

BIOL 1030 – TOPIC 16 LECTURE NOTES
Topic 17: Integumentary System (Ch. 40)

- I. Structures – skin, scales or feathers or hair, nails, sweat glands, **sebaceous glands**
- II. Functions – protection, stimulus reception, temperature regulation, energy storage, more
- III. skin – (focus on mammalian skin)
 - A. **epidermis** (outermost layer) – 10-30 cells thick
 1. stratified epithelial tissue
 2. in mammals, pores and ducts for sweat glands and hair filaments
 3. **stratum corneum** – dead, keratin-filled cells; shed continuously – functions mainly for protection
 - water loss or water entry barrier (**keratin** – a water-resistant protein)
 - chemicals or radiation (dead or dying cells take on most of the damage dished out by the environment) – pigmentation also used to absorb UV
 - physical stress – same idea, expose dead cells to the environment instead of living ones; extra layers deposited on areas exposed to large amounts of stress (pads – normally present; calluses – added as needed)
 - barrier to pathogen entry – hard for pathogens to penetrate unbroken skin
 4. **stratum spinosum** – intermediate layer where cells make keratin and are pushed to corneum
 5. **stratum basale** – base of epidermis; site of cell division where all epidermal cells are made; very active cell division (sometimes, stratum spinosum and stratum basale are grouped as the **stratum germinativum**)
 6. average human skin cell duration in stratum corneum is one month
 - B. **dermis** – 15-40x thicker than epidermis
 1. mostly loose connective tissue
 2. blood vessels – increase or decrease of blood flow used to regulate body temperature (also involves degree of exposure of skin to a heat source)
 3. nerves – serve for stimulus reception and response
 4. in mammals, hair follicles, sweat glands, and sebaceous (oil) glands
 5. holds skin together and supports epidermis
 - C. **subcutaneous tissue**
 1. mainly adipose tissue within loose connective tissue

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2. thickness varies depending on location (none in eyelids)
 3. serves for shock absorption, insulation, and food storage
 4. attaches skin to underlying structures (some do not consider it part of skin)
- D. other functions – sometimes, stretched skin is used to make wings (pterosaurs, bats)
- İÇ. scales, feathers, hair
- A. **scales** – tough, keratinized segments found on reptiles; typically shed as a unit
- B. **feathers** – exclusive to birds; modified scales; used for insulation and often for flight
- C. **hair**
1. keratin-filled filament exclusive to mammals (some analogous structures also called "hair", such as sensory hairs on bees, are not keratin-filled)
 2. produced by special cells in stratum basale
 3. **hair follicle** – place of hair formation; deep invagination of dermis filled with epidermal cells
 4. **hair shaft** – twisted filaments of keratin
 5. **arrector pili muscle** – used to raise hair shaft (response to cold, other stimuli)
 6. used for insulation, sensory reception; in some cases, defense (example: porcupine quills)
- Ç. nails – fingernails, toenails, claws, hooves
- A. platelike, keratinous, translucent structure
- B. consists of highly specialized epithelial cells that grow from a deep groove in the dermis of the skin at the base of the nail, forming the **nail plate**
- C. **nail bed** underlies nail plate and supports nail plate with nutrient and waste exchange
- D. cells at the front edge of the nail plate die and turn white as they lose contact with the nail bed
- E. chief functions are: protection of the digits, and when sharp as weapons or as tools for grabbing or manipulating objects
- Çİ. **sweat glands**
- A. glands that release mainly water to the skin surface
- B. occur only in mammals
- C. two types, **eccrine** and **apocrine**
- D. eccrine sweat glands
1. secrete water through pores directly to the skin surface

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2. secretion controlled by the sympathetic nervous system (non-voluntary)
 3. used for **evaporative cooling** of the body: evaporating water on skin removes heat
 - over most of body in many mammals (ex: horses, bears, humans)
 - mainly on pads of paws or lip margins in "panting" animals (ex: dogs, cats, cattle, sheep)
 - small mammals (such as rodents) often lack eccrine glands – cannot stand much water loss
 4. also secrete **lysozyme**, which digests bacterial cell walls
 5. humans: 2,000,000 to 5,000,000 eccrine glands, same # in men and women
 6. primates have concentrations of eccrine glands on the palms and soles – purpose is to keep these surfaces damp; damp hands and feet do not flake, remain more sensitive, and grip better if not too wet
- E. apocrine sweat glands
1. associated with and secrete into hair follicles
 2. include fatty substances in released material
 3. used to secrete pheromones by many mammals
 4. in humans, concentrated in underarm and genital regions
- F. specialized sweat glands – likely evolved from apocrine glands; include wax-secreting glands of the ear canal and mammary glands

ϷII. **sebaceous glands** – oil glands

- A. in mammals, empty into hair follicles (some of these lack a hair shaft and function essentially as duct for the sebaceous gland)
- B. secretion called **sebum**; a mixture of fats and cellular debris
- C. function(s) of sebum debated: keep skin flexible? reduce water loss? chemical weapon against pathogens (skin surface has pH between 3 and 5)? vestigial?