Chapter 06
Lecture Outline

See separate PowerPoint slides for all figures and tables pre-inserted into PowerPoint without notes.
Introduction

• **Integumentary system**
  – Consists of the skin and accessory organs; hair, nails, and cutaneous glands

• **Inspection of the skin, hair, and nails is significant part of a physical exam**

• **Skin is the most vulnerable organ**
  – Exposed to radiation, trauma, infection, and injurious chemicals

• **Receives more medical treatment than any other organ system**

• **Dermatology**—scientific study and medical treatment of the integumentary system
The Skin and Subcutaneous Tissue

- Expected Learning Outcomes
  - List the functions of the skin and relate them to its structure.
  - Describe the histological structure of the epidermis, dermis, and subcutaneous tissue.
  - Describe the normal and pathological colors that the skin can have, and explain their causes.
  - Describe the common markings of the skin.
The Skin and Subcutaneous Tissue

Dermal papilla
Tactile corpuscle (touch receptor)
Blood capillaries
Hair follicle
Sebaceous gland
Hair receptor
Apocrine sweat gland
Hair bulb
Sensory nerve fibers
Piloerector muscle
Lamellar (pacinian) corpuscle (pressure receptor)

Hairs
Sweat pores
Epidermis
Dermis
Hypodermis (subcutaneous fat)
Merocrine sweat gland
Cutaneous blood vessels
Motor nerve fibers

Figure 6.1
The Skin and Subcutaneous Tissue

• Skin is body’s largest and heaviest organ
  – Covers 1.5 to 2.0 m²; composes 15% of body weight

• Layers
  – Epidermis: stratified squamous epithelium
  – Dermis: deeper connective tissue layer
  – Hypodermis—connective tissue layer below dermis (not part of skin, but associated with it)

• Skin thickness ranges from 0.5 to 6 mm
  – Thick skin covers front of hands, bottoms of feet
    • Has sweat glands, but no hair follicles or sebaceous (oil) glands
    • Epidermis 0.5 mm thick
  – Thin skin covers rest of the body
    • Possesses hair follicles, sebaceous glands, and sweat glands
    • Epidermis about 0.1 mm thick
Functions of the Skin

- **Resistance to trauma and infection**
  - Keratin
  - Dermacidin and defensins
  - Acid mantle
- **Other barrier functions**
  - Water
  - UV radiation
  - Harmful chemicals
- **Vitamin D synthesis**
  - Skin carries out first step
  - Liver and kidneys complete process

Figure 6.2a
Functions of the Skin

• **Sensation**
  – Skin is an extensive sense organ
  – Receptors for temperature, touch, pain, and more

• **Thermoregulation**
  – Thermoreceptors
  – Vasoconstriction/vasodilation
  – Perspiration

• **Nonverbal communication**
  – Facial expression
  – Importance in social acceptance and self image
The Epidermis

- **Epidermis**—keratinized stratified squamous epithelium
  - Includes dead cells at skin surface packed with tough **keratin** protein
  - Lacks blood vessels
    - Depends on the diffusion of nutrients from underlying connective tissue
  - Contains sparse nerve endings for touch and pain
Cells of the Epidermis

• Five epidermal cell types
  – Stem cells
    • Undifferentiated cells that give rise to keratinocytes
    • In deepest layer of epidermis (stratum basale)
  – Keratinocytes
    • Great majority of epidermal cells
    • Synthesize keratin
  – Melanocytes
    • Synthesize pigment melanin that shields DNA from ultraviolet radiation
    • Occur only in stratum basale but have branched processes that spread among keratinocytes and distribute melanin
Cells of the Epidermis

(Continued)

– **Tactile cells**
  • Touch receptor cells associated with dermal nerve fibers
  • In basal layer of epidermis

– **Dendritic cells**
  • Macrophages originating in bone marrow that guard against pathogens
  • Found in stratum spinosum and granulosum
The Epidermis

Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Stratum basale
Dermis
Sweat pore
Exfoliating keratinocytes
Dead keratinocytes
Sweat duct
Living keratinocytes
Dendritic cell
Tactile cell
Melanocyte
Stem cell
Dermal papilla
Tactile nerve fiber
Dermal blood vessels
Layers of the Epidermis

- Thin skin contains four strata; thick skin contains five strata

- **Stratum basale** (deepest epidermal layer)
  - A *single layer* of stem cells and keratinocytes resting on the basement membrane
  - Stem cells divide and give rise to keratinocytes that migrate toward skin surface to replace lost cells
  - Also contains a few melanocytes and tactile cells

- **Stratum spinosum**
  - Several layers of keratinocytes joined together by desmosomes and tight junctions
  - Named for appearance of cells after histological preparation (spiny)
  - Also contains some dendritic cells
Layers of the Epidermis

(Continued)

- **Stratum granulosum**
  - Three to five layers of flat keratinocytes
  - Cells contain dark-staining **keratohyalin granules**

- **Stratum lucidum**
  - Thin, pale layer found **only in thick skin**
  - Keratinocytes packed with clear protein **eleidin**

- **Stratum corneum (surface layer)**
  - Several layers (up to 30) of dead, scaly, keratinized cells
  - Resists abrasion, penetration, water loss
The Life History of a Keratinocyte

- **Keratinocytes** are produced by mitosis of stem cells in stratum basale or mitosis of keratinocytes in deepest part of stratum spinosum
  - Mitosis requires abundant oxygen and nutrients, so once cells migrate away from blood vessels of the dermis, mitosis cannot occur
- **New keratinocytes push older ones toward the surface**
- **Over time, keratinocytes flatten, produce more keratin and membrane-coating vesicles**
- In **30 to 40 days** a keratinocyte makes its way to the skin surface and flakes off (exfoliates) as dander
  - Slower in old age
  - Faster in injured or stressed skin
    - **Calluses** or **corns**—thick accumulations of dead keratinocytes on hands or feet
The Life History of a Keratinocyte

- Four important events occur in stratum granulosum
  - Keratohyalin granules release filaggrin—a protein that binds keratin into tough bundles
  - Cells produce tough envelope proteins beneath their membranes
  - Membrane-coating vesicles release lipid mixture that spreads out over cell surface and waterproofs it
  - Keratinocytes’ organelles degenerate and the cells die

- Epidermal water barrier
  - Water retention is fostered by tight junctions between skin cells and the waterproofing that occurs in the stratum granulosum
    - Helps prevent dehydration
    - Does not prevent the absorption of water by the stratum corneum when we soak in a bath (“prune fingers”)
The Dermis

- **Dermis**—connective tissue layer beneath epidermis
  - Ranges from 0.2 mm (eyelids) to 4 mm (palms, soles)
  - Composed mainly of collagen
  - Well supplied with blood vessels, sweat glands, sebaceous glands, and nerve endings
  - Houses hair follicles and nail roots
  - Is the tissue of the facial skin to which skeletal muscles attach and cause facial expressions of emotion
  - Has a wavy, conspicuous boundary with the superficial epidermis
    - **Dermal papillae** are upward, finger-like extensions of dermis
    - **Epidermal ridges** are downward waves of epidermis
    - Prominent waves on fingers produce **friction ridges** of fingerprints
The Dermis

- **Papillary layer**—superficial zone of dermis
  - Thin zone of areolar tissue in and near the dermal papilla
  - Allows for mobility of leukocytes and other defense cells
  - Rich in small blood vessels

- **Reticular layer**—deeper and thicker layer of dermis
  - Consists of dense, irregular connective tissue
  - **Stretch marks (striae):** tears in the collagen fibers caused by stretching of the skin due to pregnancy or obesity
Figure 6.5
The Hypodermis

- **Hypodermis**
  - Subcutaneous tissue
  - Has more areolar and adipose than dermis has
  - Pads body and binds skin to underlying tissues
  - Common site of drug injection since it has many blood vessels

- **Subcutaneous fat**
  - Energy reservoir
  - Thermal insulation
  - Thicker in women
  - Thinner in infants, elderly
Skin Color

- **Melanin**—most significant factor in skin color
  - Produced by melanocytes, accumulates in keratinocytes
  - Two forms of the pigment:
    - **Eumelanin**—brownish black
    - **Pheomelanin**—reddish yellow (sulfur-containing)

- People of different skin colors have the **same number of melanocytes**
  - **Darker skinned people**
    - Produce greater quantities of melanin
    - Melanin breaks down more slowly
    - Melanin granules more spread out in keratinocytes
    - Melanized cells seen throughout the epidermis
  - **Lighter skinned people**
    - Melanin clumped near keratinocyte nucleus
    - Little melanin seen beyond stratum basale
Skin Color

Figure 6.6a,b

(a) Dark skin
(b) Light skin

Copyright © McGraw-Hill Education. Permission required for reproduction or display.
Skin Color

- **Exposure to UV light stimulates melanin secretion and darkens skin**
  - This color fades as melanin is degraded and old cells are exfoliated

- **Other pigments can influence skin color**
  - **Hemoglobin**—pigment in red blood cells
    - Adds reddish to pinkish hue to skin
  - **Carotene**—yellow pigment acquired from egg yolks and yellow/orange vegetables
    - Concentrates in stratum corneum and subcutaneous fat
Skin Color

• Colors of diagnostic value
  – Cyanosis—blueness due to oxygen deficiency
  – Erythema—redness due to increased blood flow to skin
  – Pallor—paleness due to decreased blood flow to skin
  – Albinism—milky white skin and blue-gray eyes due to genetic lack of melanin synthesizing enzyme
  – Jaundice—yellowing due to bilirubin in blood (can be caused by compromised liver function)
  – Hematoma—bruising (clotted blood under skin)
The Evolution of Skin Color

• Variations in skin color result from multiple evolutionary selection pressures, especially differences in exposure to UV light (UV accounts for up to 77% of skin tone variation)

• UV light has both harmful and beneficial effects
  – Adversely: it causes skin cancer, breaks down folic acid
  – Beneficially: it stimulates vitamin D synthesis

• Populations that evolved in the tropics have well-melanized skin to protect against excessive UV
The Evolution of Skin Color

- Populations that evolved in far northern and southern latitudes (weak sun) have light skin to allow adequate UV.
- Populations that evolved at high altitudes or dry climates (less UV filtering) also are darker skinned.
- Importance of vitamin D for calcium (crucial for pregnancy, lactation) might explain why women are lighter skinned than men.
The Evolution of Skin Color

- Other factors complicate the association between UV exposure and skin tone
  - Migration, cultural differences in clothing, and shelter
  - Intermarriage of people of different geographic ancestries
  - Sexual selection: a preference in mate choice for partners of light or dark complexion
Skin Markings

• **Friction ridges**—markings on the fingertips that leave oily fingerprints on surfaces we touch
  – Everyone has a unique pattern formed during fetal development that remains unchanged throughout life
  – Not even identical twins have identical fingerprints
  – Allow manipulation of small objects

• **Flexion lines (flexion creases)**—lines on the flexor surfaces of the digits, palms, wrists, elbows
  – Mark sites where skin folds during flexion of joints
  – Skin bound to deeper tissues along these lines
Skin Markings

• **Freckles and moles**—tan to black aggregations of melanocytes
  – **Freckles**—flat, melanized patches
  – **Moles (nevi)**—elevated, melanized patches often with hair
    • Moles should be watched for changes in color, diameter, or contour that may suggest cancer

• **Hemangiomas (birthmarks)**—patches of discolored skin caused by benign tumors of dermal capillaries
  – Some disappear in childhood, others last for life
  – Capillary hemangiomas, cavernous hemangiomas, port-wine stain
Hair and Nails

• Expected Learning Outcomes
  – Distinguish between three types of hair.
  – Describe the histology of a hair and its follicle.
  – Discuss some theories of the purposes served by various kinds of hair.
  – Describe the structure and function of nails.
Hair and Nails

- Hair, nails, and cutaneous glands are **accessory organs (appendages)** of the skin.

- **Hair and nails** are composed of mostly dead, keratinized cells.
  - Pliable **soft keratin** makes up stratum corneum of skin.
  - Compact **hard keratin** makes up hair and nails.
    - Tougher and more compact due to numerous cross-linkages between keratin molecules.
Hair

- **Pilus**—another name for a hair; **pili**—plural of *pilus*
- **Hair**—a slender filament of keratinized cells growing from a tube in the skin called a hair follicle
- **Hair covers most of the body**
  - Hair does not cover: palms, soles; palmar, plantar, and lateral surfaces and distal segments of fingers and toes; lips, nipples, and parts of genitals
  - Limbs and trunk have 55 to 70 hairs per cm$^2$
    - Face has about 10 times as many
  - 100,000 hairs on an average person’s scalp
- Differences in hairiness across individuals is mainly due to differences in texture and pigment of hair
Hair

• Three types of hair
  – **Lanugo**: fine, downy, unpigmented hair that appears on the fetus in the last 3 months of development
  – **Vellus**: fine, pale hair that replaces lanugo by time of birth
    • Two-thirds of the hair of women
    • One-tenth of the hair of men
    • All of hair of children except eyebrows, eyelashes, and hair of the scalp
  – **Terminal**: longer, coarser, and more heavily pigmented
    • Forms eyebrows, eyelashes, and the hair of the scalp
    • After puberty, forms the axillary and pubic hair
    • Male facial hair and some of the hair on the trunk and limbs
• Hair is divisible into three zones along its length
  – **Bulb:** a swelling at the base where hair originates in dermis or hypodermis
    • Only living hair cells are in or near bulb
  – **Root:** the remainder of the hair in the follicle
  – **Shaft:** the portion above the skin surface

Figure 6.7a
Structure of the Hair and Follicle

- **Dermal papilla**—bud of vascular connective tissue encased by bulb
  - Only source of nutrition for hair

- **Hair matrix**—region of mitotically active cells immediately above papilla
  - Hair’s **growth center**
Structure of the Hair and Follicle

• Three layers of the hair in cross section
  – Medulla
    • Core of loosely arranged cells and air spaces
  – Cortex
    • Constitutes bulk of the hair
    • Consists of several layers of elongated keratinized cells
  – Cuticle
    • Composed of multiple layers of very thin, scaly cells that overlap each other
    • Free edges directed upward
Structure of the Hair and Follicle

- **Follicle**—diagonal tube that extends into dermis and possibly hypodermis
  - **Epithelial root sheath**
    - Extension of the epidermis lying adjacent to hair root
    - Widens at deep end into **bulge**—source of stem cells for follicle growth
  - **Connective tissue root sheath**
    - Derived from dermis but a bit denser
    - Surrounds epithelial root sheath

- **Hair receptors**—sensory nerve fibers entwining follicles

- **Piloerector muscle** (arrector pili)—smooth muscle attaching follicle to dermis
  - Contracts to make hair stand on end (goose bumps)
Hair Texture and Color

• **Texture**—related to cross-sectional shape of hair
  – **Straight hair** is round
  – **Wavy hair** is oval
  – **Curly hair** is relatively flat

• **Color**—due to pigment granules in the cells of the cortex
  – **Brown** and **black hair** is rich in eumelanin
  – **Red hair** has high concentration of pheomelanin
  – **Blond hair** has an intermediate amount of pheomelanin and very little eumelanin
  – **Gray** and **white hair** have little or no melanin
    • Air present in medulla
Figure 6.8

Hair Texture and Color
Hair Growth and Loss

• Three stages of hair cycle
  – **Anagen**: growth stage
    • 90% of scalp follicles at a given time
    • Stem cells multiply
    • Root sheath cells above papilla form hair cells of hair matrix
    • Hair cells make keratin and die as they are pushed upward
  – **Catagen**: degeneration stage
    • Mitosis in hair matrix ceases and sheath cells below bulge die
    • Base of hair keratinizes into a hard club—**club hair**
      – Easily pulled out by brushing
  – **Telogen**: resting stage
    • When papilla reaches the bulge
Anagen (early) 
(Growing phase, 6–8 years) 
Stem cells multiply and follicle grows deeper into dermis; hair matrix cells multiply and keratinize, causing hair to grow upward; old club hair may persist temporarily alongside newly growing hair.

Anagen (mature) 

Catagen 
(Degenerative phase, 2–3 weeks) 
Hair growth ceases; hair bulb keratinizes and forms club hair; lower follicle degenerates.

Telogen 
(Resting phase, 1–3 months) 
Dermal papilla has ascended to level of bulge; club hair falls out, usually in telogen or next anagen.

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Figure 6.9
Hair Growth and Loss

• We lose about 50-100 hairs daily
  – A club hair may fall out during catagen or telogen or be pushed out in the next anagen phase
  – In young adults, scalp follicles spend 6–8 years in anagen, 2–3 weeks in catagen, 1–2 months in telogen

• Hair growth—scalp hairs grow 1 mm per 3 days

• Alopecia—thinning of the hair or baldness

• Pattern baldness—hair lost from select regions
  – Baldness allele is dominant in males and expressed when testosterone levels are high
  – Testosterone causes terminal hair on top of scalp to be replaced by vellus hair

• Hirsutism—excessive or undesirable hairiness in areas that are not usually hairy
Functions of Hair

• **Most hair on trunk and limbs is vestigial**
  – Has little present function but kept ancestors warm
• **Hair receptors alert us of parasites crawling on skin**
• **Scalp retains heat and protects against sunburn**
• **Pubic and axillary hair signify sexual maturity and aid in transmission of sexual scents**
• **Guard hairs (vibrissae)**
  – Guard nostrils and ear canals
• **Eyelashes and eyebrows**
  – Nonverbal communication
Nails

- **Fingernails and toenails**—clear, hard derivatives of stratum corneum
  - Composed of thin, dead cells packed with hard keratin

- **Functions:**
  - Improve grooming, picking apart food, other manipulations
  - Provide a counterforce to enhance sensitivity of fleshy fingertips to tiny objects

- **Nail plate**—hard part of the nail
  - **Free edge:** overhangs the fingertip
  - **Nail body:** visible attached part of nail
  - **Nail root:** extends proximally under overlying skin
Figure 6.10

Nails

- Free edge
- Nail body
- Nail groove
- Nail fold
- Lunule
- Eponychium (cuticle)
- Nail plate
- Eponychium
- Nail root
- Nail fold
- Nail bed
- Nail matrix
Nails

- **Nail fold**—surrounding skin rising above nail
- **Nail groove**—separates nail fold from nail plate
- **Nail bed**—skin underlying the nail plate
  - **Hyponychium**—epidermis of the nail bed
- **Nail matrix**—growth zone (mitotic) of thickened stratum basale at proximal end of nail
  - 1 mm per week in fingernails, slightly slower in toenails
  - **Lunule**—opaque white crescent at proximal end of nail due to thickness of matrix
- **Eponychium (cuticle)**—narrow zone of dead skin overhanging proximal end of nail
Cutaneous Glands

• Expected Learning Outcomes
  – Name two types of sweat glands, and describe the structure and function of each.
  – Describe the location, structure, and function of sebaceous and ceruminous glands.
  – Discuss the distinction between breasts and mammary glands, and explain their respective functions.
The skin has five types of glands: merocrine sweat glands, apocrine sweat glands, sebaceous glands, ceruminous glands, and mammary glands.
Sweat Glands

- Two kinds of sweat (sudoriferous) glands: apocrine and merocrine
  - Apocrine sweat glands
    - Locations: groin, anal region, axilla, areola, beard area in men
      - Inactive until puberty
    - Ducts lead to nearby hair follicles
    - Produce sweat that is milky and contains fatty acids
    - Respond to stress and sexual stimulation
      - Believed to secrete pheromones—chemicals that can influence behavior of others
    - Bromhidrosis—disagreeable body odor produced by bacterial action on sweat from apocrine glands
Sweat Glands

(Continued)

- **Merocrine (eccrine) sweat glands**
  - Most numerous skin glands—3 to 4 million in adult skin
    - Especially dense on palms, soles, and forehead
  - Simple tubular glands
  - Watery perspiration that helps cool the body

- **Myoepithelial cells**—contract in response to stimulation by sympathetic nervous system and squeeze perspiration up the duct
  - Found in both apocrine and merocrine glands
Sweat Glands

- **Sweat**—begins as a protein-free filtrate of blood plasma produced by deep secretory portion of gland
  - Some sodium chloride and other small solutes remain in the sweat
    - Some sodium chloride reabsorbed by duct
  - Some drugs are excreted in sweat
  - On average, 99% water, with pH range of 4 to 6
    - **Acid mantle**—inhibits bacterial growth
- **Insensible perspiration**—500 mL/day
  - Does not produce visible wetness of skin
- **Diaphoresis**—sweating with wetness of the skin
  - Exercise—may lose 1 L sweat per hour
Sebaceous Glands

• Sebaceous glands are flask-shaped and have short ducts opening into hair follicles
• Holocrine secretion style
• **Sebum**—oily secretion of sebaceous glands
  – Keeps skin and hair from becoming dry, brittle, and cracked
  – Lanolin—sheep sebum
Ceruminous Glands

• Ceruminous glands are simple, coiled, tubular glands in **external ear canal**
• Their secretion combines with sebum and dead epithelial cells to form **earwax** (cerumen)
  – Keeps eardrum pliable
  – Waterproofs the canal
  – Kills bacteria
  – Makes guard hairs of ear sticky to help block foreign particles from entering auditory canal
Mammary Glands

• **Mammary glands**—milk-producing glands that develop only during pregnancy and lactation
  – Modified apocrine sweat glands
  – Rich secretion released through ducts opening at nipple

• **Mammary ridges or milk lines**
  – Two rows of mammary glands in most mammals
  – Primates kept only two glands, but a few people have additional nipples along the milk line (polythelia)
# Cutaneous Glands

TABLE 6.2

<table>
<thead>
<tr>
<th>Gland Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudoriferous glands</td>
<td>Sweat glands</td>
</tr>
<tr>
<td>Merocrine glands</td>
<td>Sweat glands that function in evaporative cooling; widely distributed over the body surface; open by ducts onto the skin surface</td>
</tr>
<tr>
<td>Apocrine glands</td>
<td>Sweat glands that function as scent glands; found in the regions covered by the pubic, axillary, and male facial hair; open by ducts into hair follicles</td>
</tr>
<tr>
<td>Sebaceous glands</td>
<td>Oil glands associated with hair follicles</td>
</tr>
<tr>
<td>Ceruminous glands</td>
<td>Glands of the ear canal that contribute to the cerumen (earwax)</td>
</tr>
<tr>
<td>Mammary glands</td>
<td>Milk-producing glands located in the breasts</td>
</tr>
</tbody>
</table>
Skin Disorders

• **Expected Learning Outcomes**
  – Describe the three most common forms of skin cancer.
  – Describe the three classes of burns and the priorities in burn treatment.
Skin Cancer

• **Skin cancer**—most cases caused by UV rays of the sun damaging skin cell DNA
  – Most often on the head, neck, and hands
  – Most common in fair-skinned people and the elderly
  – One of the most common, easily treated cancers
  – Has one of the highest survival rates if detected and treated early

• **Three types** of skin cancer named for the epidermal cells in which they originate
  – Basal cell carcinoma, squamous cell carcinoma, and malignant melanoma
Skin Cancer

Copyright © McGraw-Hill Education. Permission required for reproduction or display.

- **Basal cell carcinoma**
  - Most common type
  - Least dangerous because it seldom metastasizes
  - Forms from cells in stratum basale
  - Lesion is small, shiny bump with central depression and beaded edges

Figure 6.12a
Squamous cell carcinoma
- Arises from keratinocytes of stratum spinosum
- Lesions usually on scalp, ears, lower lip, or back of the hand
- Have raised, reddened, scaly appearance later forming a concave ulcer
- Chance of recovery good with early detection and surgical removal
- Tends to metastasize to lymph nodes and may become lethal
Skin Cancer

- **Malignant melanoma**
  - Skin cancer that arises from melanocytes
  - Less than 5% of skin cancers, but most deadly form
  - Can be successfully removed if caught early, but if it metastasizes it is usually fatal
  - Greatest risk factor: familial history of malignant melanoma
  - Highest incidence in men, redheads, and people who had severe sunburn as a child

(c) Melanoma

Figure 6.12c

(c) ©James Stevenson/SPL/Science Source
Burns

- **Burns**—leading cause of accidental death
  - Fires, kitchen spills, sunlight, ionizing radiation, strong acids or bases, or electrical shock
  - Deaths result primarily from fluid loss, infection, and toxic effects of **eschar** (burned, dead tissue)
  - **Debridement**: removal of eschar

- **Classified according to depth of tissue involvement**
  - **First-degree burn**: involves only epidermis
    - Redness, slight edema, and pain
    - Heals in days
  - **Second-degree burn**: partial-thickness burn; involves part of dermis
    - May appear red, tan, or white; blistered and painful
    - Two weeks to several months to heal and may leave scars
  - **Third-degree burn**: full-thickness burn; involves epidermis, all of dermis, and often some deeper tissues
    - Often requires skin grafts
    - Needs fluid replacement, infection control, supplemental nutrition
Degrees of Burn Injuries

(a) First degree

(b) Second degree

(c) Third degree

Figure 6.13
UV Rays and Sunscreen

- **UVA and UVB** are improperly called “tanning rays” and “burning rays”
  - Both thought to initiate skin cancer
  - No such thing as a “healthy tan”
- **Sunscreens** protect you from sunburn but unsure if they provide protection against cancer
  - High SPF numbers can give false sense of security
  - Chemical in sunscreen damage DNA and generate harmful free radicals
Skin Grafts and Artificial Skin

• Third-degree burns often require skin grafts

• Graft options
  – **Autograft**: tissue taken from another location on the same person’s body
    • **Split-skin graft**—taking epidermis and part of the dermis from an undamaged area such as the thigh or buttocks and grafting it into the burned area
  – **Isograft**: skin from identical twin

• **Temporary grafts (immune system rejection)**
  – **Homograft (allograft)**: from unrelated person
  – **Heterograft (xenograft)**: from another species
  – Amnion from afterbirth
  – Artificial skin from silicone and collagen