

THOMAS ADEWUMI UNIVERSITY

ANA 218: DEVELOPMENT OF
INTEGUMENTARY SYSTEM

MR AJIBOYE ADEFIKAYO. A

B.Sc; M.Sc, Ph.D In view (Unilorin)

Integumentary System

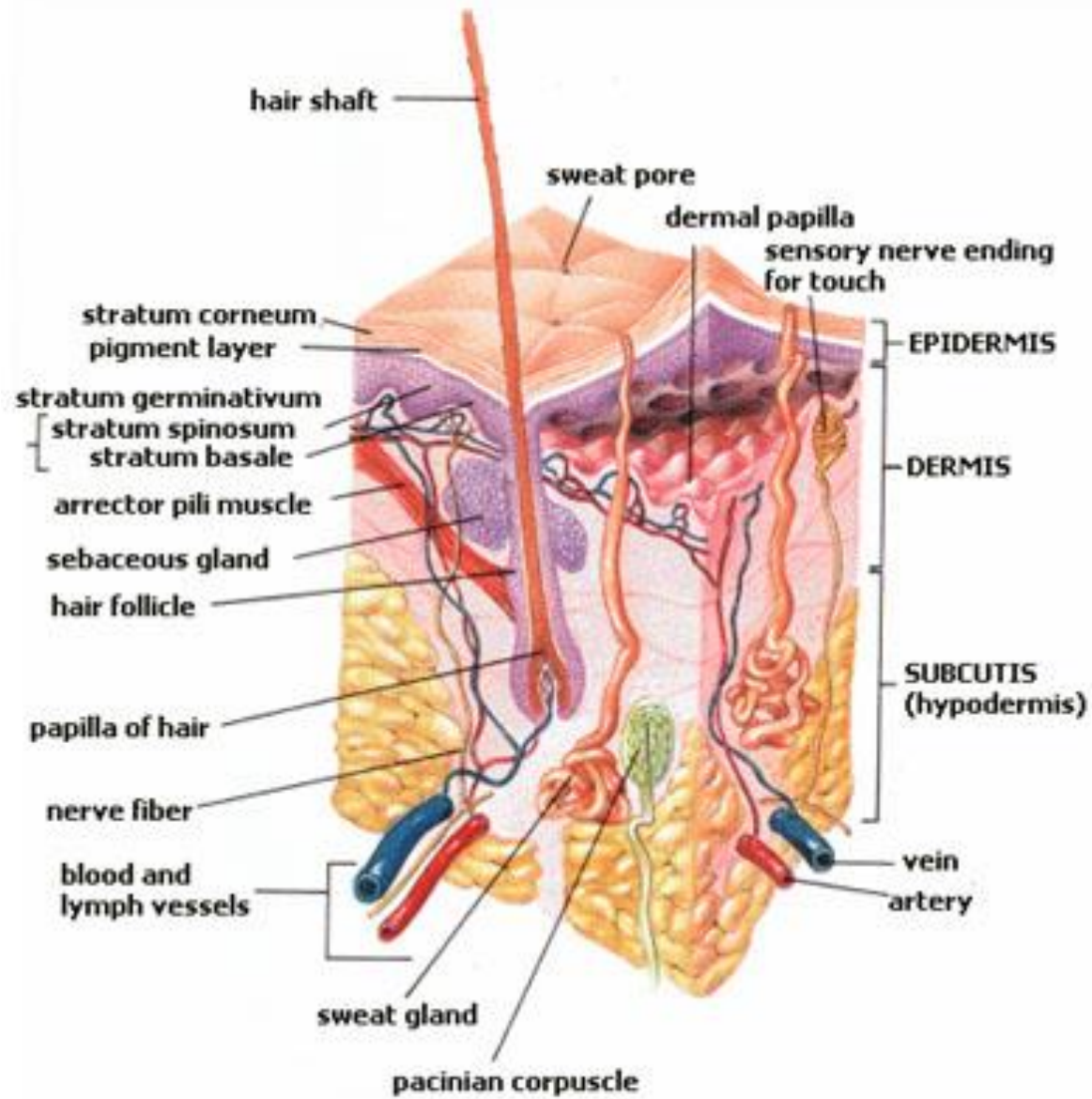
- ❖ The integumentary system is the largest organ system in the human body, responsible for protection from physical and environmental factors.
- ❖ The integumentary system is both a barrier and a sensory organ, and includes the skin (the largest bodily organ), as well as appendages, sweat and sebaceous glands, hair, nails and arrectores pillorum.
- ❖ The integumentary system develops from all embryonic layers (ectoderm, mesoderm, and neural crest cells).

Key Terms

- ❖ Sebaceous gland: A gland of the skin that secretes an oily substance, sebum, usually into a hair follicle near the surface of the skin.
- ❖ Neural crest cells: A transient, multipotent, migratory cell population that gives rise to a diverse cell lineage including melanocytes, craniofacial cartilage and bone, smooth muscle, peripheral and enteric neurons, and glia.
- ❖ Fetal skin: This forms from three layers: ectoderm, mesoderm, and neural crest cells.

Development of Integumentary System

- ❖ THE SKIN has a twofold origin: a superficial layer, the epidermis, derived from surface ectoderm, and a deep, thick layer, the dermis, derived from mesenchyme
- ❖ Epidermis: initially the embryo's surface is covered by a single layer of ectodermal cells which, in month 2, divides to form a superficial protective layer of simple, flattened squamous epithelial cells, the epidermis or periderm
- ❖ The cells of the periderm layer continually undergo keratinization and desquamation to be replaced by cells arising from the basal layer



Development of Integumentary System

- ❖ The basal layer of epidermis later becomes the stratum germinativum which produces new cells that are displaced into layers above.
- ❖ The exfoliated cells form part of the vernix caseosa, a white, cheesy, protective substance that covers the fetal skin
- ❖ The vernix caseosa also includes sebaceous gland sebum, fetal hair, and desquamated amniotic cells
- ❖ By week 11, the basal layer (stratum germinativum) forms an intermediate skin layer, and by the end of month 4, all the epithelial layers of the adult epidermis of skin have acquired their definitive arrangement. Four successive layers are seen (bottom to top)

Development of Integumentary System

- ❖ Replacement of the peridermal cells continues until about week 21 (the cells are lost into the amniotic fluid), thereafter the periderm normally disappears
- ❖ During the first 3 months of development, neural crest migrates and invades the epidermis, to form melanoblasts and then melanocytes, which synthesize melanin pigment. After birth, these cells cause skin pigmentation and are found in the epidermal-dermal junction
- ❖ In dark-skinned races, melanin granules are produced by fetal melanocytes; in white-skinned races, the fetal melanocytes contain very little to no melanin pigment

Development of Integumentary System

- ❖ The dermis is derived from mesenchyme of the somatic lateral mesodermal layer which underlies the surface ectoderm
- ❖ During months 3 and 4, the dermis forms many collagenous and elastic fibers; simultaneously, the superficial dermal layer or corium forms irregular papillary structures, the dermal papillae, which project into the epidermis
- ❖ Some papillae contain small capillary loops, and others have sensory nerve endings
- ❖ The deep dermal layer or subcorium is characterized by fatty tissue

Development of Integumentary System

- ❖ At birth, the skin is covered by the vernix caseosa, a whitish paste formed by sebaceous gland secretion, degenerated epidermal cells, and hairs. It protects the skin against the maceration action of the amniotic fluid
- ❖ **If the superficial layers of the skin show excessive cornification, the skin has a scaly appearance, a condition spoken of as ichthyosis**

Development of Hair

- ❖ Hair development begins as solid epidermal proliferations from the germinative layer, which penetrates the underlying dermis.
- ❖ At their terminal ends, hair buds invaginate, The invaginations, the hair papillae, are rapidly filled with mesoderm in which vessels and nerve endings develop.
- ❖ Soon, cells in the center of the hair buds become spindle-shaped and keratinized, forming the hair shaft, while peripheral cells become cuboidal, giving rise to the epithelial hair sheath.

Development of Hair

- ❖ The dermal root sheath, formed by the surrounding mesenchyme, is connected to the arrector pili muscle. Hair growth is accelerated by epithelial cells, with the first hairs appearing in the eyebrow and upper lip region by the third month.
- ❖ The first hair that appears, lanugo hair, shed at birth, is replaced by coarser hairs from new hair follicles.
- ❖ The hair follicle's epithelial wall contains a small bud that penetrates the surrounding mesoderm, forming sebaceous glands. Sebum, a fat-like substance, is secreted into the hair follicle and reaches the skin.

Development of Sweat Glands

- ❖ Eccrine sweat glands are tubular, coiled glands found in the skin throughout the body. They develop as buds from the epidermis and grow into the mesenchyme. As they elongate, they coil to form the secretory parts of the glands.
- ❖ The epithelial attachments of the developing glands to the epidermis form the primordia of the sweat ducts. The central cells of these ducts degenerate, forming lumina.
- ❖ The peripheral cells of the secretory parts of the glands differentiate into myoepithelial and secretory cells.

Development of Sweat Glands

- ❖ The myoepithelial cells are thought to be specialized smooth muscle cells that assist in expelling sweat from the glands.
- ❖ Apocrine sweat glands are confined to the axillary, pubic, and perineal regions and areolae surrounding nipples.
- ❖ They develop from downgrowths of the stratum germinativum of the epidermis, opening into hair follicle canals. Secretion begins during puberty.

Development of Sebaceous Glands

- ❖ Sebaceous glands, derived from the epidermis, develop from cellular buds from hair follicles' root sheaths. These buds invade the dermis, forming alveoli and ducts.
- ❖ The central cells of the alveoli break down, forming an oily substance—**sebrum**—that protects the skin against friction and dehydration.
- ❖ It is released into hair follicles and mixes with peridermal cells to form vernix caseosa, a greasy substance.
- ❖ Sebaceous glands, independent of hair follicles, also develop as cellular buds from the epidermis.

Development of Mammary Glands

- ❖ The mammary glands (breasts) are derived from 2 thickened strips of epidermal ectoderm, the *primitive mammary ridges or milk lines*, which appear during week 6. The ridges extend from the axillae to the inguinal regions, but rapidly regress except in the thorax
- ❖ THE MAMMARY BUDS that persist in the thoracic region penetrate the underlying mesenchyme and give rise to several secondary buds which develop into *lactiferous ducts* and their branches.
- ❖ The lactiferous ducts form the small ducts and alveoli

Development of Mammary Glands

- ❖ The fibrous connective tissue and fat of the mammary gland develop from the surrounding mesenchym.
- ❖ Only the main ducts are found at birth, and the gland remains undeveloped until puberty
- ❖ DURING THE LATE FETAL PERIOD, the epidermis, where the gland originated, becomes depressed to form a shallow *mammary pit* (epithelial pit) on which the ducts open
- ❖ The lactiferous ducts at first open onto this epithelial pit which is formed by the original mammary line

Development of Mammary Glands

- ❖ THE NIPPLE itself forms during the perinatal period due to proliferation of the mesenchyme under the areola (circular area of skin around the nipple) in the area of the mammary pit. The nipple is often depressed and poorly formed during infancy
- ❖ THE MAMMARY GLANDS of both newborn males and females are often enlarged and may secrete "witches' milk" or *colostrum*, as a result of maternal hormones passing into the fetal circulation by way of the placenta.

Development of Mammary Glands

- ❖ AT PUBERTY, the female mammary glands enlarge rapidly as a result of the development of fat and connective tissue. The duct system also grows, stimulated by the estrogen and progesterone of the ovary
- ❖ The glandular tissue remains completely undeveloped until pregnancy when the intralobular ducts rapidly develop, form buds, and become alveoli
- ❖ The male glands undergo little postnatal development

Development of Nails

- ❖ Toenails and fingernails develop at the tips of the digits at 10 weeks, with fingernails developing by 4 weeks.
- ❖ The primordia of nails are thickened areas or nail field of the epidermis at the tip of each digit, which migrate onto the dorsal surfaces.
- ❖ The nail folds surround the nail fields, and cells from the proximal nail fold grow over the nail field and form the nail plate.
- ❖ The eponychium, the corneal layer of epidermis, covers the nail initially, but later degenerates, exposing it except at its base. Fingernails reach fingertips by 32 weeks, toenails by 36 weeks.

Clinical Anamolies

- ❖ **ABSENCE OF THE GLAND (AMASTIA) AND/OR NIPPLE (ATHELIA)** is rare; may occur bilaterally or unilaterally, and is due to failure of development or complete disappearance of the mammary ridge(s). Also can be due to failure of the mammary bud to form.
- ❖ **SUPERNUMERARY BREASTS (POLYMASTIA) AND NIPPLES (POLYTHELIA)** are seen in about 1% of the female population and are usually inherited. They generally are found below the normal breast, but less commonly are seen in the axilla or abdominal area, developing along the mammary ridges.

Clinical Anamolies

- ❖ **CONGENITAL ECTODERMAL DYSPLASIA:** This skin condition represents a group of rare hereditary disorders involving tissues that are ectodermal in origin. The teeth are completely or partially absent and often the hairs and nails are affected. Ectrodactyly-ectodermal dysplasia-clefting syndrome is a congenital skin condition that is inherited as an autosomal dominant trait. It involves both ectodermal and mesodermal tissues, consisting of ectodermal dysplasia associated with hypopigmentation of skin and hair, scanty hair and eyebrows, absence of eyelashes, nail dystrophy, hypodontia and microdontia, ectrodactyly, and cleft lip and palate.

Clinical Anamolies

- ❖ ALBINISM: In generalized albinism, an autosomal recessive trait, the skin, hairs, and retina lack pigment; however, the iris usually shows some pigmentation. Albinism occurs when the melanocytes fail to produce melanin because of the lack of the enzyme tyrosinase or other pigment enzymes. In *localized albinism—piebaldism—an autosomal dominant trait, there is a lack of melanin in patches of skin and/or hair.*

Clinical Anamolies

- ❖ **ALOPECIA:** Absence or loss of scalp hairs may occur alone or with other defects of the skin and its derivatives. Congenital alopecia (hair loss) may be caused by failure of hair follicles to develop, or it may result from follicles producing poor-quality hairs.
- ❖ **HYPERTRICHOSIS:** Excessive hairiness results from the development of supernumerary hair follicles, or from the persistence of lanugo hairs that normally disappear during the perinatal period.

Clinical Anamolies

- ❖ **APLASTIC ANONYCHIA:** Congenital absence of nails at birth is extremely rare. Anonychia results from failure of nail fields to form or from failure of the proximal nail folds to form nail plates. The abnormality is permanent. Aplastic anonychia (defective development or absence of nails) may be associated with extremely poor development of hairs and with defects of the teeth. Anonychia may be restricted to one or more nails of the digits of the hands and/or feet.

Key Points

- ❖ Ectoderm forms at 4 weeks.
- ❖ Between 4 and 12 weeks, the stratified epithelium forms and mesoderm forms the blood vessels and connective tissue.
- ❖ At 16 weeks, the basement membrane folds and melanoblasts start producing melanin.
- ❖ At 20 weeks, hair begins to grow from sebaceous glands and sweat glands form.



Thank You

For Listening

It's not bye bye, but see you again!

Ajiboye A.A ✓