• Functions -
  - Prevents water loss
  - Sensory
  - Secretes
  - Coloration
  - Protection
  - Gas Exchange

Basic structure and development of skin is conserved among vertebrates

Epidermis
• General movement from stratum germinativum to stratum corneum

Keratin
• Two molecular types of keratin:
  - $\alpha$ keratin - skin and hair
  - $\beta$ keratin - feathers, claws
**Keratin**
- Keratin is further modified by binding other molecules to it
  - Phospholipids
  - Calcium

**Comparison of stratum corneum**
- Fish
- Amphibians
- Amniotes

**Skin derivatives**
- Teeth, bony scales, horny scales, feathers, hair are formed in skin
- Development formed from an interaction between dermis, epidermis and neural crest

**Skin coloration**
- Birds and mammals vs.
- Amphibians, Fish, Reptiles
**Skin coloration**

- **Chromatophores**
  - Neural crest origin
  - Dermis - fish, amphibians, reptiles
  - Penetrate into epidermis – mammals, birds

- **Erythrophores**
- **Xanthophores**
- **Iridophores**

- **Melanophores**
  - Cell can rearrange organelles with melanin granules – usually hormonal control.

**Structural coloration**

- Most cells living
- Unicellular glands

**Fish epidermis**

- Fig. 6-6
Fish epidermis

- Rare multicellular glands
  - hagfish slime gland
  - photophores

Fish epidermis

- Lamprey and hagfish “teeth”

Bone formation

- Endochondral

Bone formation

- Intramembranous
Fish dermis

- Bony scales arise from dermis (dermal bone)

Ostracoderm head shield

Fish dermis

- Bony scales – Vary in contributions from bone, dentine, enamel

Ganoid

Placoid

Fish dermis

- Loss of bony layer lead to more flexible ctenoid, cycloid scales
  - Scales form in epidermis folds

Derivatives of bony armor
**Amphibian epidermis**
- Thin stratum corneum - except toads
- Capillaries close to epidermis
- Mucus and poison glands

**Reptile epidermis**
- Horny scales
- Thicker stratum corneum
- Glands rare

**Reptile epidermis**
- Inner vs. outer generation of epidermis

**Reptile dermis**
- Dermal bone
  - Crocodile
  - Osteoderms
**Bird epidermis**

Feather anatomy
- barbs, barbules

**Bird epidermis and dermis**

- Uropygial gland - oil gland for feather management

**Mammal epidermis**

- Thick stratum corneum
- 3 glands
- Keratinized hair

Rare bone in skin

Fig. 6-11
**Mammal epidermis**

- Hair – develops differently from horny scales, feathers

**Mammal epidermal glands**

- Sebaceous - secrete at hair follicles – oil
- Apocrine sweat (scent)
- Eccrine sweat - usually at snout, paws

**Hair**

- Medulla
- Cortex
- Cuticle

**Scent glands**

- Sebaceous gland
- Apocrine gland
- Eccrine gland

- Hyena
- Sugar Glider
**Human skin vs. other mammals**

- Furry mammals cannot eliminate heat as easily
- Eccrine sweat evaporates quickly
- Gene variant for melanin as much as 1.2 mill.y ago – protects from sun after loss of fur

**Horns vs Antlers**

**Hair horns - Rhinoceros**

- Compacted hairlike keratin - attached to rough patch on nasal bone

**Baleen**

Calcium makes curved shape