**Mammals**

* Functions of Skin
  + *Protection* of underlying tissues and organs
  + *Excretion* of salts, water, and organic wastes (glands)
  + *Maintenance* of body temperature (insulation and evaporation)
  + *Production* of melanin
  + *Production* of keratin
  + *Synthesis* of vitamin D3
  + *Storage* of lipids
  + *Detection* of touch, pressure, pain, and temperature

Mammals generally have skin that conforms to the basic structure described previously, with the epidermal layers of the skin being especially thick in areas such as the soles and the palms of the feet, where proection is needed.   
**Hair** is the distinctive characteristic of mammals, and it provides insulation as well as some additional protection to the animal   
    - grow in folllicles derived from the stratum germinativum of the epidermus but are rooted in the dermis (Fig. 6.20)   
    - hair growth continues until the mitosis in the root stops - individuals in which mitosis completely stops at the hair root are usually the ones that go bald.   
The fine structure of an individual hair consists of three layers: medulla, cortex and cuticular scale (which contain a lot of keratin).  (Fig. 6.20).  Softer hairs (such as our fine body hairs) lack a medulla, whereas our scalp hair contains a medulla and is usually very strong.   
Modifications of hair include guard hairs (that protect the undercoat hair), quills (such as in hedgehogs and porcupines) and vibrissae (the tactile whiskers on the snouts of mammals).   
Other modifications of mammalian skin includes blubber, which is found in many cetaceans and marine mammals.  Blubber is a highly thickened subcutaneous fat layer that adds to the insulation of marine mammals and also acts as a food source for the body.

**Glands of the skin:**  Glands associated with the skin that help to protect the skin and its associatedd structures, aid in heat regulation, and give off scent.  Include:   
    - sebaceous glands which lubricate and waterproof hairs - special case in birds the uropygial gland located at the base of the tail which secretes a waxy substance that is used to waterproof and clean feathers.   
    - two types of sweat glands in mammals aid in heat regulation: eccrine and apocrine sweat glands   
    - eccrine sweat glands secrete a watery solution that assists in evaporative cooling on the entire body   
    - apocrine sweat glands have thicker secretions that contain more odor, and are sometimes modified into scent glands in some species to use for scent marking (dogs) or defense (skunks); also the wax gland, which secretes the wax in mammalian ears.   
    - the mammary gland (related to sebaceous glands) which contain fatty tissue in addition to secretory cells that produce milk; usually only become active under hormonal influences, such as the secretion of prolactin by the body that occurs in females during pregnancy and lactation.

**Nails, claws, hoofs, horns and antlers:** all are integumental derivatives.   
    - nails grow from the nail bed located in the epidermis at the distal part of the phalanges; the nail is higly cornified in ungulates whereas in clawed animals the nail is elongated and thickened for defense or predation   
    - horns are supported by a bony structure growing out from the skull; surrounding the bony core is a highly keratinized layer of the epidermis which is generally permanent   
    - antlers are not present throughout the year, and are shed during the non-breeding season; develop under a protective covering of skin (velvet), which is lost as the antlers mature   
    - rhinoceros horns are simply hairlike keratin fibers that are woven together without a bony core - similar to baleen in whales that is used for feeding

**Integument coloration - Pigment cells**   
Pigment cells (chromatophores) are derived from neural crest cells that break off from the ectoderm during neural tube formation and are usually found in the dermis   
    - in the epidermis of mammals and birds, the pigment cells are usually melanophores which contain the pigment melanin.  Melanin is red or blackish brown.  Melanophores in the epidermis are usually responsible for slow color change, such as that related to aging or seasonal changes.   
    - in groups other than mammals and birds the chromatophores are mostly in the dermis:   
    - melanophores are like those of the epidermis   
     iridophores have organelles that contain platelets of guanine pigment, which reflects or scatters light   
    - xanthophores and erythrophores have yellowish pteridine pigments and reddish carotenoid pigments   
    - dermal chromatophores are responsible for rapid, physiological color change.   
Coloration can be of many types, including **cryptic** (providing blend into the environment) and **aposematic** (warning coloriation, that occurs in some snakes)