

CHAPTER 5 –INTEGUMENTARY SYSTEM

OBJECTIVES

On completion of this chapter, you will be able to:

- Describe the integumentary system and its accessory structures.
- List the functions of the skin.
- Describe skin differences of the child and the older adult.
- Analyze, build, spell, and pronounce medical words.
- Comprehend the drugs highlighted in this chapter.
- Describe the diagnostic and laboratory tests related to the integumentary system.
- Identify and define selected abbreviations.
- Describe each of the conditions presented in the Pathology Spotlights.
- Review the Pathology Checkpoint.
- Complete the Study and Review section and the Chart Note Analysis.

OUTLINE

I. Anatomy and Physiology Overview

The integumentary system is composed of the skin and its accessory structures: hair, nails, sebaceous glands, and sweat glands. (See the Integumentary System: Organ/Structure and Primary Functions, p. 72):

- A. **Functions of the Skin** – external covering of the body. In an average adult, it covers more than 3,000 square inches of surface area, weighs more than 6 pounds, and is the largest organ in the body. It is well supplied with blood vessels and nerves and has four main functions: protection, regulation, sensation, and secretion.
1. **Protection** – the skin protects against invasion by bacteria and other potentially harmful agents that might try to penetrate to deeper tissue. It protects against mechanical injury of delicate cells located beneath its epidermis or outer covering, inhibits excessive loss of water and electrolytes, provides a reservoir for food and water storage, guards the body against excessive exposure to the sun’s ultraviolet rays by producing a protective pigmentation, and helps to produce the body’s supply of vitamin D.
 2. **Regulation** – the skin serves to raise or lower body temperature as necessary. It cools by **radiation** (blood vessels dilate to bring more blood to the surface) and by **evaporation** (sweat glands secrete more sweat). When conservation of heat is necessary, the blood vessels constrict to allow more heat-carrying blood to circulate to muscles and other vital organs.
 3. **Sensation** – the skin contains millions of microscopic nerve endings that act as **sensory receptors** for pain, touch, heat, cold, and pressure. When stimulation occurs, nerve impulses are sent to

the cerebral cortex of the brain where, if necessary, a response is triggered.

4. **Secretion** – the skin contains millions of **sweat glands**, which secrete perspiration or sweat, a water solution with a small amount of salt and other chemical compounds. It also contains **sebaceous glands**, which secrete oil (**sebum**), for lubrication. Sebum also protects the body from dehydration and possible absorption of harmful substances.

B. Layers of the Skin – the two layers of the skin are the **epidermis** and the **dermis** (Fig. 5–1, p. 74).

1. **The Epidermis** – is divided into four strata:
 - a. **Stratum Corneum** – the outermost, horny layer, consisting of dead cells filled with a protein substance called **keratin**. It forms the protective covering of the body that varies in thickness.
 - b. **Stratum Lucidum** – a translucent layer lying directly beneath the stratum corneum. It is not seen in thin skin and is also composed of dead or dying cells.
 - c. **Stratum Granulosum** – consist of several layers of living cells that are in the process of becoming a part of the previously mentioned strata. The cells are active in the **keratinization** (they lose their nuclei and become hard or horny) process.
 - d. **Stratum Germinativum** – the innermost layer is composed of several layers of living cells capable of **mitosis** or cell division. It is also called the **mucosum** or **malpighii** and is responsible for regeneration of the epidermis. Damage to this layer of skin necessitates the use of skin grafts. **Melanin** (pigment that gives color to the skin) is formed here.
2. **Dermis** – also called the **corium** or **true skin**. The dermis is composed of connective tissue containing lymphatics, nerves and nerve endings, blood vessels, sebaceous and sweat glands, elastic fibers, and hair follicles. It is attached to underlying structures by **subcutaneous tissue** that supports, nourishes, insulates, and cushions the skin. Is divided into two layers:
 - a. **Upper or Papillary Layer** – arranged into parallel rows of microscopic structures called **papillae** (produces ridges that are one's fingerprints or footprints).
 - b. **Lower or Reticular Layer** – composed of white fibrous tissue that supports the blood vessels.

C. Accessory Structures of the Skin

1. **Hair** – a thin, threadlike structure formed by a group of cells that develop within a hair **follicle** or **socket**. Each hair is composed of

- a **shaft**, which is the visible portion and a **root**, which is embedded within the follicle. Hair is distributed throughout the body with the exception of the palms of the hands and the soles of the feet and varies in thickness and color. At the base of the follicle is the:
- a. **Hair Papilla** – a loop of capillaries enclosed within connective tissue.
 - b. **Pilomotor Muscle** – attached to each side of the follicle; when skin is cooled or the individual has an emotional reaction, the skin forms “**gooseflesh**” as a result of contraction by these muscles.
2. **Nails (Fig. 5–2, p. 75)** – horny cell structures of the epidermis and are composed of hard **keratin**. Nail growth may vary with age, disease, and hormone deficiency. The nail also has a crescent-shaped white area known as the **lunula**. A nail is composed of
- a. **Body**
 - b. **Root**
 - c. **Matrix or Nailbed**
3. **Sebaceous (oil) Glands** – the oil-secreting glands of the skin. The tiny ducts open into the hair follicle and their secretion lubricates the hair and the skin. Sebum secretion, which is controlled by the endocrine system, varies with age, puberty, pregnancy, and senility.
4. **Sudoriferous (sweat) Glands** – the approximately 2 million sweat glands are coiled and tubular in structure. They are distributed over the entire surface of the body with the exception of the margin of the lips, glans penis, and the inner surface of the prepuce. The sweat glands secrete sweat or perspiration, which:
- a. Helps to cool the body by evaporation.
 - b. Rids the body of waste through the pores of the skin.

II. Life Span Considerations

- A. **The Child** – in the fetus, the skin is transparent and blood vessels are clearly visible. **Vernix caseosa** (a cheeselike substance) covers the fetus until birth. At approximately 15½ weeks, lanugo hair develops and as the fetus ages the skin remains reddish and wrinkled. Babies are more sensitive to heat and cold because of a lack of subcutaneous fat. Their skin conditions can be acute or chronic, local, systemic or congenital. Skin infections in children can produce systemic symptoms, such as fever and malaise. Their skin tends to be drier and chap easily because the sebaceous glands do not produce sebum until 8 to 10 years of age. The hair of a child will vary according to race, texture, quality, and distribution. It can become dry and brittle due to improper nutrition, and lose color due to severe illness. Age associated disorders of the skin may include:
1. **Milia** – white pin-head-size pimples of a newborn which appear on the face and sometimes the trunk.

2. **Acne** – also known as **pimples**, is an inflammatory condition of the sebaceous glands and hair follicles (**Fig. 5–3, p. 76**).
- B. The Older Adult** – the skin becomes looser (due to dermal papilla growing less dense). Collagen and elastic fibers of the upper dermis decrease and skin loses its elastic tone and skin wrinkles more easily. The hair of older adults becomes somewhat gray with scalp hair thinning and becoming dry and brittle in both men and women. Older women have an increase in facial hair and men have an increase in growth of the hair of the nares, eyebrows, or helix of the ears. The nails flatten and become discolored, dry, and brittle. Skin conditions common to older adults include:
1. **Xerosis** – dryness.
 2. **Pruritis** – itching.
 3. **Premalignant and Malignant Skin Lesions** – carcinomas frequently appear on the nose, eyelids, or cheeks. **Basal cell carcinoma (BCC)** accounts for 80% of skin lesions in the older adult (**Fig. 5–4, p. 76**).

III. Building Your Medical Vocabulary

- A. Medical Words and Definitions** – this section provides the foundation for learning medical terminology. Medical words can be made up of four types of word parts:
1. **Prefix (P)**
 2. **Root (R)**
 3. **Combining Forms (CF)**
 4. **Suffixes (S)**

By connecting various word parts in an organized sequence, thousands of words can be built and learned. In the text, the word list is alphabetized so one can see the variety of meanings created when common prefixes and suffixes are repeatedly applied to certain word roots and/or combining forms. Words shown in *pink* are additional words related to the content of this chapter that have not been divided into word parts. Definitions identified with an *asterisk icon* (*) indicate terms that are covered in the Pathology Spotlights section of the chapter.

IV. Drug Highlights

- A. Emollients** – substances that are oily in nature. These are used for dry skin caused by aging, excessive bathing, and psoriasis.
- B. Keratolytics** – agents that promote loosening of the horny layers of the skin. These agents are used for acne, warts, psoriasis, corns, calluses, and fungal infections.
- C. Local Anesthetic Agents** – agents that inhibit the conduction of nerve impulses from sensory nerves and thereby reduce pain and discomfort; can be used topically to reduce discomfort associated with insect bites, burns, and poison ivy.

- D. **Antihistamine Agents** – agents that act to prevent the action of histamine; used to help relieve symptoms, such as itching, in allergic responses, and contact dermatitis.
 - E. **Antipruritic Agents** – agents that prevent or relieve itching.
 - F. **Antibiotic Agents** – agents that destroy or stop the growth of microorganisms. They are used to prevent infection associated with minor skin abrasions and to treat superficial skin infections and acne. Several antibiotic agents are combined in a single product to take advantage of the different antimicrobial spectrum of each drug.
 - G. **Antifungal Agents** – agents that destroy or inhibit the growth of fungi and yeast. These are used to treat fungus and/or yeast infections of the skin, nails, and scalp.
 - H. **Antiviral Agents** – agents that combat specific viral diseases.
 - I. **Anti-inflammatory Agents** – agents used to relieve the swelling, tenderness, redness, and pain of inflammation. They consist of:
 - 1. **Topical Corticosteroids** – used to treat dermatitis and psoriasis.
 - 2. **Oral Corticosteroids** – used to treat contact dermatitis, such as poison ivy, when symptoms are severe.
 - J. **Antiseptic Agents** – agents that prevent or inhibit the growth of pathogens. Generally applied to the surface of living tissue.
 - K. **Other Drugs** – includes the following specific medications:
 - 1. **Retin-A (*tretinoin*)** – used to treat acne vulgaris.
 - 2. **Rogaine (*minoxidil*)** – used to stimulate hair growth.
 - 3. **Botulinum Toxin Type A (*Botox Cosmetic*)** – approved by the FDA to temporarily improve the appearance of moderate to severe frown lines between the eyebrows.
- V. **Diagnostic and Lab Tests**
- A. **Tuberculosis Skin Test** – test performed to identify the presence of the *Tubercle bacilli*. The tine, Heaf, or Mantoux test may be used.
 - 1. **Tine and Heaf Test** – intradermal test performed using a sterile, disposable, multiple-puncture lancet. The tuberculin is on the metal tines that are pressed into the skin. The presence of the pathogen in the blood is indicated by a hardened raised area at the site 48 to 72 hours later.
 - 2. **Mantoux Test** – 0.1 mL of purified protein derivative (PPD) tuberculin is intradermally injected. Results are read 48 to 72 hours after administration.
 - B. **Scratch (Epicutaneous) or Prick Test** – test involves the placement of a suspected allergen in the uppermost layers of the epidermis, usually if the skin of the forearm or back. Redness or swelling at the scratch site within 10 minutes indicates allergy to the substance, rendering a positive test result. If no reaction occurs, the test result is negative.
 - C. **Sweat Test (Chloride)** – a test performed on sweat to determine the level of chloride concentration on the skin. In **cystic fibrosis** there is an increase in skin chloride.

- D. **Tzanck Test** – a microscopic examination of a small piece of tissue that has been surgically scraped from a pustule to identify types of viral infections.
- E. **Wound Culture** – a test done on wound exudates to determine the presence of microorganisms.
- F. **Biopsy (Skin)** – a small piece of living tissue from any skin lesions that exhibits signs or characteristics of malignancy is examined microscopically to establish a diagnosis.

VI. Abbreviations (p. 93)

VII. Pathology Spotlights

- A. **Decubitus Ulcer (Bed Sore or Pressure Ulcer) (Fig. 5–41, p. 97)** – an area of skin and tissue that becomes injured or broken down. The word decubitus, which means *lying down*, indicates what causes pressure ulcers. When a person sits or lies on a position too long, without shifting his or her weight, the constant pressure causes a decrease of blood supply to the area. Without blood, the tissue dies and infection may occur, leading to systemic problems. The National Pressure Ulcer Advisory Panel (NPUAP) created the following system for evaluating pressure sores which are staged and treated as follows (**Fig. 5–38, p. 94**):
 - 1. **Stage I** – a reddened area on the skin that, when pressed, is “non-blanching.” Indicates the beginning of a pressure ulcer.
 - 2. **Stage II** – the skin blisters or forms an open sore and involves redness and irritation.
 - 3. **Stage III** – the skin breakdown resembles a crater where there is damage to the tissue below the skin.
 - 4. **Stage IV** – the pressure ulcer has become so deep that there is damage to the muscle bones, tendons, and joints.
- B. **Eczema (Atopic or Contact Dermatitis)** – a chronic skin disorder categorized by scaly and itching rashes. It is common in infants with at least half of those cases clear by age 3. In adults, the condition is chronic. Sufferers often have a family history of eczema or an allergic condition.
 - 1. **Treatment** – depends on the appearance or stage of the lesions.
 - a. **Weepy Lesions** – treated with moisturizers, mild soap, or wet dressings.
 - b. **Dry Scaly Lesions** – treated with mild anti-itch lotions or low-potency topical corticosteroids.
 - c. **Chronic Dry, Thickened Lesions** – treated with ointments or creams that contain tar compounds, medium to very high potency corticosteroids, and ingredients that lubricate or soften the skin.
 - d. **Severe Cases** – systemic corticosteroids to reduce inflammation.
 - 2. **Latest Eczema Treatment** – a new class of nonsteroidal skin medications known as **immunomodulators (TIMs)**.

- C. **Psoriasis (Fig. 5–39, p. 95)** – common skin inflammation characterized by frequent episodes of redness, itching, and thick, dry, silvery scales on the skin. Most common in individuals between the ages of 15 and 35 and is thought to be an inherited, autoimmune disease. The disease presents with a buildup of dead skin and the formation of thick scales within a few days versus the normal one month period of time that it takes new skin cells to move up from lower layers to the surface. Treatment depends on the extent and severity of the disorder:
1. **Severe or Resistant Cases** – lesions that affect most of the body may require intensive treatment with hospitalization. The body loses large amounts of fluids and is susceptible to severe secondary infections that can become systemic, involve internal organs, and even progress to septic shock and death. Medications include analgesics, sedatives, IV fluids, retinoids, and antibiotics.
 2. **Mild Cases** – treated at home with topical medications including prescription or nonprescription dandruff shampoos, cortisone or other corticosteroids, antifungal medications, and antifungal medications.
 3. **Other Treatments** – moderate exposure to sunlight or **phototherapy** (skin is sensitized and person is exposed to ultraviolet light).
- D. **Skin Cancer (Fig. 5–40, p. 96)** – disease in which malignant cells are found in the epidermis. Three type of skin cells include **Squamous cells** (flat, scaly cells on the surface), **Basal cells** (round cells), and **melanocytes** (give skin its color). The most common sign of skin cancer is a change in the skin. Genetic markers have been pinpointed that may serve as an early detector for **melanoma**, which is cancer that develops in the pigment cells. Melanoma is a more serious type of malignancy than the previously mentioned skin cancers. It metastasizes quickly to other body parts through the lymphatics or blood. The **ABCDs** of melanoma describes the changes that occur in moles and include:
- A – **Asymmetry** – the shape of one half does not match the other.
 - B – **Border** – the edges are ragged, notched, or blurred.
 - C – **Color** – is uneven with shades of black, brown, or tan present; may present with areas of white, red, or blue.
 - D – **Diameter** – changes in size are seen.
- E. **Skin Signs (Fig. 5–41, p. 97)** – objective evidence of an illness or disorder, which can be seen, measured, or felt. They may be described as lesions that are circumscribed areas of pathologically altered tissue.
- F. **Burns (Fig. 5–42, p. 98)** – burns are classified according to the degree or depth of skin damage as follows:
1. **First-Degree (Superficial)** – when only the outer layer of the skin is burned. The skin is red with some degree of swelling and pain. **Treatment** – this treatment also includes second-degree burns of less than 2 to 3 inches in diameter:

- a. Cool the burn with running water or cold compresses to reduce swelling by conducting heat away from the skin.
Do not use ice.
 - b. Cover the burn with clean gauze to keep air off the burned skin, reduce pain, and protect blistered skin.
2. **Second-Degree (Partial Thickness)** – is when the second layer of skin is burned. Blisters develop and the skin takes on an intensely reddened, splotchy appearance that presents with severe pain and swelling.
Treatment – this treatment is recommended for burns over 2 to 3 inches and third-degree burns: **Call 911 for emergency assistance.** Until an emergency unit arrives, you can:
 - a. Remove the victim from contact with smoldering materials or exposure to smoke and heat, however **do not remove burned clothing.**
 - b. Do not immerse severe large burns in cold water because this could cause the victim to go into shock.
 - c. Check for signs of circulation, and if indicated, start cardiopulmonary resuscitation (CPR).
 - d. Cover the area of the burn. Use a cool, moist, sterile bandages; clean, moist cloth; or moist towels.
3. **Third-Degree (Full Thickness)** – burns involve all three layers of skin, usually destroying the sweat glands, hair follicles, and nerve endings. Areas involved are generally charred black or appear dry and white. Since the nerve endings have been burned, there is usually no pain involved.
The **Rule of Nines** estimates the extent of burns received by a patient. It is expressed as a percentage of body surface area. The body is divided into either sections, multiples, or divisions of 9% to accurately estimate the extent of the burns for fluid replacement therapy (**Fig. 5–43, p. 98**).

VIII. Pathology Checkpoint

IX. Study and Review (pp. 100–104)

X. Practical Application: SOAP: Chart Note Analysis