Integumentary system(SKIN)

INTRODUCTION

- **The outer or external protective covering which envelops the entire surface of the body is known as skin or integument**
- **The integumentary system contributes to homeostasis by protecting the body and helping regulate body temperature.**
- **It also allows to sense pleasurable, painful, and other stimuli in our external environment.**
- **The integumentary system is composed of the skin, hair, oil and sweat glands, nails, and sensory receptors**

- **The skin is regarded as an important organ of the body because of a large number of its function**
- **Area – 2sqm**
- **Weight- 5 kg**
- **Total body weight – 16%**
- **Thickness – 1-2 mm**

Gross anatomy

- **Epidermis – superficial, thinner and composed of epithelial tissue**
- **Dermis – deep, thicker and composed of connective tissue**

- **Deep to the dermis, but not part of the skin, is the subcutaneous layer.**
- **Also called the hypodermis, this layer consists areolar and adipose tissues.**
- **The subcutaneous layer serves as a storage for fat and contains large blood vessels that supply the skin**

Pigmentation of skin

The color of skin is determine by a five pigments present at different level and places of the skin these are;

1 Melanin (brown)

2 Melanoid (Dark)

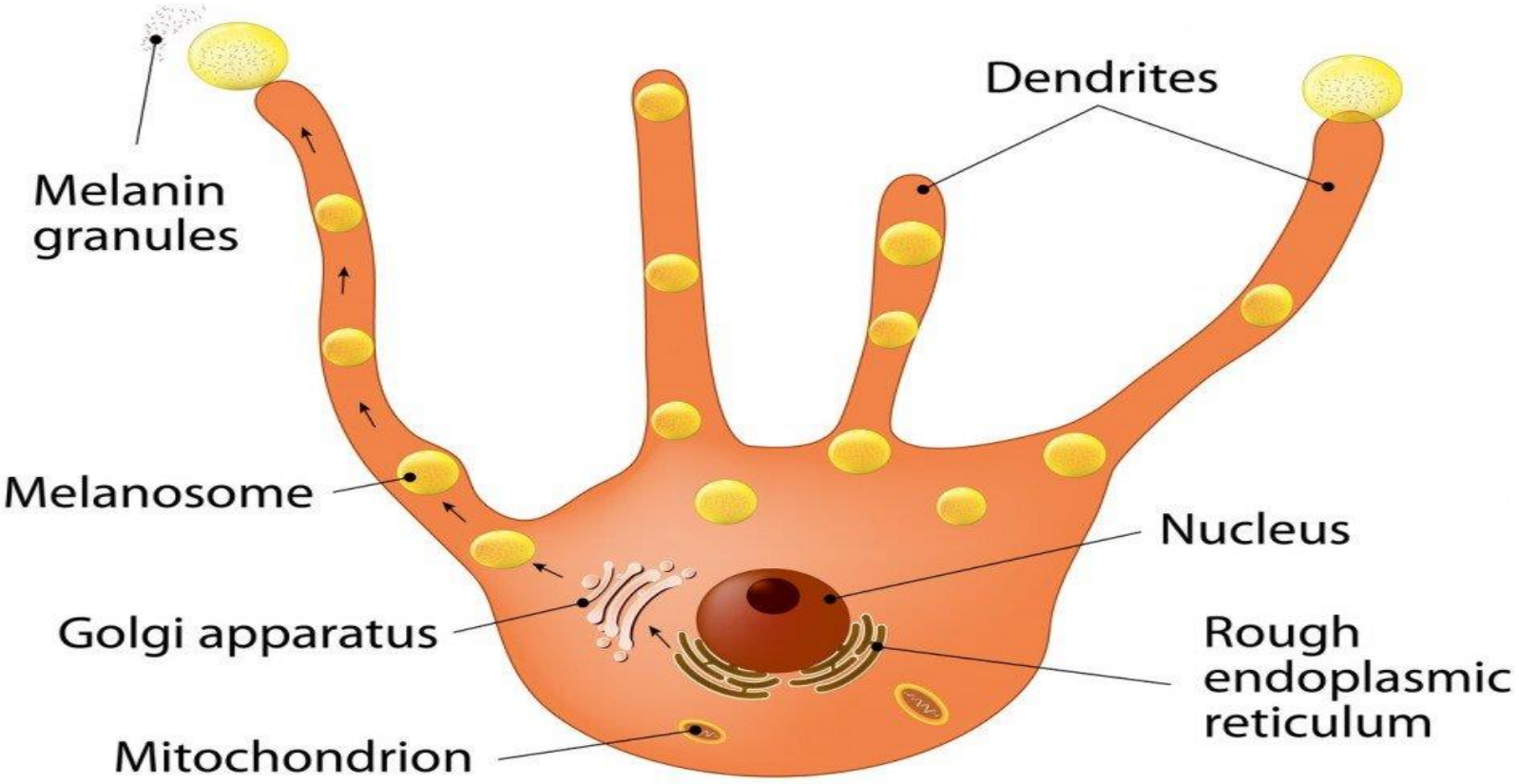
3 Carotene (yellow to orange)

4 Haemoglobin (purple)

5 Oxyhaemoglobin(red)

- **The amount of first three pigments vary with race, age, and part of the body**

MELANOCYTE


Dendrites
Melanin granules
Melanosome
Nucleus
Golgi apparatus
Rough endoplasmic reticulum
Mitochondrion

EPIDERMIS

- **The epidermis is a compound tissue keratinized, stratified squamous epithelium: the principal cells are called keratinocytes**

- **It contains four principal types of cells: keratinocytes, melanocytes, Langerhans cells, and Merkel cells**

Keratinocytes

- About 90% of epidermal cells are keratinocytes, which are arranged in four or five layers and produce the protein keratin.

- Keratin is a tough, fibrous protein that helps protect the skin and underlying tissues from heat, microbes, and chemicals.

Melanocytes cell

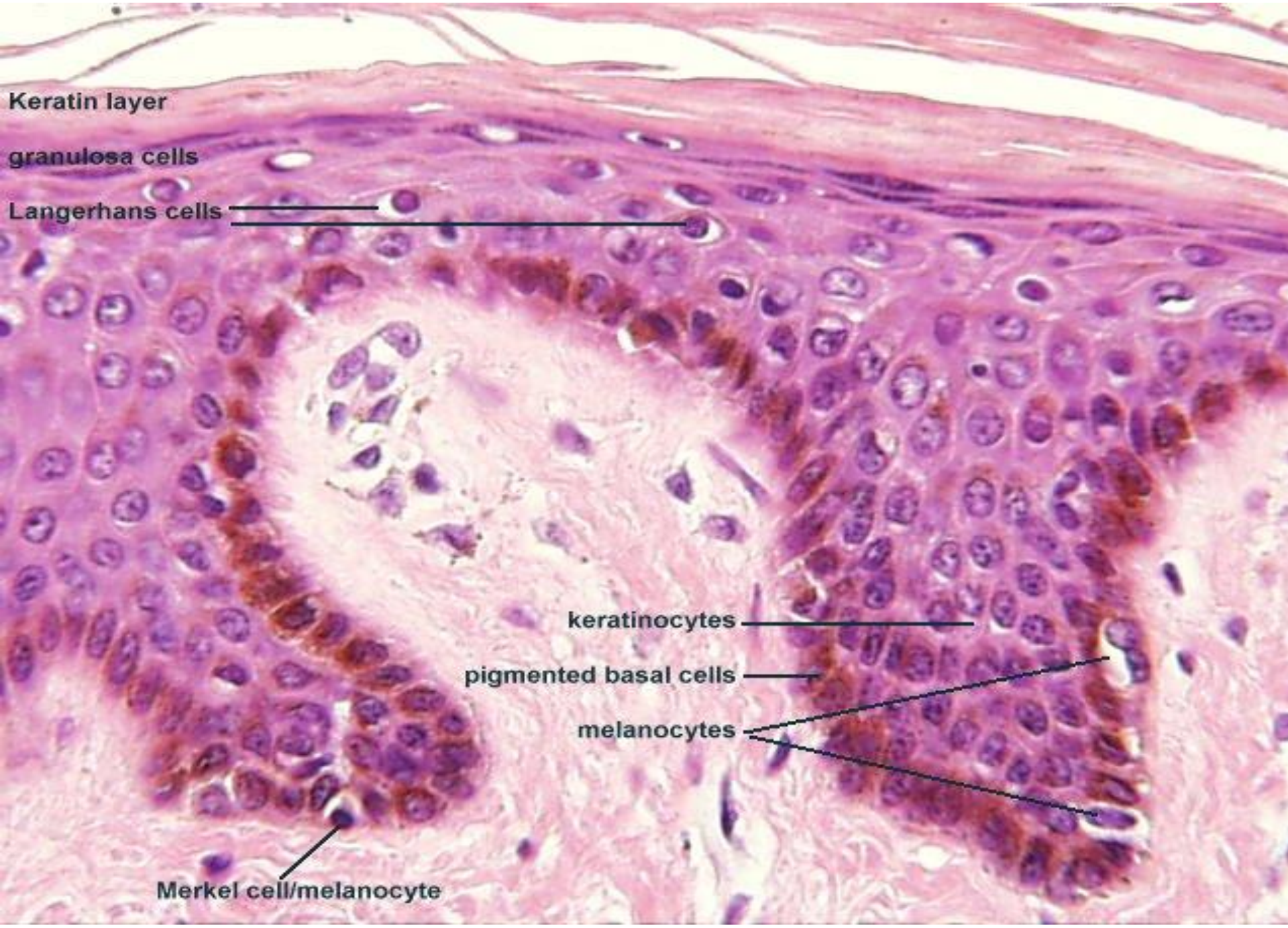
- About 8% of the epidermal cells are melanocytes, which develop from the ectoderm of a developing embryo and produce the pigment melanin

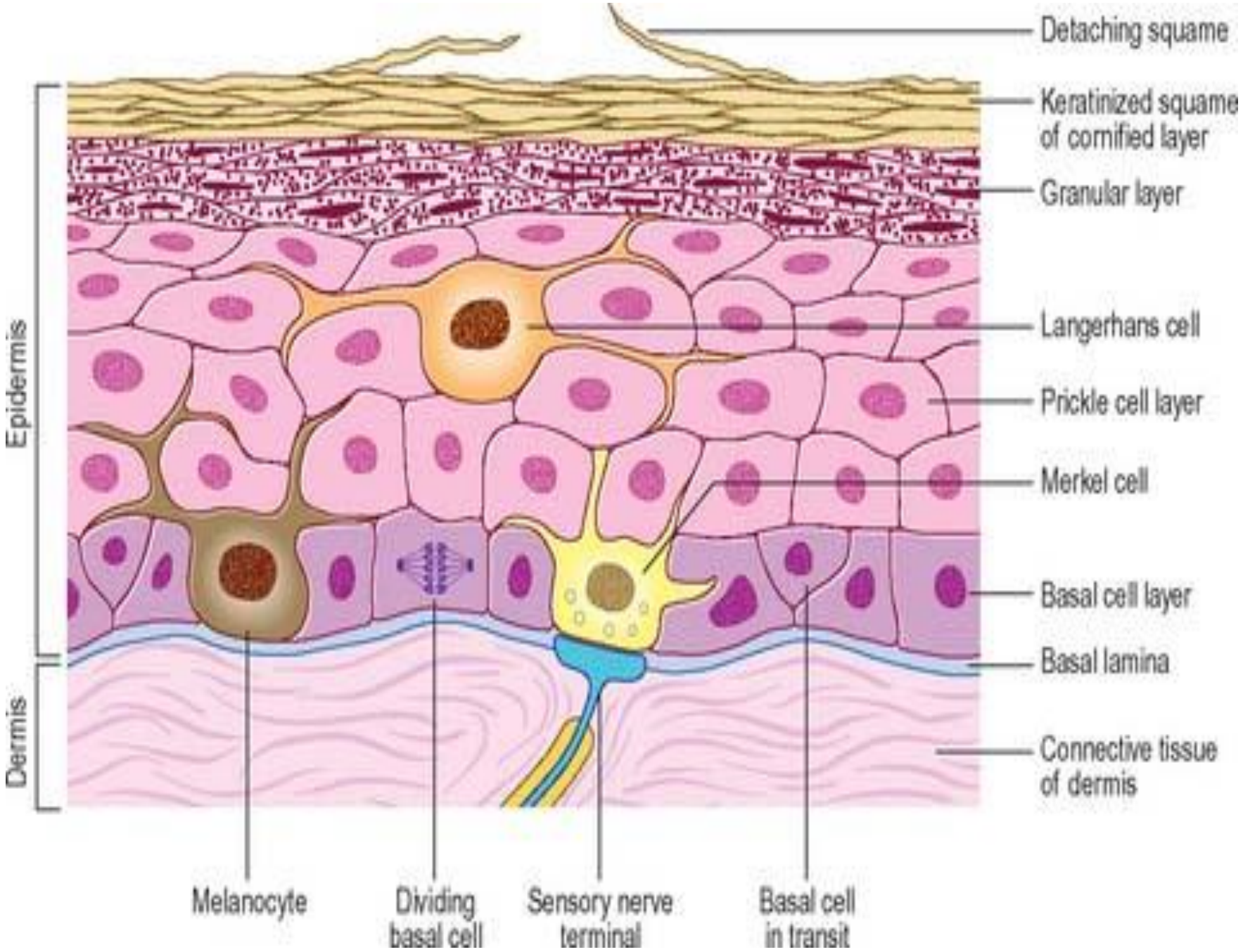
Langerhans cells

- Langerhans cells arise from red bone marrow and migrate to the epidermis
- Their role in the immune response is to help other cells of the immune system recognize an invading microbe and destroy it

Merkel cells

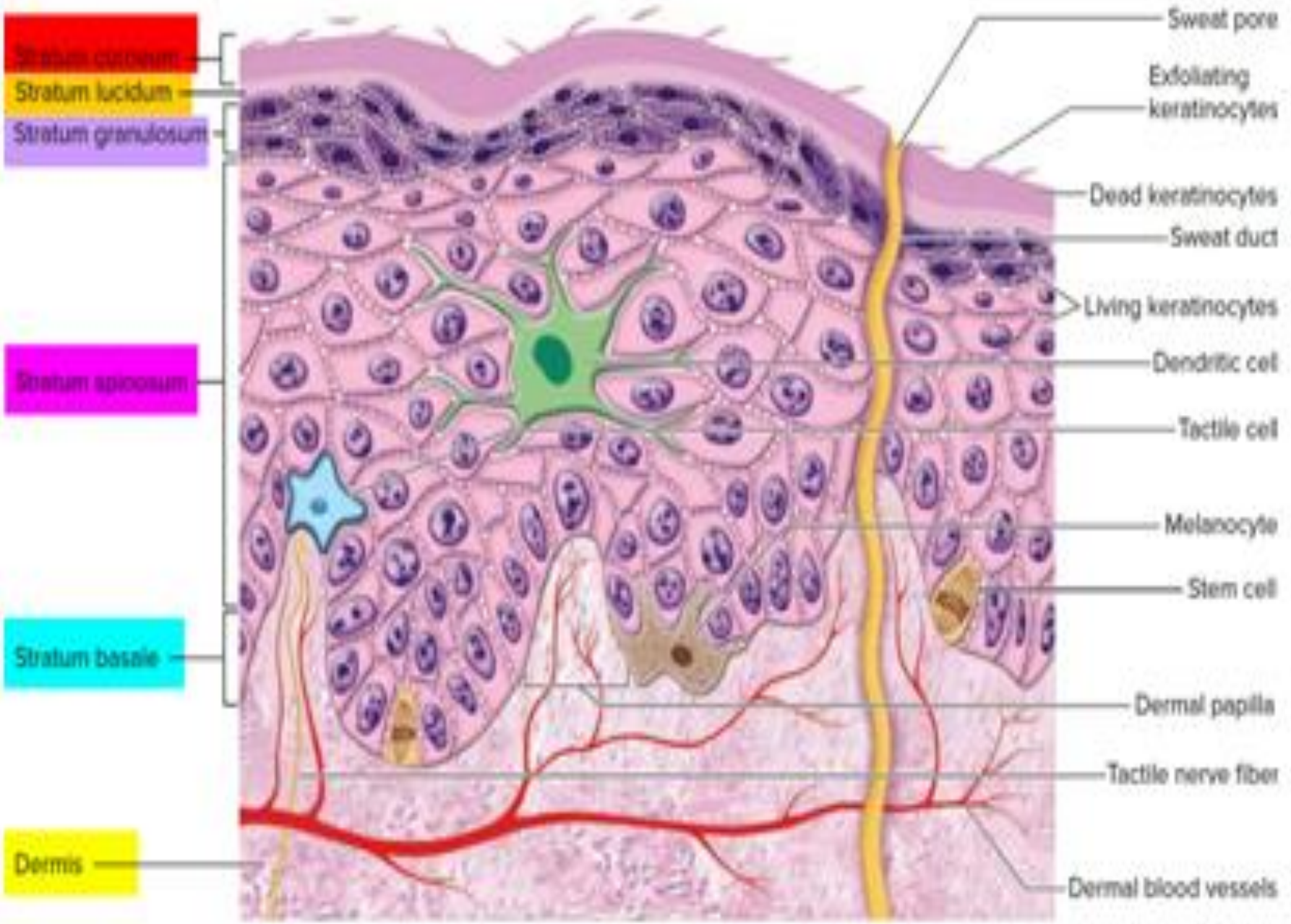
- **Merkel cells are the least numerous of the epidermal cells.**
- **They are located in the deepest layer of the epidermis, where they contact the flattened process of a sensory neuron (nerve cell), a structure called a Merkel (tactile) disc**


Keratin layer
granulosa cells
Langerhans cells
keratinocytes
pigmented basal cells
melanocytes
Merkel cell/melanocyte


Detaching squame
Keratinized squame of cornified layer
Granular layer
Langerhans cell
Prickle cell layer
Merkel cell
Basal cell layer
Basal lamina
Connective tissue of dermis
Epidermis
Dermis
Melanocyte
Dividing basal cell
Sensory nerve terminal
Basal cell in transit

The epidermis can be divided into a number of layers from deep to superficial as follows:

1. **Stratum basale- basal layer**
2. **Stratum spinosum- spinous or prickle cell layer**
3. **Stratum granulosum- granular layer**
4. **Stratum lucidum -clear layer**
5. **Stratum corneum- cornified layer**


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

Basal layer (STRATUM GERMINATIVUM)

- **The deepest layer of the epidermis is the stratum basale composed of a single row of cuboidal or columnar keratinocytes.**

- **Some cells in this layer are stem cells that undergo cell division to continually produce new keratinocytes.**

- **The cytoskeleton within keratinocytes of the stratum basale includes scattered intermediate filaments, called tonofilaments.**
- **The tonofilaments are composed of a protein that will form keratin in more superficial epidermal layers.**
- **The stratum basale is also known as the stratum germinativum to indicate its role in forming new cells.**

Stratum Spinosum

- **Stratum Spinosum Superficial to the stratum basale**
- **Stratum spinosum (thorn like), arranged in 8 to 10 layers of many-sided keratinocytes fitting closely together.**
- **Spiny projection in a prepared tissue section is a point where bundles of tonofilaments are inserting into a desmosome, tightly joining the cells to one another.**
- **This arrangement provides both strength and flexibility to the skin.**

Stratum Granulosum

- At about the middle of the epidermis
- Stratum granulosum (little grains) consists of three to five layers of flattened keratinocytes
- A distinctive feature of cells in this layer is the presence of darkly staining granules of a protein called keratohyalin
- Present in the keratinocytes are membrane enclosed lamellar granules which release a lipid-rich secretion

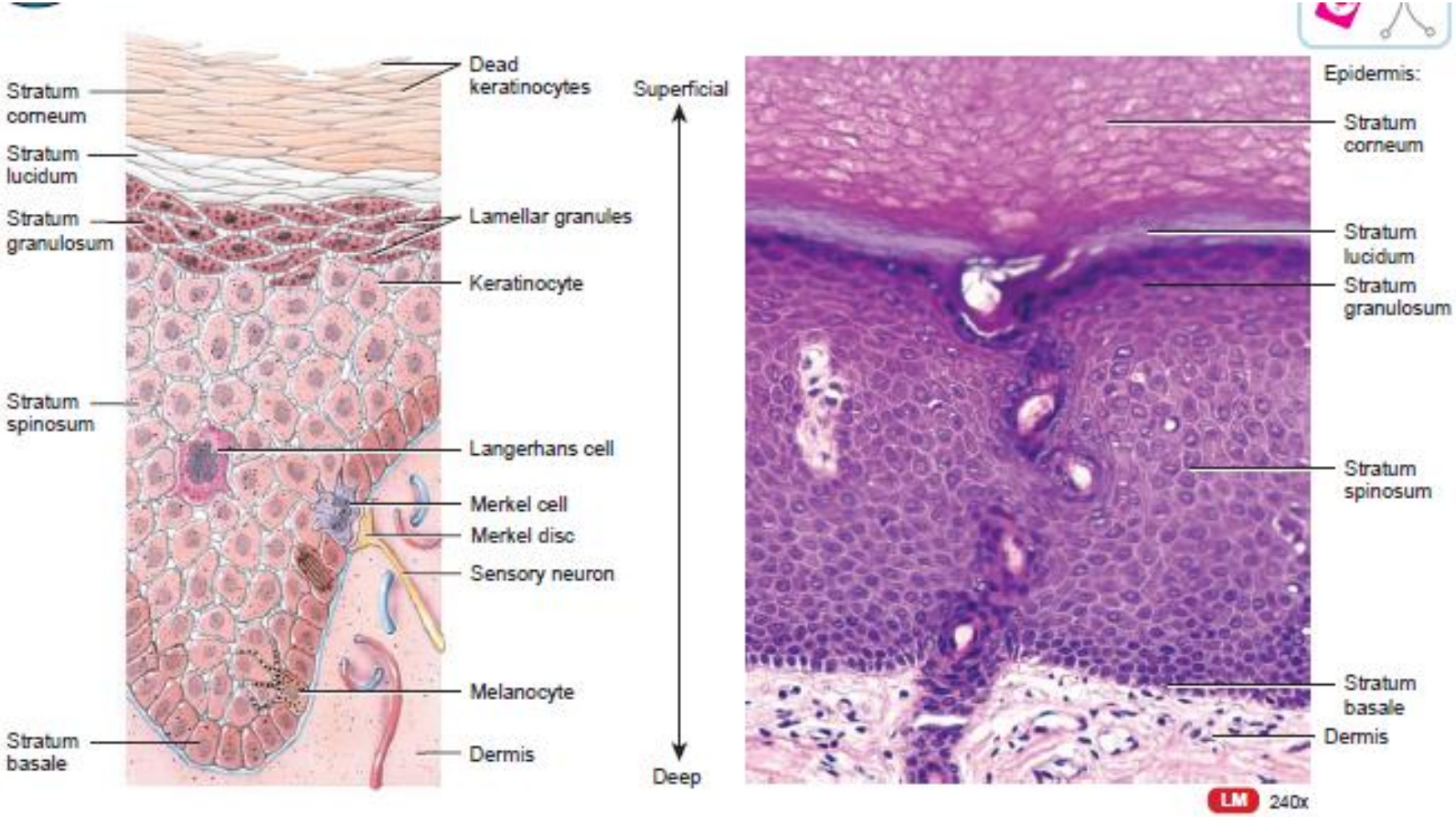
Stratum Lucidum

- **The stratum lucidum(clear) is present only in the thick skin of areas such as the finger tips, palms, and soles.**

- **It consists of three to five layers of flattened clear, dead keratinocytes that contain large amounts of keratin and thickened plasma membranes.**

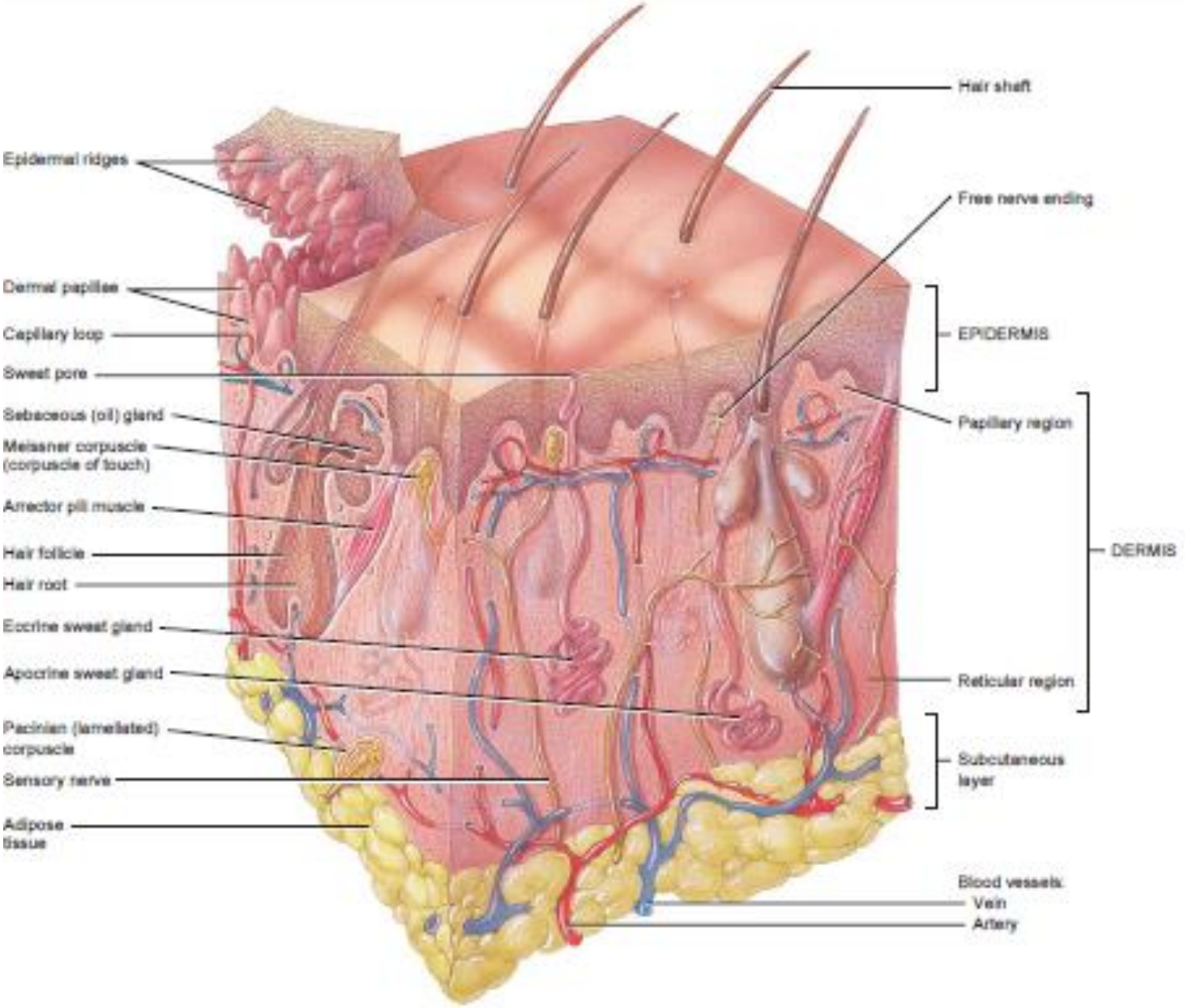
Stratum Corneum

- **The stratum corneum (horn or horny) consists on average of 25 to 30 layers of flattened dead keratinocytes.**
- **These cells are continuously shed and replaced by cells from the deeper strata.**
- **The interior of the cells contains mostly keratin. Between the cells are lipids from lamellar granules that help make this layer an effective water-repellent barrier.**
- **Its multiple layers of dead cells also help to protect deeper layers from injury and microbial invasion.**



(a) Four principal cell types in epidermis

(b) Photomicrograph of a portion of thick skin



(a) Sectional view of skin and subcutaneous layer

Dermis

- **The second, deeper part of the skin, the dermis, is composed of a strong connective tissue containing collagen and elastic fibers.**
- **This woven network of fibers has great tensile strength (resists pulling or stretching forces).**
- **Blood vessels, nerves, glands, and hair follicles (epithelial invaginations of the epidermis) are embedded in the dermal layer.**
- **Based on its tissue structure, the dermis can be divided into a superficial papillary region and a deeper reticular region.**

- **The papillary region makes up about one-fifth of the thickness of the total layer**
- **It consists of areolar connective tissue containing thin collagen and fine elastic fibers.**
- **Its surface area is greatly increased by dermal papillae, small, fingerlike structures that project into the undersurface of the epidermis.**
- **Some dermal papillae also contain tactile receptors called Meissner corpuscles or corpuscles of touch.**
- **Different free nerve endings initiate signals that give rise to sensations of warmth, coolness, pain, tickling, and itching.**

- **The reticular region (reticul-netlike), which is attached to the subcutaneous layer, consists of dense irregular connective tissue containing fibroblasts, bundles of collagen, and some coarse elastic fibers.**
- **The collagen fibers in the reticular region interlace in a netlike manner.**
- **A few adipose cells, hair follicles, nerves, sebaceous (oil) glands, and sweat glands occupy the spaces between fibers.**
- **The combination of collagen and elastic fibers in the reticular region provides the skin with strength, extensibility (ability to stretch), and elasticity (ability to return to original shape after stretching).**

Accessory structures of the skin

- **Hair, skin glands, and nails—develop from the embryonic epidermis.**

- **They have a host of important functions. For example, hair and nails protect the body, and sweat glands help regulate body temperature.**

Functions of the integumentary system

- **Thermoregulation,**
- **Storage of Blood,**
- **Protection,**
- **Cutaneous Sensations,**
- **Excretion and Absorption,**
- **Synthesis of Vitamin D**

THANK YOU