch receptor			
r. Vein			
Follows Instructions: • Project submitted on time • Neat	0 – 8 points		
TOTAL POINTS:	Up to 100 points		
FINAL GRADE:			

Suturing Activity

Lab Developed by: David Holland, M.S., STARS Program
University of Texas Southwestern Medical Center at Dallas

Purpose:

In this activity, the student will practice basic suturing technique on pig's feet.

Background Information:

Sutures (stitches) are used to close wounds caused by injury or surgical procedures. By holding together tissues at the site of a wound, sutures aid in the healing process and help to reduce the chance of scarring. Skin sutures further help to exclude any pathogens from a wound that may cause infection.

Suture material is manufactured from many different natural and synthetic materials and is available in a variety of sizes. Absorbable sutures are made of materials that are broken down by the body and are used mainly on deep structures and do not have to be removed at a later date. Historically, the most popular absorbable suture material is called "catgut" or simply "gut," and is manufactured from the submucosa of sheep intestine and consists of nearly pure collagen. A number of synthetic absorbable products are also currently on the market. Silk has been the material of choice for non-absorbable sutures. While extremely strong, silk and other non-absorbable materials cause some degree of tissue irritation and must be removed once healing has taken place.

The needles used in conjunction with suture material also come in a variety of shapes and sizes for various applications. The earliest needles contained eyes to hold the thread, however, in 1920 a technique was developed to attach the suture material directly to the needle. This innovation helped to reduce the amount of trauma caused by pulling a double thickness of material through the tissue. Most suture needles are curved to various degrees, however for some applications straight needles are used. Most have sharp, beveled edges to help cut through the tissues as the needle is advanced.

As you might imagine, there are many different techniques for stitching wounds. The simplest is the simple interrupted suture. In this technique the needle is inserted downward through the tissue on one side of the wound, retrieved with forceps and inserted upwards through the tissue on the other side. A square knot is tied to hold the suture firmly in place and the ends are trimmed. A series of similar sutures are placed evenly along the length of the wound until it is completely closed. Other techniques include continuous sutures that run a single length of suture material through the entire length of the wound.

Materials:

- Forceps
- Gloves
- Scalpel or Razor Blade
- Dissecting Pan
- Needle Holder or Hemostat
- Suture Material

Scissors
Pig's Foot

Procedure:

Beginning the suture

1. Put on your gloves and place the pig's foot in the dissecting pan. Using the scalpel make a single incision through the skin down the length of the pig's foot.
2. Carefully open the package containing the suture material. Clip the needle into the needle holder. The needle should be placed near the end of the jaws of the holder, oriented at a right angle with the concave side up. If you are right handed, the point of the needle should be on the left side of the holder.
3. Make sure that the thumb and 4th finger are inserted into the needle holder only to the first knuckle. The illustration below shows the correct orientation of the needle in the holder and the correct way to grasp the needle holder.
4. With the forceps, grasp the flap of skin on the right side of the incision. Rotate your wrist so that the pointed end of the needle is at a right angle with the surface of the skin. Aim for a spot about 5 mm to the right of the incision and insert the needle point. With a rotation of the wrist, insert the needle through the skin until the point appears beneath the dermis.
5. Use the forceps to grasp the end of the needle and pull it through the skin until about 3 cm of suture material remains above the skin. Use a rotation of the wrist to be sure you pull along the line of curvature of the needle.
6. Lift the left side of the incision with the forceps and insert the needle up through the skin until the point appears on the surface about 3 mm from the edge of the incision. Use your forceps to pull the needle and suture material out, again along the line of curvature of the needle. Make sure that you leave the short end of the suture in place on the right side of the incision.

Tying the knot

7. To make an instrument tie, hold the long end of the suture in your left hand and the unlocked needle holder in your right. Place the jaw end of the holder next to the long suture and wrap the suture two times around the holder in a direction away from your body.
8. While maintaining some tension on the line to prevent it from slipping off the holder, open the jaws and grab the short end of the suture. Pull the holder back to the left, through the two loops of the long end. Move the left hand away from your and to the right to tighten the loops. Now you have made the first throw of the knot. Tighten the knot enough to hold the flaps of skin together, but not so tight that it puts undue pressure on the skin.
9. Maintaining tension on the long end of the suture with your left hand, repeat the above procedure, but this time loop the long end back toward you around the holder and only make one loop. Grab the short end again and secure the loop. This will hold the first loop in place.
10. Repeat three more times to completely secure the knot. Trim the excess off close to the knot, leaving about 2 mm of free end.

11. Adjust the knot to the right or left as necessary to insure that the two sides of the incision are level with one another.

Complete the remaining sutures

12. Choose a location for your next suture, not too close to the first, nor too far away. About 7 mm is a good distance. Repeat the above procedures to insert the needle to form the stitch and to tie the knot.
13. Repeat until you have placed at least three or four sutures. Then give your lab partners a chance to try their hands.

Data

Draw the placement of the sutures and then label the tissues the suture material goes through.

Conclusion:

1. What are the advantages to using sutures to close wounds?
2. How do pig skin and human skin differ? How are they alike?
3. If this were a human patient being sutured, what procedures would be performed prior to the actual suturing?
4. Why should all instruments, suture material and needles be sterile before suturing on a patient? Aseptic technique should be used to prevent possible infection.
5. Why should non-absorbable sutures have a very smooth surface? Non-absorbable sutures must be removed. The smoother the surface, the less painful the removal process will be.

Laboratory Investigation Rubric

Scoring Criteria	4. Excellent	3. Good	2. Needs Some Improvement	1. Needs Much Improvement	N/A
Problem is appropriately identified					
Problem is precise, clear, and relevant					
Association between the problem and the predicted results is direct and relevant					
All variables are clearly operationalized					
Student demonstrates comprehension of the use of scientific concepts and vocabulary					
All significant data is measured.					
Data is recorded effectively and efficiently					
Data table is well designed to the task requirements.					
All graph forms are appropriate.					
All data accurately plotted					
Graph visually compelling, highlights conclusions of the study					
Conclusion relates directly to hypothesis					
Conclusion has relevancy in resolution of the original problem					
Conclusion relates the study to general interest					

Case Study

A 16 year-old boy was admitted to the emergency room with first and second degree burns over his upper torso, limbs and face. He had just attempted to remove the radiator cap from his car when it sprayed steam and boiling radiator fluid over the upper part of his body. When he arrived via ambulance in the local hospital his vital signs were B/P 138/88, pulse 110, and respiration 20. He was experiencing significant pain. His eyelids and face were swollen and red with small scattered blisters. The ventral aspects of his fore-arms were covered with a predominance of large connecting blisters that extended to his hands and fingers. His chest and neck were red with scattered blisters ranging from a few millimeters to 5 centimeters.

1. What would your initial assessment be?
2. What do you believe the initial treatment would be and how might it differ if the victim was very young or very old?
3. Identify ways that the burn would alter normal skin physiology.
4. Identify how the alteration in the skin due to a burn would affect the integrity of the body's defense mechanism.
5. How would a skin graft affect the body's defense mechanism?
6. What might be the most important focus of treatment one week after the accident?
7. What should you do if you are the first person at an accident scene with a burn victim?